e-Maturity and e-Readiness Assessment Report

Prepared for the Gauteng Department of Education (GDE)

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South African Institute
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Table of Contents

Appendices

Appendix One: Research Instruments

Appendix Two: Survey Data

Appendix Three: Case Studies

List of Tables

List of Figures

Acronyms and Abbreviations

ABET	Adult Basic Education and Training
B. Ed.	Bachelor of Education
CAMI	Computer-Aided Maths Instruction
CAT	Computer Applications Technology
DoE	Department of Education
ELSN	Education for Learners with Special Needs
GDE	Gauteng Department of Education
GoL	Gauteng Online Project
HOD	Head of Department
ICT	Information and Communication Technology
IQMS	Integrated Quality Management System
IT	Information Technology
M&E	Monitoring and Evaluation
SASAMS	South African School Administration and Management System
SAIDE	South African Institute for Distance Education
SGB	School Governing Body
SMS	Short Message Service
SMT	School Management Team
UJ	University of Johannesburg

Summary of Key Data

- ICT infrastructure:
  - Percentage of schools with computers: 97%
  - Percentage of schools with Internet connectivity: 83%
  - Percentage of schools with reliable Internet connectivity: 51%
  - Computers per school: 33:1
  - Laptops per primary school: 2
  - Laptops per secondary school: 2.4
  - Administration computers per primary school: 3.1
  - Administration computer per secondary school: 4.73
- Learner access to ICT:
  - Computers per 100 primary school learners: 3.6
  - Computers per 100 secondary school learners: 4.1
  - Average computer minutes per day for primary learner: 13
  - Average computer minutes per day for secondary learner: 15
- Teacher access to ICT:
  - Computers in classrooms per primary school: 1.3
  - Computers in classrooms per secondary school: 3.7
  - Computers dedicated for teacher use per primary school: 3.58
  - Computers dedicated for teacher use per secondary school: 5.88
  - Average computer minutes per day for primary teacher: 69
  - Average computer minutes per day for secondary teacher: 61
  - Average percentage of teachers having access to a computer at home: 60%
- Administrative staff access to ICT:
  - Average number of administrators to average number of computers for administration in primary schools: 1.14
  - Average number of administrators to average number of computers for administration in secondary schools: 1.08
  - Average computer time per day for primary school administrative staff members: 595 minutes (8 hours 45 minutes)
  - Average computer time per day for secondary school administrative staff member: 491 minutes (8 hours 11 minutes)
- ICT planning and management

- – Percentage of schools with an ICT committee: 41%

- – Percentage of schools with an ICT policy: 30%

- – Percentage of schools with an ICT implementation plan (27%):

- – Percentage of Primary schools with an ICT coordinator: 74%

- – Percentage of Secondary schools with an ICT coordinator: 70%

- – Percentage of schools with an ICT coordinator involved in ICT planning: 55%

- – Percentage of schools with the SMT involved in ICT planning: 44%

- – Percentage of SMTs using ICT for SMT tasks: 60%

- – Percentage of schools with no community involvement in ICT activities: 63%

- – Percentage of schools conducting any form of monitoring and evaluation of the effectiveness of ICT use: 47%

- Perceptions of major challenges facing schools in ICT use:

  - – Lack of staff training in 60% of schools (and staff training in supporting teaching and learning in particular, in 54% of schools); and

  - – Lack of sufficient computers for teaching and learning in 58% of schools.

- Budgeting and funding:

  - – Percentage of schools having no ICT budget from either school funds or donors or equipment/technical support from GDE/GoL: 6.1%

  - – Percentage of schools having an ICT budget that includes all six of these items - computers, hardware, maintenance, connectivity and staff development: 22.7%

  - – Percentage of schools having an ICT budget including all three of these items: software, insurance and technical support: 27% (37% of primary but only 3,7% of secondary schools)

- Teacher skills:

  - – Percentage of teachers who feel confident to use ICT on their own: 45%

  - – Percentage of teachers who feel confident to help a colleague or support learners in ICT use: 20%

  - – Percentage of teachers who feel able to do any ICT related task: 50%

  - – Teachers most commonly use ICT for administration, then for preparation, and only then for teaching or learning.

  - – Percentage of teachers who have received any type of ICT training: 49%

  - – Percentage of teachers who have received computer literacy training: 45%

  - – Percentage of teachers who have participated in fewer than four hours of ICT related training in last 12 months: 76%

- Learner Use

- – Percentage of secondary schools offering Information Technology (IT): 38%

- Percentage of secondary schools offering Computer Application Technology (CAT): 38%

- Percentage of secondary schools offering computer literacy classes to some or all grades: 43%

- Percentage of secondary schools confirming that they do not offer computer literacy classes: 45% (and a further 12% did not respond to this question)

- Availability of learner access to computers outside of formal school time (informal learner use) in secondary schools: 50%

- Percentage of secondary schools offering CAT and/or IT which also offer computer literacy classes: 21,1% (when overall average of schools offering computer literacy is 43%)

- Percentage of secondary schools offering CT and/or IT that also offers informal access to learners outside of school time: 29,6% (when overall average of secondary schools providing informal learner use is 50%)

- Percentage of primary schools offering computer literacy classes to some or all grades: 55%

- Percentage of primary schools confirming that they do not offer computer literacy classes: 28% (a further 17% did not respond)

Conceptual Framework and Methodology

Introduction

This research report is the culmination of the e-readiness/e-maturity research project that was commissioned by the Gauteng Department of Education (GDE) in order to inform its future strategies and plans for implementing information and communication technology (ICT) in Gauteng schools. Over the past few years, the GDE has embarked on a significant drive to implement ICT in all of its schools. This was informed by international trends, National Policy, and the Gauteng Department's e-learning framework, which called for introduction of ICT into all aspects of schooling. However, as tends to be the case with large-scale initiatives, there has been a gap between planned/intended and actual outcomes. Therefore, in line with good implementation practice, the GDE commissioned an audit to assess the status of ICT use in its schools as part of a process of reviewing its strategies and plans. This report provides the findings of the research study of ICT deployment and use in Gauteng schools and offers some recommendations for consideration by the Department.

Background

ICT has come to play a significant role in all aspects of our lives, both in the private and public spheres. It has revolutionized communication and information services and been a catalyst in the development of a range of innovative solutions to society's challenges. ICT use in education has also become common practice in most developed countries, and is increasing its footprint in developing countries. Most country educational policy documents make it clear that ICT use in education is essential. In South Africa, Kader Asmal, a previous Minister of Education, stated that 'it is no longer about whether schools should introduce ICT but how' (e-Education White Paper, 2004: 1).

The South African e-Education White Paper (2004) makes it clear that effective use of ICT in the school environment is essential. Since the White Paper's inception, provinces have made significant strides in introducing ICT into the school environment. The white paper indicates that:

> *In the South African context, the concept of e-Education revolves around the use of ICTs to accelerate the achievement of national education goals. e-Education is about connecting learners and teachers to each other and to professional support services, and providing platforms for learning. e-Education will connect learners and teachers to better information, ideas and one*

another via effective combinations of pedagogy and technology in support of educational reform. It supports larger systematic, pedagogical, curricular and assessment reforms that will facilitate improved education and improved use of educational resources such as ICT' (e-Education White Paper, 2004: 14).

The White Paper has a comprehensive notion of ICT use which goes well beyond using ICT to promote computer literacy:

e-Education is more than developing computer literacy and the skills necessary to operate various types of information and communication technologies. It is the ability to:

*   *apply ICT skills to access, analyse, evaluate, integrate, present and communicate information;*

*   *create knowledge and new information by adapting, applying, designing, inventing and authoring information;*

*   *function in a knowledge society by using appropriate technology and mastering communication and collaboration skills' (e-Education White Paper, 2004: 14)*

However, it also acknowledges that implementing ICT is a complex undertaking, noting that 'the challenge is to transcend the mere exchange of information and to transform e-Education into a range of learning activities that meet educational objectives' (e-Education White Paper, 2004: 14).

Significant progress has been made in introducing ICT into South African schools. There have been substantial changes in perceptions of ICT use in the country's schools, and there has been meaningful progress since the conception and early development of e-education in the country. Ten years ago, few 'former model C 'and private schools had computers. Today in Gauteng, almost all schools (98%) have computers (Appendix 2, Graph 2.1). Similarly, while administration was previously done primarily through paper-based approaches, many schools have started implementing computer-based administrative systems and processes.

The Gauteng Online Project (GoL) has been the major ICT initiative in Gauteng, aiming to provide schools with computer laboratories and a range of related components. A key objective of GoL has been to equip each school in Gauteng 25 computers in a laboratory, connected using a thin-client networking model. Deployment was also intended to include one printer and one server. Various training courses are part of what GoL aimed to deliver to schools: an orientation course comprising three sessions of three hours each (aimed at all educators), as well as advanced training for five educators from each school. The intention has been to ensure that each laboratory is installed with a remote alarm system which is centrally controlled. This system is disarmed every morning before schools start and re-armed at 16h00. The GoL laboratory model does not allow teachers to save their work on the system, but they can save work on a memory stick. Schools cannot install software onto the GoL network, but the system offers various pre-installed applications and educational software.

In recent years, enormous progress has been made in introducing computers into Gauteng schools through GoL and a variety of other partnerships. The GDE now wishes to leverage this infrastructure to operationalize the strategic goals of the White Paper on e-Education. To this end, it decided to initiate a detailed research

study into the state of the current ICT context within GDE schools. In particular, the study was aimed at understanding what exists on the ground in terms of infrastructure, how and why it is being used, and what some of challenges are with respect to implementation. This called for a comprehensive study that focused on infrastructure, management of ICT, teacher competence and skills, and use in administration, teaching and learning at Gauteng schools.

While excellent progress has been made with regard to introducing infrastructure into these schools and providing some level of training, there continue to be various challenges with regard to effective use of ICT in schools. In order to better understand these challenges, this study will explore what has taken place, and also focus on how and why this is occurring. This requires an understanding of the key drivers of change in these schools and of what the minimum conditions for effective ICT use are.

Conceptual Framework

Use of ICT in schools involves a complex interplay between various factors. There is a set of structural conditions that needs to be in place to enable effective ICT use in schools. However, these structural conditions interact with the people using the technologies in schools. Thus, structures are a necessary, but not sufficient, condition for effective ICT use in schools, as it is only when the structure interacts with the agents that changes are possible. From this perspective, the notions of e-readiness and e-maturity describe conditions for increasingly effective use of ICT in schools.

In order to understand these conditions better, it is thus worth exploring briefly different e-maturity and competency models. There are several such models used to describe levels of use of ICT in educational contexts. E-maturity is a concept that can be used to describe the capacity of an institution or individual to use ICT in their core business. An e-mature institution is one that has the capacity to make strategic and effective use of technology to improve educational outcomes:

> *An e-mature learner is anyone who has sufficiently internalized the use of technology in their processes of learning so that it significantly modifies their thinking, their behaviour and their responses when they are learning' (BECTA).*

However, there are several stages through which institutions go in order to achieve e-maturity. These reflect different levels of readiness and maturity. These stages have been described in different ways by several experts in the field. For example, UNESCO, BECTA, and the e-Education White Paper all refer to the notion of stages of ICT maturity, even though they use slightly different terms.

UNESCO has identified four broad stages through which schools progress in the adoption and use of ICT. These are: Emerging, Applying, Infusing, and Transforming. UNESCO links these school stages to four stages through which educators and learners pass to gain confidence in using ICT tools. These stages are listed as:

• Discovering ICT tools – linked to the emerging stage.

- Learning how to use ICT tools – linked to the applying stage.
- Understanding how and when to use ICT tools – linked to the infusing and transforming stages.
- Specializing in use of ICT tools.

The e-Education White Paper, by contrast, refers to five stages of integration of ICT into school environments: Entry, Adaptation, Adoption, Appropriation, and Innovation.

In addition to ICT integration stages, there are also the sites at which the integration occurs. BECTA's self-review framework of a school's e-maturity evaluates the school against a series of statements describing an agreed set of standards based on a series of level descriptors. The framework consists of eight elements: Leadership and Management, Curriculum, Learning and Teaching, Assessment, Professional Development, Extending Opportunities for Learning, Resources, and Impact on Pupil Outcomes. For each element, there are five level descriptors against which a school can measure itself. These are analogous to the different levels of ICT integration referred to above.

To guide the design of research instruments for this study, e-readiness and e-maturity frameworks were developed. Thus, for the purposes of this study'

> *E-Readiness measures the capacity of a community to use ICT by assessing the physical, management, social, and educational conditions in place that lead to receptiveness to the introduction of ICT.*

> *E-Maturity measures the extent of use of ICT by a school and its teachers and learners. It assesses the management of ICT and different levels of use and perceptions by learners, teachers, and school management.*

The analogy of a tree is illustrated by Figure 1.

Figure 1   Tree Analogy for E-Readiness and E-Maturity

E-Maturity: The evidence of growth and fruit-bearing of the tree over time.

E-Readiness: The fertility of the soil, which would determine how well the tree takes root and develops.
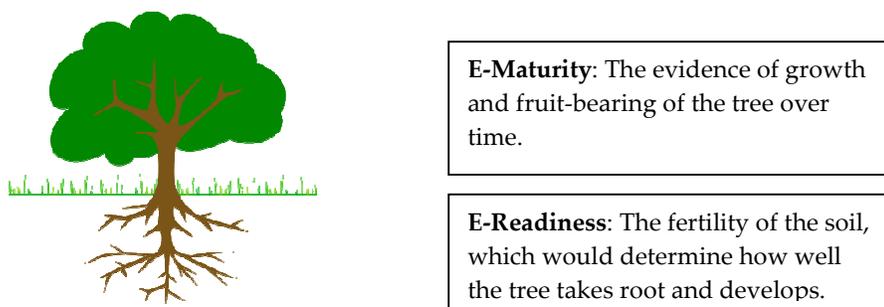
The two concepts are part of one inter-related system. A tree cannot grow if it is planted in infertile soil. E-Readiness examines the factors in place when the technology is placed in a school. Given that GoL has already placed much technology in schools, this audit report will measure a snapshot of e-readiness at the time of the visit. The conditions of e-readiness can change at any time, thus potentially influencing developing e-maturity. Just as a tree may shrivel and die, a school's e-maturity may degenerate if e-readiness factors are not maintained. This audit will,

therefore, also seek to measure the extent to which schools in Gauteng and their communities have grown in their use of the technology.

Many inter-related factors contribute to successful use of ICT in a school. No one factor can be separated from the other or be conclusively proved to be responsible for this success. For the purposes of this report, these factors have been grouped into five related dimensions.

- **School ICT Capacity** – The school provides and maintains the basic infrastructure that supports ICT.

- **School Management Environment** – The school environment is supportive of administration, teaching, and learning using ICT and is able to sustain this support.

- **Learning Environment** – Through the use of ICT, the learning environment can support achievement of the outcomes of the national curriculum.

- **Learner ICT Capability** – Through the use of ICT, learners develop ICT capability and use ICT in everyday life.

- **Teacher ICT Integration Competency** – The teacher exploits the strengths of ICT to become more efficient and effective as a teacher.

We propose considering four core levels of achievement, the names of which are derived from levels of technology adoption used in the e-Education White Paper:

Table 1   Dimensions and Levels

Level	Applied to the School	Applied to the Teacher
Entry	Represents a scenario dominated by *lack of readiness* for technology adoption in that *serious shortcoming* in one or more of the dimensions indicates that the school lacks the capacity for successful use.	The teacher is computer literate and is *able to use computers*. However, frustrations and insecurities are common in the introduction of ICT. At this level, teachers are likely to *lack confidence*.
Adoption	The school has sufficient, but limited, capacity to adopt technology, may already be using ICT on a small scale, and has identified areas in which it needs to develop in order to sustain and grow use. The school will not have measures in place to sustain technology at this stage, but has a strategy to develop such capacity.	The teacher is able to use various ICTs, including computers, to *support traditional management, administration, teaching and learning,* and is able to teach learners how to use ICT.
Adaptation	Measures are in place and the school has adapted to the extent that placing technology in this school will represent an investment with a low risk of failure, provided that the capacity does not diminish. The school has some experience of managing ICT well.	The teacher is able to use ICT to support everyday classroom activities at an appropriate NCS level, assess the learning that takes place, and ensure progression. He/she is able to reflect critically on how *ICT resources can enable him/her to redesign the teaching and learning processes* and to use ICT systems for management and administration. Productivity increases at this level.

Level	Applied to the School	Applied to the Teacher
Appropriation	The school has a strong base of readiness components which are ideal for the growth in maturity levels in teaching and learning, as defined in the teaching and learning dimensions. The school has considerable capacity and a proven track record of effective use of ICT.	The teacher has a *holistic understanding* of the ways in which ICT can contribute to teaching and learning. He/she has the experience and confidence to *reflect* on how ICT can influence teaching and learning strategies, and to *use new strategies*. If necessary, the teacher is able to develop entirely new learning environments that use ICT as a flexible tool, so that learning becomes collaborative and interactive.

There are three key pillars of growing e-maturity, which affect the extent to which ICT is used effectively in schools to improve their core business. These three factors are access to ICT, organizational culture, and teaching and learning culture.

Access to ICT is self-explanatory, but Organizational culture involves developing an understanding of the relationship between ICT, and leadership/management. It covers the following broad areas:

- The school's leadership and management approaches to implementing ICT;

- Policy and planning; and

- Use of ICT to support management and administrative practices in the school.

Teaching and Learning Culture focuses on relationships between teacher competence, teacher pedagogical practices, and teacher attitudes and beliefs about ICT, as well as the nature and extent of use of ICT in teaching and learning contexts. In addition, it is also important to focus on how teachers use ICT with learners, as well as how learners themselves are using it.

Research Questions

In order to proceed with a study on use of ICT in Gauteng schools, a key research question was identified. The overall research question guiding this project was:

- What is the nature and extent of ICT use in Gauteng schools?

The sub-questions were:

- What infrastructure do schools have, is it in working order, and how did they obtain it?

- What management strategies, structures and plans have been put in place to ensure successful ICT use?

- How is ICT being used in these schools and why is it being used?

- What are the beliefs of teachers and leadership about the role of ICT in education development?

- What are the drivers and inhibitors of ICT use?

- What are the challenges and opportunities of ICT use in these schools?

Methodology

This study is aimed at understanding the nature and extent of ICT use in Gauteng schools i.e. what is happening in terms of ICT deployment and use, as well as how and why it is occurring in this way. It thus requires the establishment of some general trends and patterns that are occurring across schools but also requires one to illuminate and unpack some practices in detail. This calls for a combination of quantitative and qualitative research methods. The qualitative approach focuses on impressions, perspectives, and unpacking meaning in a social context, while the quantitative approach is 'more objective' in that it focuses on analysing the numerical data. This study therefore used both quantitative and qualitative methods through a survey and case study technique respectively.

Quantitative Approach: Survey of Gauteng Schools

As stated above, a quantitative research approach was selected in order to provide insight into trends across the full population of Gauteng schools. The survey technique was selected for this study, as it is generally able to answer the 'what' of the research question quite thoroughly. Thus a survey was used to understand the nature of ICT deployment and use on the ground.

Survey Instruments

The study surveyed all schools in the province. It included the following instruments:

- An Audit of ICT in schools;

- A Group Interview with senior managers at schools;

- A Teachers' Survey.

The Audit sought to establish what infrastructure, processes, products, and systems are in place in schools, whether these are in working order, and whether they are being used. Its purpose was to:

- Compile an inventory of all ICT resources in schools;

- Establish regularity of use of the listed inventory items;

- Establish how the ICT was procured;

- Establish where the ICT is used;

- Determine how many educators use each resource; and

- Establish the nature and reliability of Internet access at schools.

The Group Interview focused on understanding management and governance issues pertaining to implementing ICT in schools. For example, it tried to establish what management principles and practices exist with regard to implementing ICT in schools. The purpose of the Group Interview was to:

- Provide schools an opportunity to provide feedback about the survey;

- Gather information about the readiness of school management and governance to use ICT;

- Gauge attitude towards ICT at schools.

The Teachers' Survey focused on understanding teachers' use of, and competence in using ICT for personal and professional purposes (including lesson preparation and teaching and learning activities and administration). It focused on:

- Identifying which capacity-building programmes teachers have been exposed to;

- Numbers of teachers participating in each programme;

- Staff ICT proficiency and confidence, in order to establish the school's stage of ICT rollout; and

- How teachers integrate ICT in the curriculum, based on a categorization of potential uses of ICT in the curriculum as outlined in the DoE *Guidelines for Teacher Training and Professional Development in ICT (2007)*.

Piloting the Instruments

As with all survey studies, piloting is essential in order to test both instruments and process. As agreed with the GDE and in line with sound research principles, a pilot was conducted to inform both the process and the instruments of this study. Consequently, an initial pilot test was conducted with six schools to test the instruments.

Following this initial pilot and subsequent reworking of the instruments, the SAIDE team embarked on a wider pilot study in order to ensure that the process was efficient and effective and that the questions were clear, unambiguous and effective, and to test the instruments when they were used by field workers and not ICT 'experts'. While the target was 40 schools, only 36 were ultimately visited because some schools were not cooperative while others indicated that they were very busy during the period of the pilot.

This piloting exercise established that physical delivery of instrument packs to schools was the most viable strategy to complete the survey successfully. Faxing resulted in lost pages and some schools were unable to receive their documents because of the problems with their faxing services. It was thus agreed that instrument packs would be physically delivered to all schools for the large scale roll out.

In addition to understanding how the instrument worked in the field, the research team also conducted data analysis to inform instrument re-design. While the Audit and Group Interview instruments worked well in general, the teacher survey was initially a failure. It did not yield the desired results and provided inaccurate data about teacher use and competencies. For example, the mean scores of the number of teachers per individual question did not necessarily reflect the number of teachers in the school. This meant that, while we may have been able to establish, for example, that eight teachers at a school used computers daily, we could not extrapolate what proportion of teachers this number represented of the overall population of teachers

in the school. Furthermore, it was not possible to calculate percentages based on the number of teachers answering the questionnaire, because some schools completed questions on behalf of all teachers in the school. Additionally, there were difficulties with using the overall number of teachers in the schools, as many schools only presented data for those teachers present, with the result that using the overall number of teachers could skew the percentages. Consequently, the survey instrument was changed from a group survey to a survey aimed at individual teachers, where each teacher would be required to respond to 13 questions.

As a result of the piloting activities:

- Clearer instructions were supplied to principals on how to administer the questionnaires;
- Some of the audit questions were simplified;
- The teacher survey was reworked, and was presented in the form of a spreadsheet which every teacher had to complete.

Fieldwork

Once the instruments and processes were re-designed, the large scale fieldwork began. This fieldwork included contacting all schools (where possible) telephonically, followed by physically delivering the instruments and making appointments for the field visit. During the field visit, researchers/fieldworkers:

- Introduced themselves to the school principal and explained the purpose of the project;
- Went through the audit instruments with the principal (which were ideally completed before the fieldworker undertook field visits);
- Met with the senior management team for the group interview; and
- Collected and checked the teacher survey responses before leaving the school.

Fieldwork took place from October 2009 to February 2010. Because this fieldwork spread across two terms in the year, it was decided to split the fieldwork into primary and secondary schools. It was envisaged that the fieldwork would take about two to three weeks for secondary schools and about six weeks for primary schools. However, in both cases, fieldwork took longer than expected because:

- Schools sometimes cancelled appointments;
- Often, forms were not completed on time;
- Some schools refused to participate;
- Several schools that were on the GDE list did not exist or had been merged or closed down;
- Secondary schools were writing examinations in October.

Data Analysis

The survey data was gathered and checked, after which it was captured and cleaned. Cleaning was difficult and time-consuming because schools often submitted more than three instruments, but either wrote different EMIS numbers on the three or more instruments or their EMIS number did not tally with the number on the GDE list.

Once the data was cleaned, preliminary statistics were produced. These included general frequency and median tables. This was divided into the different types and quintiles of schools where the differentiation provided useful information. After several rounds of data analysis, clustering and correlations between different variables were drawn. Analysis of this data is presented in the following section of the report, while the full data analysis is presented in Appendix Two. A separate e-readiness index has been developed.

In summary, responses received and analysed were as follows:

Table 2 Audit Survey Responses

	Primary	**Secondary**	**Combined**	**ABET**	**LSEN**	**Undefined**	**Total**
Audit (one per school)	1,314	563	58	40	79		2,054
SMT/Group (one per school)	1,305	561	56	39	79	8	2,048
Teacher Survey (one per school)	1,293	540	58	36	77	7	2,011
Merged Table (schools with all three instruments)	1,280	534	56	36	77		1,983

The numbers of teachers who filled in the teacher survey, broken down by school, are as follows:

Table 3 Teacher Survey Responses

Primary	**Secondary**	**Combined**	**ABET**	**LSEN**	**Total**
26,973	15,415	1,361	758	1,727	46,234

Case Studies

The quantitative approach described above focused on understanding what is taking place with a view to establishing some general trends. However, this survey approach was not able to provide sufficient detail on how and why things are taking place in the ways in which they are. This is where qualitative methods are of particular value i.e. in exploring phenomena in detail.

Whilst there are different qualitative approaches upon which one can embark, the case study option was selected for this research project. Case studies are used to explore and understand real life contemporary phenomena (Yin, 1996). The strength of a case study is its potential to explore phenomena in detail, and its ability to focus on a few key things. Case study approaches are suited to research:

- That is exploratory in nature;

- That requires detailed information on a number of aspects within a site;

- That explores contemporary real-life phenomena which cannot be divorced from their real-life context; and

- In which there is little control over events being studied (Yin, 1984:16).

Thus, the case study approach was considered appropriate for this study because:

- The research question one seeks to answer requires significant probing. For example, one would have to probe into how teachers are using ICT in their classrooms, when they decide to use it, how it relates to teaching and learning in their subject areas, and so on.

- The nature of the research question also requires information on a number of aspects of the particular case being studied. For example, effectiveness of ICT use in a school is a feature of several factors such as school planning, teacher use, competence, and skills. Case studies provide an opportunity to examine many features of an individual case in reasonable depth.

- The study is located in a real life context.

- Provides an opportunity to connect micro level actions to macro level social issues.

While there are a number of strengths in using the case study method, there are also certain weaknesses. The strengths of the case study lie in its ability to deal with complex real-life contexts, as it has room for flexibility, probing in different directions is not limited by instruments, and it uses a variety of evidence. The case study has two key weaknesses: one is that it has the potential to become unmanageable and undirected and can result in amorphous and shoddy research which results in massive unreadable documents. Second, the findings of case studies cannot be generalized to full populations.

These potential weaknesses must be acknowledged and efforts made to mitigate them. It is, for example, important to ensure that multiple sources of evidence are used and also to ensure rigorous processes of conducting the study and analysing the data. In order to mitigate these weakness the case study approach for this study

sourced information from multiple sites. In addition, a framework for conducting the studies was drawn up to ensure rigour across the cases without 'strait-jacketing' them. Furthermore, the fact that case studies have been implemented in conjunction with the quantitative survey approach described above, assists to strengthen the study and triangulate findings.

Selection of Case Studies

Multiple case studies were conducted in this study because this provided an opportunity to locate a range of different types of cases. It is clear that schools can be categorized into different stages of e-readiness and e-maturity and therefore multiple case studies offered an opportunity to explore a variety of e-maturity school types. It was agreed to conduct 25 case studies, based on prior experience concerning ICT use in schools, as well as what was reasonable and achievable within the time and financial constraints of the project. The research imperative for this project was to select cases located across a range of levels of ICT use, as well as covering the various quintiles and also different types of schools (primary and secondary, including ABET and ELSN schools, and so on).

Initially it was intended that the case studies would be drawn from the survey data after the survey process was completed, using captured data to select schools across the e-maturity range. However, due to time constraints[1], the quantitative study was conducted almost in parallel with the case studies. Thus, the primary school survey only slightly preceded the case study selection. As a result, a compromise was agreed upon, in which about 350 instrument packs were viewed prior to their data capture in order to make a selection of cases. These instrument packs were categorized using the:

- Number of computers;

- Levels of overall use;

- Levels of specific use in administration; and

- Level of use in teaching and learning.

Once they were categorized into high and low use, schools across the quintiles were selected in each of these categories. The disadvantage of this approach is that it did not draw on the total sample of primary schools. This affects the pool from which studies are drawn and may impact on the variety of such cases.

Following completion of the survey in about 400 schools, the first phase involved the selection of 10 primary schools for case studies using the above criteria. However, despite selection of both high- and low-end schools, the case studies revealed that none of these schools were innovative high-end users of ICT. Consequently, it was decided that selection of the next round of schools would be slightly different. For phase two, 1 ELSN school, 1 ABET school, and ten secondary schools were selected. In addition, it was agreed to use a purposeful sampling method to find three 'best

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[1] The tender was awarded two months later than agreed, which rendered the sequential implementation of survey and then case studies impossible to implement.

case/practice' schools. In order to do this, the research team consulted other research and sourced information from organizations that work in ICT with schools. This included looking at the research findings from studies by the Universities of Johannesburg (UJ) and the Witwatersrand. Thus, three case studies were purposefully selected on the basis to represent good practice in ICT use.

Defining the Parameters of the Case

While it would be have been interesting to explore how many elements and characteristics affect ICT use and integration, time constraints necessitated a more narrowly constructed focus in order to obtain the required level of detail on the key issues. As a result, the case studies comprised the following components:

- Document analysis, which involved:
  - Analysis of data from the three survey instruments that were used in the quantitative part of this study;
  - Analysis of the ICT policies/plans or strategies, including computer laboratory timetables and other relevant planning documentation;
  - Analysis of teachers' work, including teachers' lesson plans for those lessons in which they use ICT;
  - Analysis of students' work, to better understand the ways in which teachers use ICT.
- Interviews, which involved:
  - Interviews with the principal and designated School Management Team (SMT) member/s;
  - Interviews with ICT coordinators;
  - Group interviews with some teachers that use ICT and others who do not;
  - Interviews with approximately four teachers who use ICT for teaching and learning.

Twenty-five detailed case studies were prepared from all of the above data. A summary of the case studies is presented in the main report, while the detailed case studies are attached in Appendix Three. We thus begin this report with a summary of the findings from the Audit Survey.

Survey Findings and Analysis

Introduction

This section presents a summary of the findings of the audit data, which is presented in full in Appendix Two. It draws on this data in an attempt to provide a high level representative overview of key trends in terms of understanding what infrastructure is in place, and how this translates to levels of access for management, administrative staff, teachers, and learners. In so doing it describes the main organizational features of schools which drive the management (including planning and resourcing) of ICT in schools, as well as having a specific focus on teacher skills and training uptake. Finally, consideration is given to patterns of ICT use for teachers and learners, and this is analysed against the contexts of the available infrastructure, the dominant organizational culture, and reported teacher skills and engagement in teacher training.

In providing this high level overview, extensive use is made of the overall mean values calculated for each question in the survey. Where appropriate, the mean values for different schools types (either primary or secondary schools, or by quintile) are presented in an attempt to explore and explain variances within the overall data set. For ease of reading, the term 'average' is used to refer to these mean values, and care is taken to ensure that the exact nature of this mean value (be it overall, primary, secondary or particular quintile) is made explicit by the context of the paragraph or sentence in question. Where further detail is required on a particular component of the survey, readers are advised to consult Appendix Two, in which graphs and key findings for each component of the survey are presented.

This section opens with a brief overview of the profiles of the schools included in this audit. The survey findings from these schools are then presented according to three key headings (or factors) that affect the extent to which ICT is used effectively in schools:

1) Infrastructure and access.
2) Organizational culture.
3) Teaching and learning, comprising:
    a) Teacher use;
    b) Teacher skills; and
    c) Learner use.

Profiles of Schools in the Audit

Understanding which types of schools were included in the survey helps to provide the context for subsequent presentation of findings. In total, 1,877 schools in Gauteng were included in the audit analysis.[2]

Most (64%) of these were primary schools. The population of schools surveyed included all five quintiles, although there is a slight over-representation of quintile 5 schools (a feature of Gauteng), as one quarter of the schools surveyed were in this socio-economic bracket. However, most audit data has been analysed by quintile, so that distinctions can easily be made between each quintile.

The schools in the audit reflect a range of school sizes. This was measured in terms of learner enrolment, as well as employment of teaching and administrative staff. Schools surveyed had an average of 817 learners. Learner enrolment was higher for secondary schools (mean score of 1,027), and lower for primary (mean score of 728). Across the quintiles, quintile 2 schools had the highest learner enrolment (mean score of 947), while quintile 3 schools had the lowest learner enrolment (mean score of 711).

Primary schools surveyed had a mean of 23.5 teachers, while secondary schools had a mean score of 38.6. Quintile 5 schools had a substantially higher number of teachers than other quintiles, with a mean score of 3.8 administrative staff in primary schools, and 6.4 administrative staff in secondary schools (although this may have been exaggerated by the inclusion of grounds staff in the numbers).

Schools in the survey had a mean score of 3.2 administrative staff. This was higher for secondary schools (mean score of 4.3) than for primary schools (mean score of 2.7). Quintile 5 had the most schools with more than 5 administrative staff per school. These schools had a mean score of 4.administratve 7 staff, compared to the lowest which was reflected in quintile 3 schools (mean score of 2.4).

Schools included in the audit also reflected diversity in fee structures, which is a feature of Gauteng schooling. As would be expected, almost all quintile 1, 2, and 3 schools reported charging no fees, with 45% of schools surveyed being no-fee schools. Most quintile 4 schools charged less than R400 per annum, while most quintile 5 schools charged more than R4,000 per annum. Only 17% of schools charged more than R4,000 per annum.

Schools surveyed also provided an indication of the increasing adoption of Section 21 status amongst Gauteng schools. Of the schools surveyed, 71% have full Section 21 status, while 19% have partial Section 21 status.

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[2] In total, 2,053 schools were included in the audit; however these included a range of school types. When the focus was only on primary, secondary, and combined/middle schools, the number of schools analysed was 1,877.

Infrastructure and Access

This section considers the following questions:

• What ICT infrastructure is available in Gauteng schools?

– How many schools have access to computers?

– How many computers are there in each school?

– Where are these computers located in schools?

– What other ICT equipment is available?

– How are schools accessing the Internet?

– How are computer laboratories secured?

It then analyses what the above data implies about the current state of ICT access in Gauteng schools, by considering:

• What does this mean in terms of learner access to ICT?

• What does this mean in terms of teacher access to ICT?

• What are the overall conclusions on ICT access?

ICT Infrastructure in Schools

School Access to Computers

Almost every school surveyed has access to computers. Availability of computers is remarkably high, with 97% of all schools reporting computer access. There is no meaningful difference in primary and secondary school access, with 97.9% of primary schools reporting access to computers, compared to 97.3% in secondary schools. Across all quintiles, access to computers is 94% or more. This is testimony, amongst other inputs, to the substantial investments that the Gauteng Department of Education has made into providing computer infrastructure to schools.

Numbers of Computers in Each School

Having access to computers is not simply a matter of there being one computer in each school. Schools in the survey reported having access to 32.5 computers on average. There are fewer computers in primary (average of 26.3) than in secondary schools (average of 46.9). The average number of computers per school, however, differs quite considerably across the quintiles, with the lowest quintile schools owning the fewest computers per school. While a quintile 1 school owns an average of 16.1 computers, quintile 5 schools report owning an average of 55.2 computers. Quintile 2, 3, and 4 schools all, on average, own similar numbers of computers per school, (reported on average as 24, 25 and 27 computers per school respectively).

The Figure 2 shows the variation in number of computers in a school, by type of school, in terms of both fee levels and quintiles.

Most commonly, both primary and secondary schools have between 21 and 30 computers for learner use (48% of primary and 33% of secondary schools). About 55 % of quintile 5 schools own more than 30 computers, and 31% of quintile 5 schools have more than 60 computers. About 1 in 5 secondary schools possess more than 60 computers for learner use, and these schools are almost all in quintile 4 or 5.

Schools also reported on how many laptop computers were available (Figure 3). On average, schools surveyed own 2.1 laptops. This average is substantially skewed by the quintile 5 schools which own an average of 4.6 laptops. Schools in quintiles 1 to 4 have, on average, no more than 1.5 laptops per school. High fee schools have the most laptops available per school.

Figure 2   Schools by Number of Computers
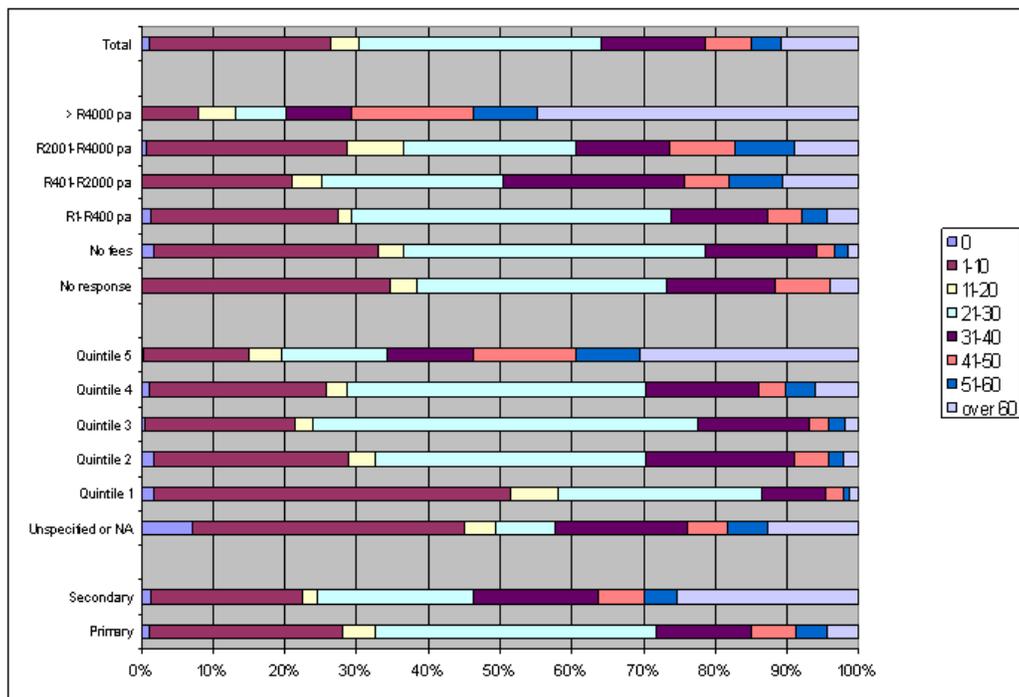
Figure 3   School Ownership of Laptop Computers
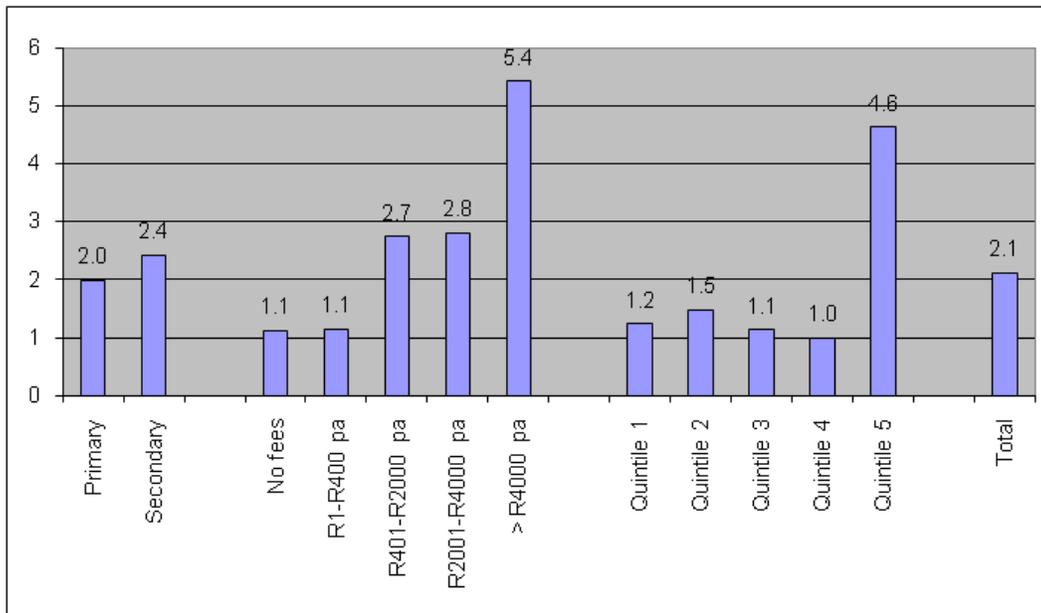
Computers Available for Administrative Staff

The mean number of computers for administration in schools is 3.57. In primary schools, the mean is 3.1 administrative computers per school, while the mean for secondary schools is 4.7. Most commonly, primary schools have between 1 and 3 computers for administrative staff and secondary schools between 2 and 4.

Computer Locations in Schools

For most schools audited, computers are available in computer laboratories. Four out of five schools in the audit report having at least one computer laboratory. A slightly higher percentage of secondary (83.5%) than primary schools (80.2%) have access to at least one computer laboratory. Quintile 1 schools have the lowest prevalence of computer laboratories, with only 59.7% having one or more computer laboratory. This compares to quintile 5 schools, where availability of at least one computer laboratory rises to 89.4% of schools.

This substantially high availability of computer laboratories in Gauteng schools may be significantly attributed to the ICT infrastructure investments of GoL. In total, 69.8% of secondary schools and 66% of primary schools report having a GoL laboratory.

Despite the high availability of computer laboratories in most Gauteng schools, there are still many schools (26%) that have fewer than ten computers. This is the case for over half (51%) of quintile 1 and a quarter of quintile 2 schools. In line with this, there is a higher incidence of schools with fewer than ten computers in no-fee schools (which are in quintiles 1 and 2) compared to schools which charge fees.

Far fewer computers at schools are located in classrooms, or available for teacher use (Figure 4).

Figure 4   Numbers of Computers in Classrooms
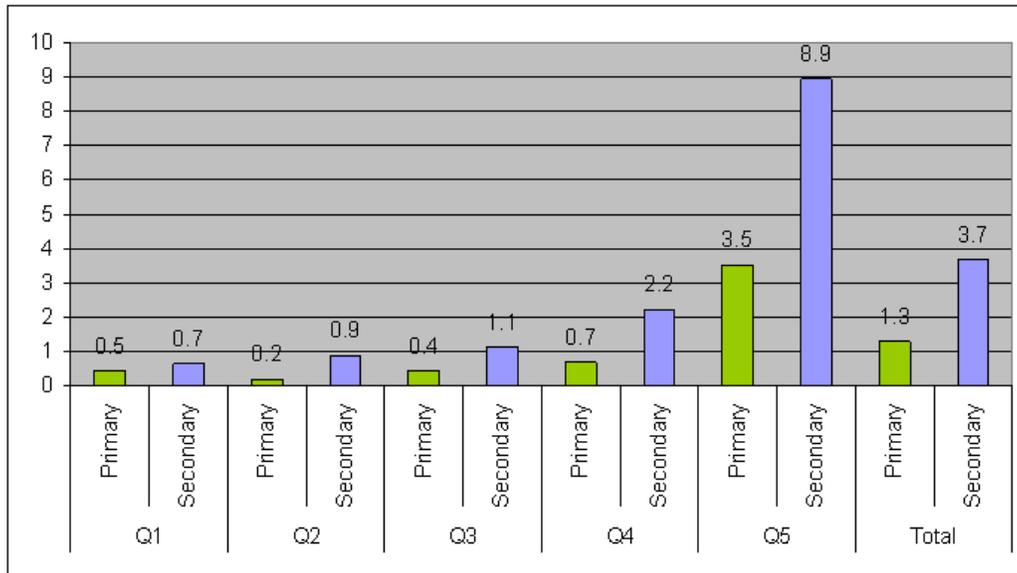
There is a mean of 3.7 computers available in classrooms per secondary school. In primary schools, this is even lower, with a mean of 1.3 computers in classrooms per school. This occurs despite the reality that in primary schools, learners tend to be allocated to a single classroom and there is far less movement between classes, which strengthens the rationale for placement of computers in classrooms in these schools. In secondary schools, learners move from subject classroom to subject classroom and have specialist timetabling and lessons, which makes it possibly easier to allocate time in dedicated computer laboratory environments at this level.

Within quintile 1, 2, and 3 schools, there is less than one computer in classrooms per school. Having a computer available in a classroom provides an indication of teacher access to computers. A computer in a classroom may be used by a teacher for administration and planning purposes, as well as for presentation of digital information to a whole class. That there are few computers in school classrooms suggests that teacher access to computers is a potential area of concern.

Types of ICT Equipment

Across all schools, thin client networks are most commonly available in schools, although a high proportion of schools also report having peer-to-peer networks. Considering schools with one or more computer laboratory:

• 40% have a thin client network;

• 31% have a peer-to-peer network; and

• 11% have both network systems.

There is a higher incidence of thin client networks in primary than in secondary schools. In quintile 5 schools, however, the reverse is the case, as there are more peer-to-peer networks than there are thin client networks.

More than half of the schools audited have printers, TV/LCD monitors, and servers. Uninterrupted Power Supplies (UPSs), scanners, digital cameras and data projectors are available in one third of schools. Less commonly available, being reported in fewer than 30% of schools, were video cameras and interactive white boards. Primary and secondary schools each reported similar access to these types of ICT equipment. Printers, servers, data projectors, and interactive white boards are, however, more widely available in secondary schools than in primary schools.

Quintile 5 schools are most likely to have the most ICT equipment, especially a data projector. Interestingly, though, quintile 3 and 4 schools are more likely than those in quintile 5 to have an interactive white board. This may be as a result of these schools receiving interactive white board as donations.

Internet Access

In total, 83% of schools surveyed have Internet connectivity of some kind. There is only a marginal difference between primary and secondary schools in this regard. There is, however, substantial variation across quintiles. Connectivity is available for almost all (98%) quintile 5 schools, while nearly half (45%) of quintile 1 schools do not have access to the Internet.

Schools in the survey most commonly connect to the Internet using either DSL/ADSL (Asymmetric Digital Subscriber Line) or satellite connectivity. There is also relatively high use of wireless connectivity. There are similar proportions of the various connectivity service types amongst Primary and Secondary schools. Fewer than 5% of schools use 52K dial-up and leased lines. Quintile 5 schools most commonly use DSL/ADSL, while schools in quintiles 1 to 4 schools most commonly use satellite and wireless connectivity.

To gauge how reliable Internet connectivity is at schools, respondents were asked to estimate what proportion of time the Internet was available. Only 41% of the schools (both primary and secondary) with Internet connectivity report having it available for more than 75% of the time.

Figure 5   Reliability of Internet Connectivity
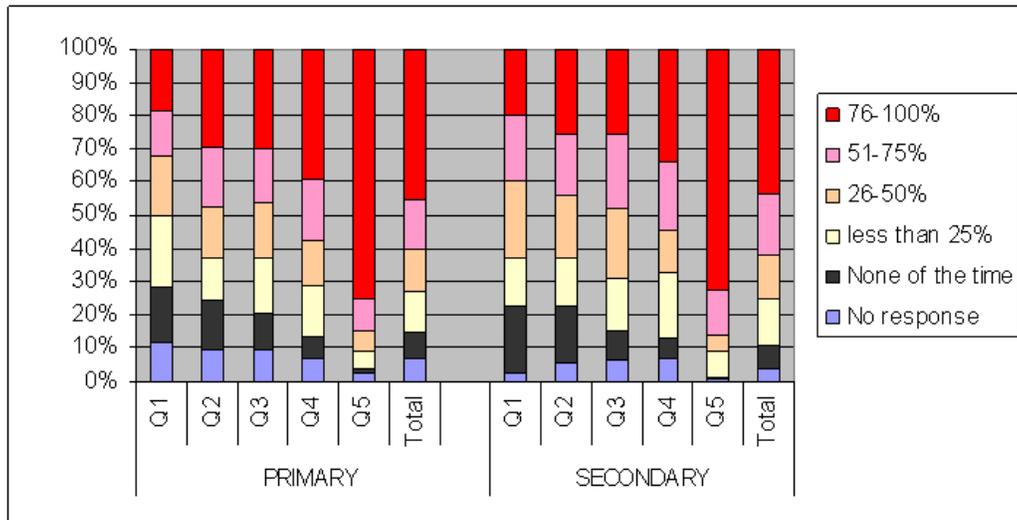
Leveraging the full benefit of ICT (as seen in the public and private sectors where ICT access is ubiquitous) requires reliable, high speed access to the Internet. Intermittent or poor connectivity prevent attainment of efficiencies and cost savings, potentially gained, for example, by being able to rely on e-mail as a cheap and efficient communication mechanism. A minimum level of 75% reliability is setting the benchmark for reliability of connectivity relatively low in this regard. Notwithstanding this, approximately half of Gauteng schools (49%) do not currently meet even this benchmark of 75% uptime. This is an impediment to plans to leverage fully the benefits of ICT in education.

Problems with Internet access affect an even higher proportion of GoL laboratories, as 66% of schools report that Internet connectivity in GoL laboratories is available less than 75% of the time. A further 20% of schools report that the Internet is never available in their GoL laboratory. This requires urgent attention if Internet access for learners is considered a priority.

Figure 6   Reliability of Internet Connectivity for GoL Laboratories
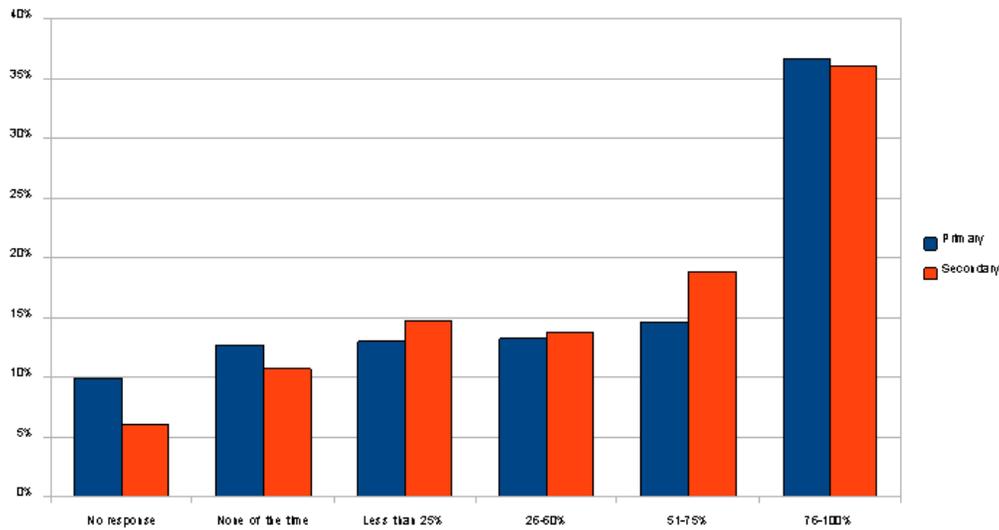
Available Software Applications

Most schools (95%) have access to Microsoft Office and school administration packages (87%). One third of schools mention other software, such as other word processing, financial, mathematics, or language/literacy software packages. There are not significant differences in this regard between schools with GoL laboratories and those without.

Access to an office suite and school administration software reflects a minimum benchmark for being able to use ICT to support school administration, teaching, and learning. It is thus encouraging to see that high proportions of schools (over 80%) report having access to this software.

Additional packages tend to be specialized for particular subject areas, providing some indication of potential to support teaching and learning and alignment to the curriculum. This suggests a gradual move in school ICT use from administrative and computer skills functions to curriculum integration and use of ICT as a source of learning resources. However, relatively few schools report having purchased or acquired software other than the basic office and administrative packages. Predictably, quintile 5 schools show the highest uptake of alternative and specialist software products. Secondary schools in quintile 5 also tend to have financial management and technical subject software, while primary schools in quintile 5 tend to have financial management, mathematics, and literacy software.

Computer Laboratory Security

GoL laboratories tend to be well secured, with only 6.3% of schools reporting no security features for their laboratories. Most commonly (39%), laboratories are protected with a gate, alarms, and bars. Most other schools have various combinations of two or three of these features: a gate, alarm, bars, and guard.

Although this is encouraging, given the high risk of theft of computers in Gauteng, it remains a concern that 1 in 17 schools have no security for its GoL laboratory. Security features of some kind should have 100% coverage across computer laboratories. The ability to secure one venue within a school was a high motivating factor for choosing to adopt a computer laboratory model, the value of which is reduced if there are still schools that have no security to protect them.

Schools were asked to report on incidences of theft. Fewer than 2% reported that computers had been stolen from school. This represents a maximum of 36 schools of the 1877 included in this analysis reported theft. The highest incidence of theft (affecting 22 schools) and largest number of computers stolen occurred in 2007. Since 2007, GoL has used thin client technology. This data is encouraging as it indicates that computer theft is far less prevalent than may have been expected or suggested from anecdotal reports. It should be noted that schools were not asked about printer or server theft, only computer theft, which may have led to some slight under-reporting (depending on how the question was interpreted). As questions about theft of ICT equipment other than computers were not included in the survey, the incidence of theft in general may be slightly higher than that of computers alone.

Use and Effectiveness of the Gauteng Online Help Desk

The Gauteng Online Help Desk has been used by about 64% of schools that have GoL computers. It is used in similar proportions by both primary and secondary schools. There are also similar levels of use across the quintiles, although the lowest proportion of use is evident amongst quintile 1 secondary schools. It has been used most by quintile 3 schools (69% primary and 70% secondary).

Almost one in five schools rates the quality of service from the Gauteng Online Help Desk highly, reporting that it is 'always' able to assist with requests. More than a quarter (28%) of schools report that it is able to assist with requests whilst almost half of schools are less satisfied with assistance from the Gauteng Online Help Desk, reporting that it is only 'sometimes' (42%) or 'never' (11%) able to assist with requests. The proportions of schools reporting this are similar for primary and secondary schools, as well as across quintiles.

Access to ICT in Schools

Learner Access to Computers

Measuring numbers of computers per school does not take into account the size of the schools. A helpful measure of learner access to computers is, therefore, how many computers there are per 100 learners within a school.

On average (Figure 7), there are 3.6 computers per 100 learners in primary schools (28 learners per computer) and 4.1 computers per 100 learners in secondary schools (24 learners per computer). [3]

Figure 7   Number of Computers per 100 Learners
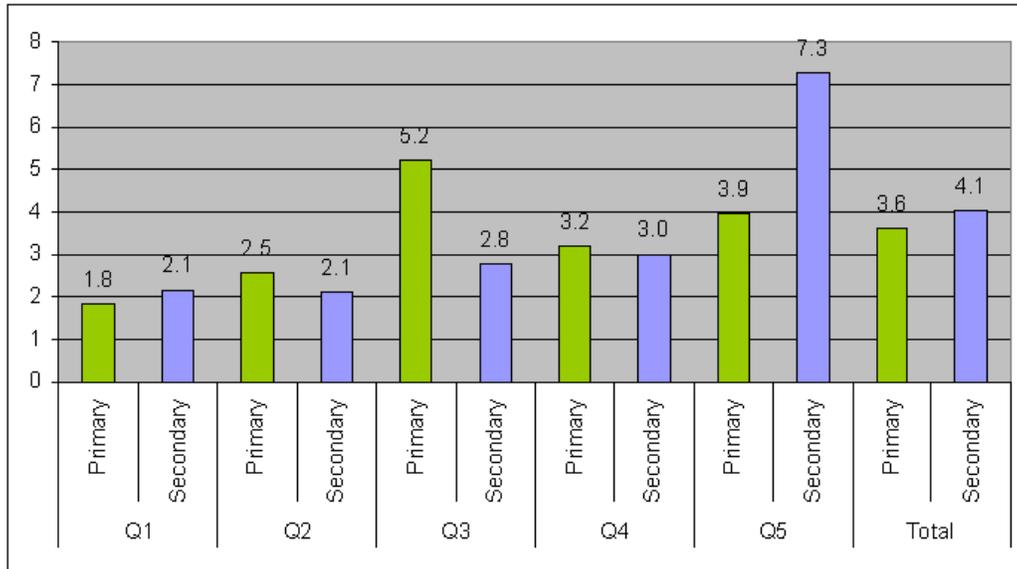
In general, the number of computers per 100 learners increases with the quintile. For example, quintile 1 schools have only 1.8 computers per 100 primary school learners, while, in quintile 5 primary schools, there are, on average, 3.9 computers per 100 learners. Quintile 3 data shows a higher ratio of computers to learners, which may be explained by the presence of some small schools in this category that have received standard GoL laboratories.

Knowing the ratio of learners to computers gives some indication of potential access to computers for learners. However, the logistics of managing learner access within a school is generally also a function of timetabling and the time that each learner has to spend on a computer.

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[3] The calculation of learners to computer has been extrapolated from the calculation of computers per 100 learners. It was not done directly from the dataset.

Figure 8   Average Computer Minutes per Learner per Day
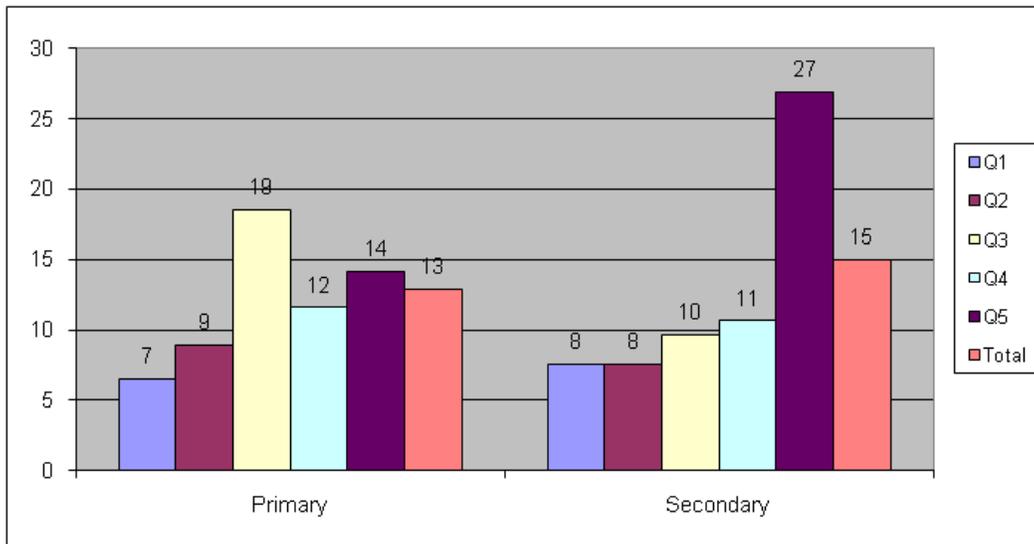
Assuming that computer use is not prioritized by either grade or subject area (i.e. all classes have equal access), the average time per day that learners would have access to a computer was calculated (Figure 8). Considering that the computers are available to learners for six hours per day, the average Gauteng learner would have access to a computer for 13.5 minutes per day. The average secondary school learner would have access to a computer for 15 minutes per day (1 hour 15 minutes per week, or just under two 45 minute lessons), while the average primary school learner could use a computer for 13 minutes per day (an hour and five minutes per week).

In quintile 1 schools, average learner time per day is only 7 minutes in primary schools (one 35-minute lesson per week), and 8 minutes per day in secondary schools (one 40-minute lesson per week). In contrast, the average learner in a quintile 5 secondary school can potentially access a computer at school for 27 minutes a day (2 hours and 25 minutes per week). The average learner's weekly access to a computer is thus not sufficient to integrate ICT meaningfully into general curriculum activities, particularly in lower quintile schools.

Teacher Access to Computers

Teacher access to computers may be measured in terms of availability of laptops or computers in resource centres, libraries, staff rooms and staff computer rooms. On average, schools reported having 2 laptops per primary school and 2.4 per secondary school. On average, there are 3.83 computers per secondary school available in classrooms. In primary schools this is lower, with an average of 1.27 computers in classrooms per school. Schools were asked directly about how many computers in the school were dedicated for teacher use. On average, there were 3.58 computers available for teachers in primary schools and 5.88 computers available to teachers in secondary schools.

As another gauge of teacher access to computers in schools, the average computer minutes per teacher per day were calculated (Figure 9). This was calculated using

data on the number of computers that were reported to be dedicated to teacher use. The calculation did not include computers available in the staff room or in a resource room or library, as these were not for the exclusive use by teachers.

Figure 9   Average Computer Minutes per Teacher per Day
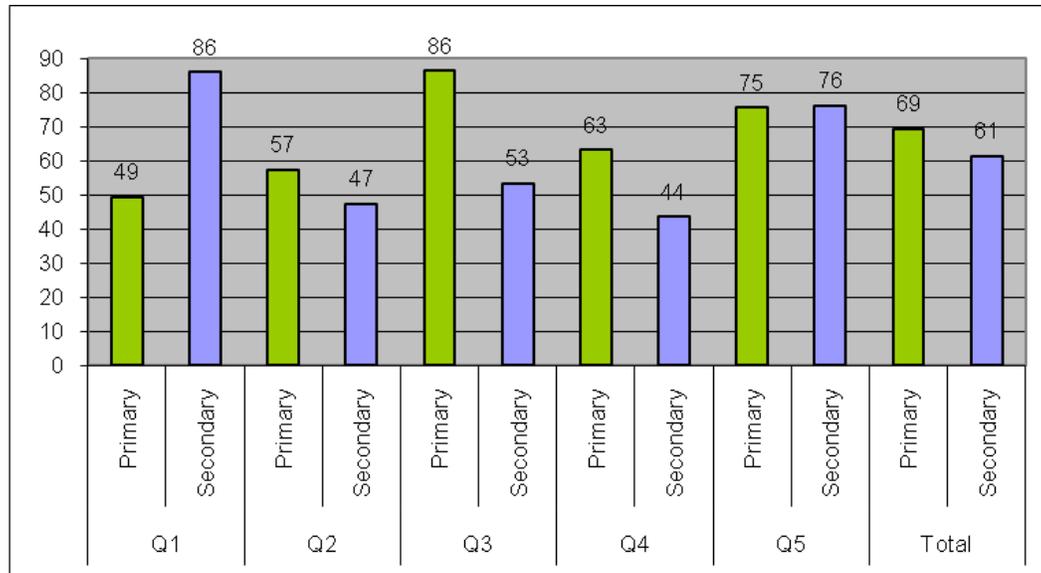
On average, a primary school teacher has access to a computer dedicated to teacher use for 69 minutes (one hour and 9 minutes) per day. Secondary teachers have, on average, daily access to a dedicated computer of 61 minutes (1 hour and 1 minute).

For primary schools, the data for quintile 3 schools shows that the average teacher in these schools has more daily computer time than those in other quintiles. This is most probably a result of the high numbers of small schools in this quintile, which nevertheless received the standard GoL infrastructure. Other than this anomaly, primary teachers' daily access to computers increases with the quintile value.

For secondary schools, there is relatively higher daily access for teachers in quintile one (almost 1.5 hours per day) than the overall average. This may be a result of schools where computers in the laboratory are used more by teachers than by learners. In quintile 2, 3, and 4 schools, there is less than an hour a day available for teachers to use a dedicated computer. Teachers in quintile 5 schools have more daily access to a computer than the overall average.

However, the above data requires further qualification. For primary schools, 31% of teachers have no access to a computer at school, while 37% can access a computer for 11-20 minutes per day. For secondary school teachers, about one third (30%) have no computer time, approximately 37% have at most ten minutes per day, and a further 27% have between 11 and 20 minutes of computer time per day. A maximum of 10 minutes per teacher is not sufficient for meaningful access to computers, even for just for the administration and communication roles of educators, but this is the reported reality for two thirds of secondary school teachers and one third of primary school teachers.

As a final gauge of teacher access to computers, teachers were asked whether they had access to a computer at home. Home access to a computer can meaningfully impact on the following six of the seven defined educator roles outlined in the norms and standards for educators:

- Interpreter and designer of learning programmes and materials;

- Scholar, researcher and lifelong learner;

- Community, citizenship and pastoral role;

- Assessor;

- Learning area/subject specialist; and

- Leader.

In the absence of access to a computer at school for use with learners, it would be difficult for a teacher to use ICT to support their other role as learning mediator. Notwithstanding this, personal ownership of a computer can greatly enhance ICT skills and be used to support most teacher roles.

Encouragingly, a relatively high proportion (60%) of teachers has access to a computer at home (Figure 10).

Figure 10   Teachers' Access to Computer at Home
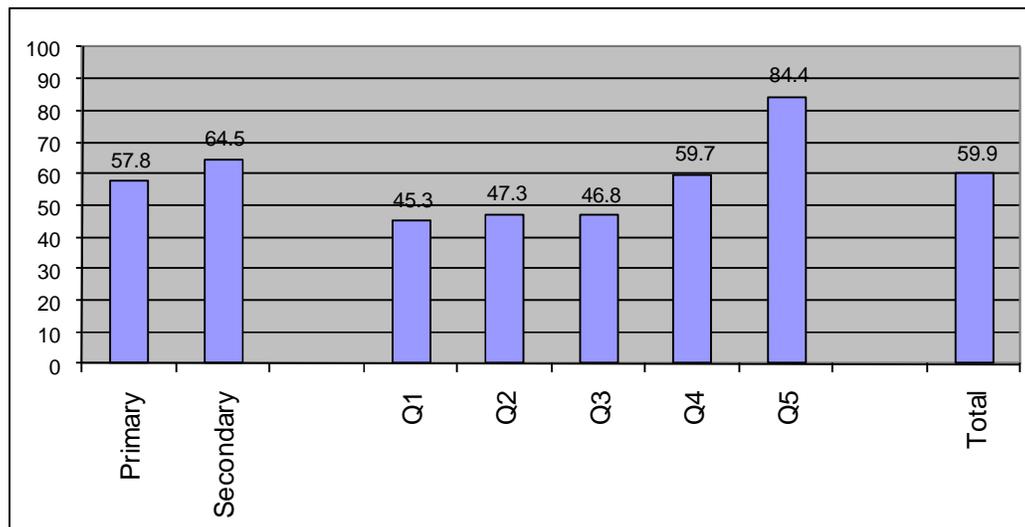
Greater proportions of secondary (65%) than primary school teachers (58%) have a home computer. The likelihood of a teacher having a home computer increases with the quintile value of their school. In quintiles 1, 2, and 3, fewer than half of teachers have access to a computer at home; while in quintile 5 nearly 85% of teachers have such access.

Considering the numbers of computers available for teachers to use at schools and related calculations of how much time each day they have for computer use, it is clear that teacher access to computers at school remains relatively low. However, it is encouraging to see that the majority of teachers have access to a computer at home. Unless teachers have regular and frequent access to computers, they are unlikely to

use ICT to support most, if any, of their educator roles. Increasing teacher access to computers is, therefore, a priority.

Administrative Staff Access to Computers

As a first indication of administrative staff access to computers, a crude calculation was conducted using the average number of administrative staff and average number of computers for administration reported by each category of school. Overall, on average there are 1.12 administrative personnel for each administrative computer. Although secondary schools have more computers for administration on average than primary schools do, they also have more administration staff. As such, access for administrative staff to computers is slightly better in primary schools (where there is an average of 1.08 administrative personnel per administrative computer) than for secondary schools (average of 1.14 administrative personnel per administrative computer). One might reasonably expect that, in a school, every administrative staff member should have full-time access to a computer. It is, therefore, encouraging that average numbers of administrative staff per administrative computer are close to 1:1, and that this is the case across quintiles.

In Figure 11, a more detailed calculation of the average number of computer minutes per day for administrative staff provides a clear indication of the levels of access that administrators have to computers in schools.

Figure 11   Average Computer Minutes per Admin Staff per Day
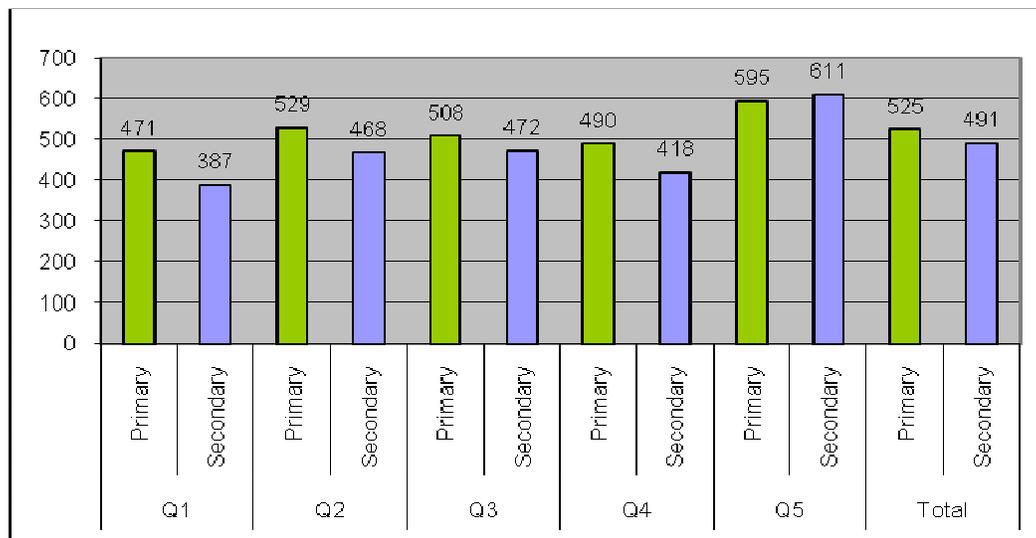
On average, therefore, an administrative staff member in a primary school has access to a computer for 525 minutes (8 hours and 45 minutes) per day. For the average administrative staff member in a secondary school, access to a computer is possible for 491 minutes (8 hours and 11 minutes) per day. Consistent with the other ICT-related data, the time that administrative staff have per day to access a computer is highest for quintile 5 schools Theoretical access to a computer for this number of hours per day indicates that there are sufficient administrative computer available for the administrative staff in primary and secondary schools.

Summary: ICT Infrastructure and Access

Schools in the audit have relatively good access to computers through the availability of computer laboratories. However, these laboratories are under pressure and the average learner is only able to access computers for about one lesson per week (based on optimal usage patterns).

The majority of schools report having Internet connectivity in principle. However, in practice, half of the schools do not have reliable Internet connectivity that would allow for systemic changes in ways of communicating or use of networked environments to shift teacher and learner behaviours.

The majority of schools in the survey have basic office and administration software. They seem to have less access to specialist software packages, and do not seem to be making purchases of software to support financial management or curriculum delivery (exacerbated possibly by the fact that schools are not allowed to install software on GoL laboratories).

Teachers in the survey in the sample generally have low access to computers – be this through laptops, dedicated teacher computers, computers in classrooms, or access to a computer at home. This is an area that requires attention, as leveraging ICT to support education requires shifts in teaching behaviour in relation to all of their educator roles.

There is relatively good access to computers amongst administrative staff, although given that most administrative work requires constant access to a computer for each administrator, this is an area where there could be still further improvement. Lack of administrator access to computers is more acute in secondary schools than in primary schools. Shifting administrative functions of schools to harness ICT is a key lever for shifting the functioning of schools.

In relation to all indicators of ICT penetration in schools, there is substantial variation in the indicators by quintile and school fee level. The pro-poor policies of the government are highly appropriate in this regard in redressing imbalances and targeting government expenditure into schools in quintiles 1 and 2. However, the data also reveals that quintile 3 and 4 schools also have low ICT penetration levels and require additional support. The fee levels in these quintiles cannot support the kinds of investments required to see ubiquitous access of ICT for South African learners and teachers. Fee levels in Quintile 5 generally do seem able to meet this requirement without further government support.

Organizational Culture

This section describes how ICT is managed in schools. It explores the beliefs that ICT Coordinators and School Management Teams (SMTs) hold about their roles in ICT management, as well their beliefs in the roles of ICT in education development. Finally, it presents descriptions of the financial management of ICT in schools by considering their ICT budget structures and sources of funding.

Management of ICT Use

The management of ICT in schools was gauged by considering whether schools had an ICT committee (41%), ICT policies (30%), and/or ICT plans (27%). 41,3% have either a policy or a plan or both. However, in 40.8% of schools use of ICT is not formally planned in any way. The likelihood of a school having an ICT plan increases with the quintile: more than half of quintile 1 schools have no ICT plan, while less than a third of quintile 5 schools are in this situation.

The majority (about three out of four) schools have an ICT Coordinator. There are ICT Coordinators in 74% of primary and 70% of secondary schools. In quintile 5 schools, the presence of an ICT Coordinator (81%) is highest. ICT Coordinators may be expected to do the following:

• On-site user support;

• Training of learners;

• Systems maintenance; and

• Training of teachers.

At 9% of schools that have an ICT Coordinator, all four types of support are provided. At almost a third (31%) of schools, the ICT Coordinator provides none of these four types of support. There is considerable variance across schools in the combinations of roles for which an ICT Coordinator is responsible. The most common combination of roles played by an ICT Coordinator is training of teachers and training of learners (this is the case for 20% of schools).

Also common at 55% of schools is the use of an ICT Coordinator to plan use of ICT in the school. Almost half of schools (44%) have ICT planning as a School Management Team (SMT) role, and a small percentage (7%) allocate this ICT planning to a librarian/resource teacher.

On average, ICT Committees comprise 2.5 SMT members and 2.26 non-SMT teachers.

SMT Beliefs about the Role of ICT in Education

SMTs identified different roles in supporting ICT in the school (listed from most to least frequently mentioned):

• Encouraging and motivating use of ICTs (66%);

• Liaison with ICT coordinator (50%);

• Planning staff ICT training (45%);

• Policy development (37%); and

• Communication with stakeholders (33%).

School SMTs have differing rationales for a school's need for ICT. Most commonly they refer to:

• Learner Development (40%);

- Teacher Efficiency (35%);

- Administration (34%).

It is significant to note that, although learner development is frequently mentioned, this variously refers to computer literacy, expanding horizons, projects, and technology skills. There is clear emphasis on learners' ICT competence, but there appears to be less emphasis on using ICT to support other elements of learners' development (for example, attaining curriculum standards for particular subjects). Learner development is the most common mentioned reason by SMTs for requiring ICT in schools, while supporting teaching and learning is far less frequently mentioned.

Most SMTs in schools (over 60%) use ICTs to prepare school timetables, learner reports, school development plans, and/or to manage school finances. The SMTs in quintile 5 schools are more likely than others to use ICT. It is notable that, on average, almost 1 in 5 (19%) SMTs do not use ICT at all in their SMT functions. The lower the quintile, the greater the likelihood that ICT is not used to support SMT functions.

For almost two thirds (63%) of schools, there is no community involvement in the school's ICT activities. Where this is such involvement, it may be in the form of having a School Governing Body (SGB) involved in ICT planning, making ICT infrastructure available for community use, or having the community provide finances, expertise, and/or technical support. Just over one-third of schools (38%) have a SGB that is involved in ICT planning and decision-making. Community use of schools in ICT is highest at quintile 3 and 4 schools, although community contributions of finance, expertise, and technical support are highest at quintile 5 schools.

One may assume that having an ICT plan and an ICT coordinator are potentially important mechanisms to support the management of ICT use in schools. A large proportion of schools has no ICT coordinator (41%) and the same proportion (41%) no ICT Plan. When engaging with SMTs on the importance of ICT planning and coordination, emphasis on the teaching and learning benefits of integrating ICT should exist. However, many SMTs (40%), and particularly those in the lower quintiles, seem to require support on the use of ICT for their own functions such as school timetables, learner reports, school development plan, and/or school finances. This may mitigate against an emphasis on ICT integration, which as a result may be compromised within SMT structures.

Monitoring and evaluating the effectiveness of ICT use in schools is another potentially important indicator of the effectiveness of school management of ICT. Fewer than half of schools (47%) indicate that they monitor and/or evaluate whether ICT is being used effectively by teachers. The lower the quintile value, the less likely a school is to have any form of monitoring and evaluation (M&E). Just over a quarter (27%) of quintile 1 schools implement any form of M&E, while 65% of quintile 5 schools conduct M&E.

Three issues emerge clearly as the main perceived challenges facing schools in using ICT (as measured by the percentage of schools citing this as a main challenge):[4]

- Lack of staff training in ICT (60%);
- Lack of sufficient computers for teaching and learning (58%);
- Lack of training to use ICT for teaching and learning (54%).

The following issues are reported by smaller proportions of schools (presented in declining order of frequency of mention):

- Insufficient funding for maintenance (37%);
- Lack of skills to use network (36%);
- Lack of connectivity (19%);
- Insufficient funding for running expenses (31%);
- Theft and vandalism (31%);
- Lack of time (29%); and
- Lack of maintenance support (26%).

Notably, although fewer than 2% of schools reported actual theft of computers, 31% see theft and vandalism as a challenge. Thus, problems may either be mostly in the form of vandalism or else thefts have been under-reported, This concern is most acutely felt in lower quintile schools.

A clear need for more training and support to staff, particularly in how to use ICT for teaching and learning, emerges from these perceived challenges. Again, these challenges are most strongly expressed in quintile 1-4 schools. Lack of access to computers (for both teachers and learners) is a further major challenge, but, the other less frequently mentioned challenges should not be overlooked.

From the above data, it can be established that SMTs, and particularly those in lower quintile schools, require different kinds of support in relation to ICT use:

- ICT planning (ICT plans, ICT Committees, and ICT Coordinator appointment and role definition);
- Use of ICT to support SMT functions (school timetables, learner reports, schools development plan, school finances);
- Use of ICT to support teaching and learning;
- Monitoring and evaluating effectiveness of ICT use in schools;
- Managing ICT staff development (identifying staff training needs, awareness of training provision and options, and accessing funding for this); and
- Managing and encouraging community involvement.

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[4] The SMT plus the person responsible for ICTs in the school (who may or may not be part of the SMT) were asked to select 5 main challenges from a list of 16 possibilities.

Prioritizing investment at the SMT level would integrate the above issues into overall school management. Ongoing challenges regarding ICT use, such as ICT maintenance, increasing ICT access, and staff training, would become part of normal school functioning, rather than an add-on to the usual annual planning processes. This would, however, need to be coupled with mechanisms for schools to access information and funding about possible options in relation to their ongoing needs (what is available and at what price) for ICT procurement, staff training, and ICT maintenance

Budgeting and Finance

Schools have options to draw on support for ICT from Banepele, GoL, or SASAMS. Over half of schools have received support from SASAMS (61% of primary and 52% of secondary schools) or GoL (50% of primary and 49% of secondary schools). Smaller proportions (11% for primary and 5% for secondary schools) on average are accessing support from Banapele[5]. Schools in quintiles 2, 3, and 4 are better supported through these funds than those in quintiles 1 and 5.

Most schools surveyed (about 7 in 10) have an ICT budget from either donors, or school funds or GDE/GoL. Where this comes from GoL or GDE, this is not in the form of funds, but rather through supply of hardware, software, and/or technical support. Budgets from donors and school funds cover allocations for computers and other hardware, maintenance, and connectivity. Notably, very few secondary schools have a budget for software, insurance, and technical support (or have been provided with this by the GDE). Primary schools are much more likely than secondary schools to use their school funds budget for software (or be provided this by the GDE). Primary schools most commonly budget for (in descending order of frequency):

- Maintenance (76%);
- Hardware (70%);
- Connectivity (67%);
- Technical support (66%);
- Software (65%);
- Staff development (62%); and
- Insurance (46%).

For secondary schools, the items most commonly included in ICT budgets are (in descending order of frequency):

- Connectivity (75%);
- Hardware (69%);
- Maintenance (68%);
- Staff development (52%);

[5] A 'Children First' initiative of the Gauteng Provincial Government.

- Software (17%);

- Insurance (9%); and

- Technical Support (9%).

The elements included in an ICT budget are very similar to the global average even when only those schools with GoL laboratories are analysed. This shows that the schools with GoL laboratories do not really demonstrate different behaviour in budgeting terms compared to schools that have not received such laboratories.

Most commonly, schools have been provided hardware and software from GoL or GDE. A much smaller number of schools source funds from school fees, while an even smaller number access donor funds. There are a few funding related trends worth mentioning:

- In primary schools, there is more hardware and software provided in lower than higher quintiles from GoL/GDE and more funding available in higher than lower quintiles from school funds.

- For other expenses, primary schools rely more on school funds than on GoL funding.

- At secondary Schools, there is minimal funding from any source for software. Where such funding does exist, the software is provided by GoL/GDE.

- Secondary schools are more likely than primary schools to receive GoL technical support and insurance.

It would seem that, with the basics in place for schools to start to use ICT, what is now needed is school access to funds to support individually developed ICT plans. As described above, a process of SMT training and support on how to manage ICT in an ongoing way could usefully be prioritized.

Summary: Organizational Culture

It is encouraging that most schools have an ICT Coordinator and that only a small minority (6%) have no ICT budget from any source. It is regarded as a priority that those schools which do not have an ICT Coordinator appoint one as soon as possible. Given the potential importance of ICT planning in the ongoing management of schools, it is of concern that only 41% of schools report having an ICT policy or plan, an ICT committee (41%), and that a similar percentage (44%) involve their SMT in ICT planning. From this, one may infer that approximately 60% of schools have a need to establish management structures for ICT planning processes. As one would expect, a similar percentage of schools lack plans and ICT budgets. These schools, one may assume, require support on ICT management (including appointing an ICT coordinator, establishing an ICT committee, involving the SMT in planning, developing ICT plans, and financing).

Where schools have ICT management structures and budgets in place, they require further support on:

- ICT software, insurance, and technical support (as these are least frequently included in ICT budgets);

- ICT-related staff training provision (cited as a major challenge facing schools), with a particular emphasis on training on using ICT to support teaching and learning;

- ICT hardware options and ways to prioritize learner ICT access (as lack of learner access to computers is cited as another major challenge facing schools);

- ICT budgeting (as few schools include all the main budget items one might expect in a school ICT budget);

- Monitoring and evaluation of the effectiveness of ICT (as less than half of schools conduct any M&E); and

- Funding sources for resourcing ICT plans (as schools are inevitably going to require annual ICT plans, which will require ongoing funding from sources other than dedicated ICT budgets and initiatives such as GoL and SASAMS).

Teaching and Learning

The review of ICT use in teaching and learning is organized into three sections:

- Teacher use;
- Teacher skills; and
- Learner use.

Teacher Use

This section describes how teachers are using ICT in schools. It explores how frequently they use computers, use of e-mail, purposes for using ICT, and use and experimentation with technologies other than computers. The implications of this type of ICT use amongst teachers are then examined.

Frequency of Computer Use at School

The majority of teachers are either never using computers at school (42%) or are only using them monthly (15%). There is more regular use by teachers in secondary schools than in primary, with 40% of teachers at primary schools and 45% of teachers at secondary schools using computers on most days or weekly. Frequency of teacher use increases with the quintile value of the school, so there is most frequent ICT use by teachers at quintile 5 schools.

E-Mail Use

Use of e-mail as a cheap and efficient means of communication is a key driver of shifts in organizations harnessing ICT. Yet only 40% of teachers participating in the survey have an e-mail address. This is higher in secondary schools (48%) than in primary schools (36%). Figure 12 shows a very clear increase in the percentage of teachers with an e-mail address as the quintile value increases.

Figure 12   Percentage of Teachers with an Email Address
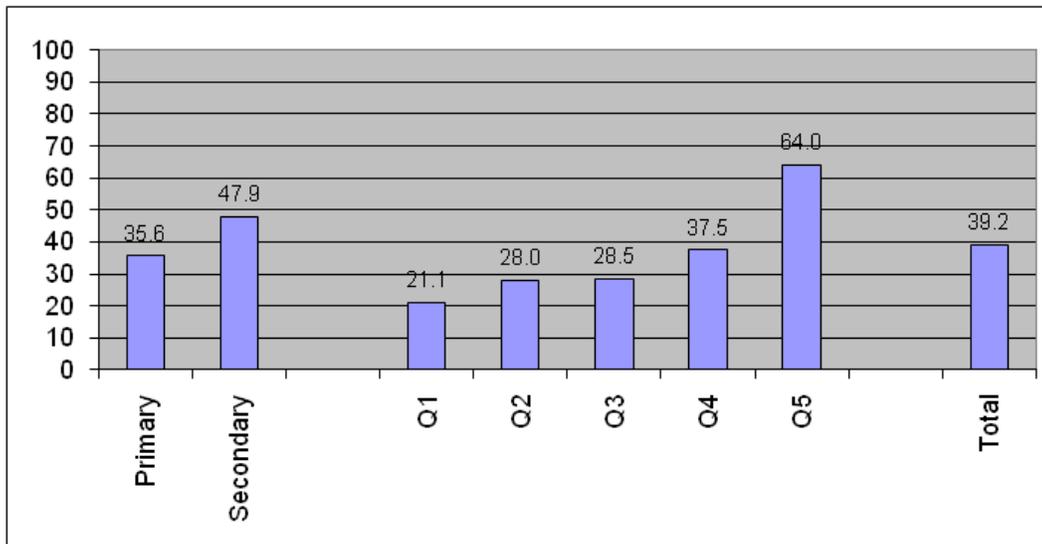
Another indicator of the extent of e-mail use is how frequently teachers report using it. On average, more than half of teachers (56%) never use e-mail. A further 16% use it infrequently (either fortnightly or monthly). Relying on e-mail as a primary means of communication usually entails daily use, a practice currently only reported by 17% of teachers. Again, there is more frequent use in secondary than in primary schools, while frequency of teacher use of e-mail increases by quintile value (Figure 13).

Figure 13   Use of Email by Teachers
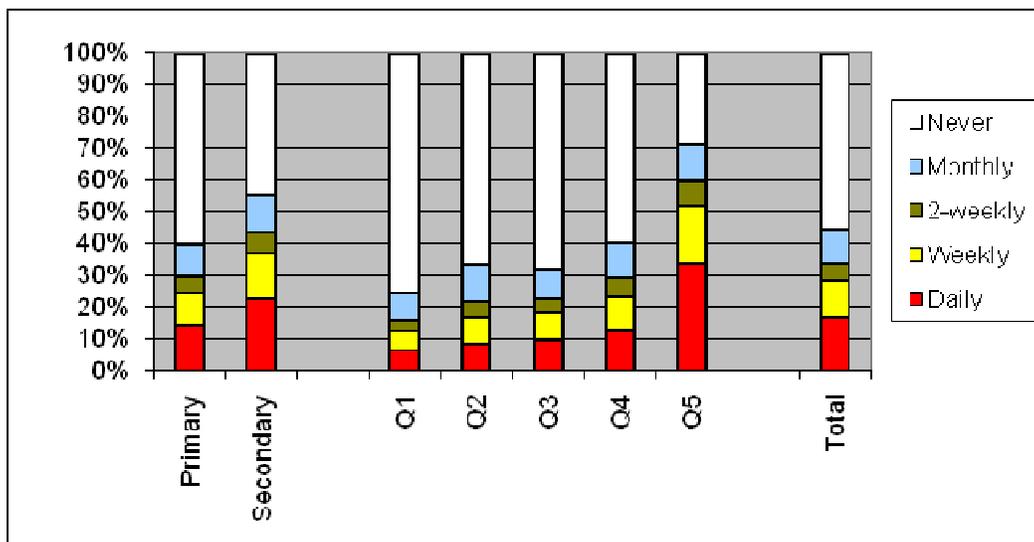
The Purposes of Teachers' Use of ICT

Teachers most commonly use ICT for the following purposes (in descending order of frequency):

- Personal (non-professional) purposes (41%);

- Finding information on the Internet (40%),

- Typing examination papers (37%);

- Recording marks (27%);

- Developing teaching resources (24%);

- School administration (21%);

- Professional development (20%);

- Developing digital content (12%); and

- Accessing resources via Thuthong (8%).

The above data provides an important indication of ways to motivate teachers to develop ICT competencies, as ICT use clearly becomes meaningful when it relates to what teachers would like to do. It seems that personal (non-professional) use could potentially be a key driver to shift teachers from being non-users to ICT users. The professional spin-offs from teachers becoming familiar with ICT for personal use can then be enhanced, while initial anxiety may be overcome through personal motivation.

Regarding use of other technologies, schools reported use of the following technologies (listed from most to least frequently used): a television, an interactive white board or data projector, and a digital camera or a video camera. A very small minority has created a wiki or a blog. There is a high percentage (80%) of schools which have experimented with using television, while almost half (45%) have experimented with using a digital camera. A quarter of schools have reportedly experimented with using interactive white boards and/or mobile telephones. Only 1 in 10 schools in quintile 5 have experimented with GPS, blogs and/or wikis, and proportions of use of GPS, wikis and blogs is even lower for schools in other quintiles. As with use of computers, experimentation with use of other ICT is highest at quintile 5 schools.

Implications for Future Planning

A very high proportion of teachers are not using computers at all: they do not have an e-mail address and report never using a computer at school or using it only monthly. The benefits of cheap and efficient communication cannot be realized when more than half (60%) of teachers do not have an e-mail address. Allocating e-mail addresses to teachers and creating a need for them to use e-mail communication should be a priority.

Those who do use a computer most commonly report using it for personal (non-professional) purposes. If developing the ICT competencies of teachers is a priority, acknowledging that teachers have personal needs that can be met by using ICT may be a good way of motivating teachers to start to use computers. The professional spinoffs of having basic computer competence (such as being able to use e-mail as a starting point) may then be easier to develop.

It is encouraging to see that high proportions of teachers are experimenting with ICT other than computers. Use of television in particular, seems high. Considering the tremendous pressure that computer laboratories are under (as discussed under learner access), alternative technologies should be encouraged. This includes television, data projectors, and interactive white boards which would most likely be used in classrooms. The use of digital cameras, video cameras, and mobile telephones should be actively encouraged.

Teacher Skills and Confidence Levels

Confidence in Using a Computer

To gauge levels of confidence in using computers, teachers were asked whether they were confident to make use of a computer either on their own, with the help and support of someone else, or not at all. They were also asked to comment on whether they were confident to help colleagues or to teach learners. On average, almost half of teachers report being confident enough to use a computer on their own, and over 40% feel confident if someone supports them. However, fewer than 20% of teachers feel confident enough to help colleagues or to teach students. In quintile 1-4 schools, teachers who feel that they need someone to support them outnumber those that feel confident to work on their own. This reflects relatively low proportions of confident self-use in most schools (except in quintile 5). This lack of confidence is more pronounced in primary schools.

Identified Skills

When reflecting on specific ICT skills, secondary school teachers report being able to do a wider range of ICT-related tasks than their primary colleagues. Common skills are (in descending order of frequency):

- Use of a memory stick (50%),
- Logging onto a network (33%),
- Installing a printer (30%) and/or
- Installing software (24%).

The percentages of teachers reporting being able to perform ICT-related tasks increases with the quintile value of the schools. Significantly, more than half of teachers in quintile 1 schools reporting being unable to perform any ICT-related tasks.

Categories of Teachers ICT Use

Teachers were asked about the categories of work in which they use ICT. They reported using ICT most often to support administration, then for lesson preparation, then for teaching and then for learning. For all types of use, levels of use were higher amongst secondary than amongst primary teachers.

Figure 14   Teacher use of ICTs: Indices
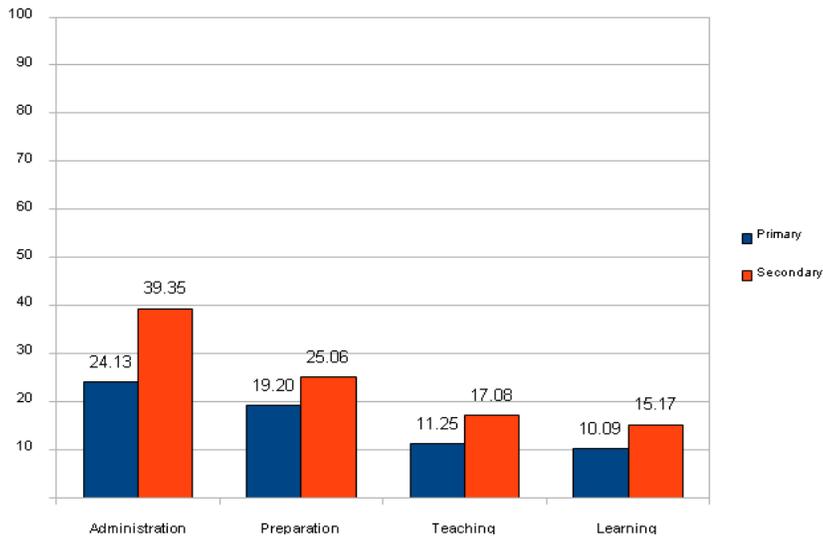
Referring to Figure 15, one in four primary and two in five secondary teachers use ICT for administration. One in five primary and a quarter of secondary teachers use ICT for lesson preparation, while only 11% of primary and 17% of secondary teachers use ICT while teaching their learners. In addition, 10% of primary and 15% of secondary teachers get learners to use ICT in their lessons. Levels of use increase with the quintile value for the school for each type of use. This is the case for both primary and secondary schools.

Figure 15   Teacher use of ICTs: Indices (Quintiles 1-5)
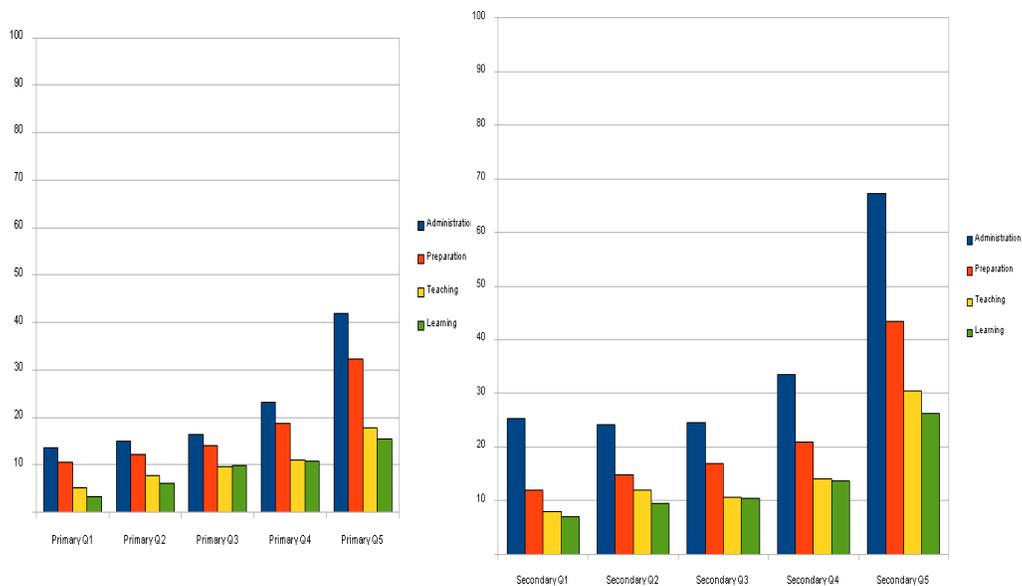
Reach and Focus of ICT-Related Training for Teachers

On average, approximately half (49%) of schools have received some form of staff training in ICT. Higher proportions of staff have been trained in secondary schools than in primary schools. There are differences in training across the quintiles, with quintile 5 schools having received more training than other quintiles. However, the range across quintiles of percentages of teachers who have received ICT training is far smaller than the range of percentages of teachers reporting types of ICT use across quintiles.

Most training for teachers seems to have been of an introductory nature, with 21% of primary and 25% of secondary teachers reporting having participated in 'ICT skills' training. There has been progressively less frequent training in:

• Technical skills support (17%);

• Integrating ICT in curriculum using the worldwide web (16%);

• Integrating ICT in classroom projects (14%);

• ICT leadership and management (13%); and

• Collaboration using Internet tools (11%).

This pattern repeats itself in training for other staff, in that most training has focused on introductory or basic ICT skills (Figure 16).

Figure 16   Percentage of Teachers who have Received any ICT Training
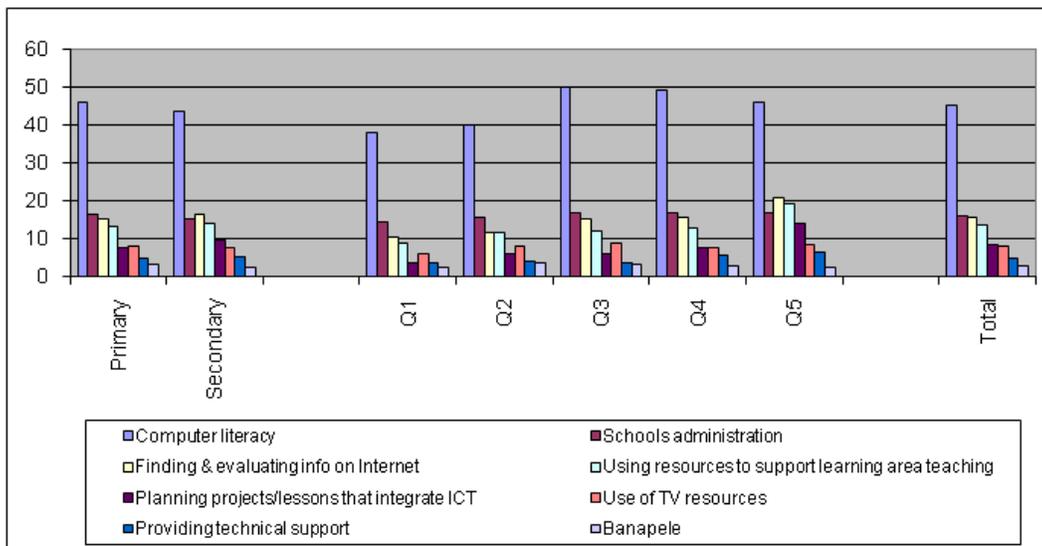
Thus, 45% of teachers have received computer literacy training, but predominantly of a very basic nature. It is also notable that there is a smaller range of differences across quintiles in relation to this basic provision of teacher training. Therefore, while there are significant inequalities between quintile 1 and 5 schools in relation to teacher skills and levels of confidence, there is less disparity when comparing how much each quintile accesses teacher training.

The dominance of basic ICT skills or computer literacy is consistent with the ICT training offered by GoL. The emphasis in these training offerings was on a 'basic

introduction', 'computer skills', and 'Internet and e-mail'. The following figure shows the relative proportions of teachers receiving these types of GoL training:

Figure 17   Gauteng Online (GoL) ICT Training Received
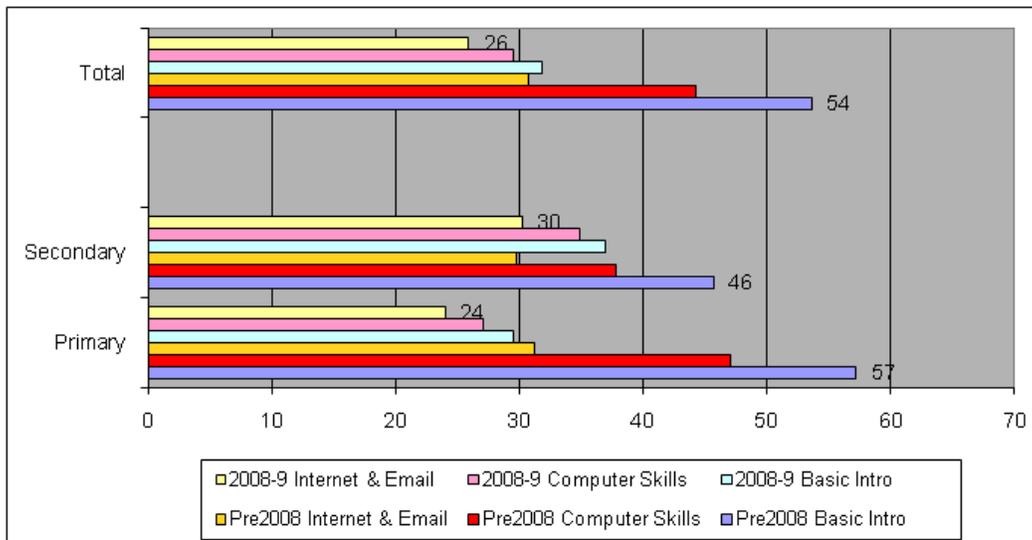
Amongst the 65% of schools that have GoL computers, 82% have received some sort of ICT training. The most common GoL training has been a basic introduction to computing, which was provided to 54% of schools before 2008 and to 32% in 2008-2009.

Most teachers (76%) have, however, received fewer than four hours of ICT training during the last 12 months. The differences between primary and secondary schools, as well as between quintiles, are not significant in term of how much ICT training has been received.

Learner Use

To understand how learners in schools are making use of ICT, it is informative to reflect on several indicators:

- What types of packages teachers report that their learners are using in their lessons;

- Their purposes for using ICT;

- Availability of ICT-related of subjects in secondary schools including IT and CAT;

- Availability of computer literacy classes; and

- Availability of learner access to computers outside of formal school time (informal learner use).

Types of Learner Use

These indicators can provide an initial, quantitative sense of how much learners are using ICT and for what purposes. As a first indication, Figure 18 explores what packages teachers report that they are using with learners while completing curriculum activities.

Figure 18   Learner use of ICT Packages
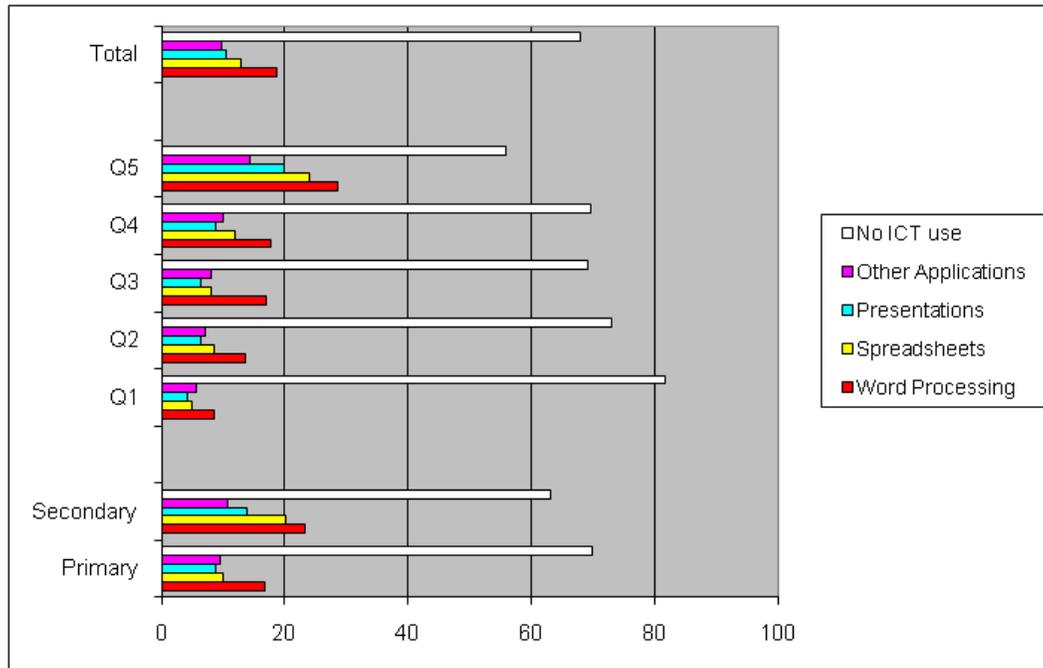
The majority of teachers (about 70%) say that they are not using ICT at all with their learners whilst completing curriculum activities, although the percentages of teachers reporting no ICT use with learners decrease with the quintile values of schools. In quintile 1 schools, more than 80% of learners report no use of ICT. This is cause for concern, considering that one of the primary objectives of harnessing ICT in schools is for learners to make use of it. Those teachers who are using ICT with their learners most commonly make use of word processing (18.7%), then spreadsheets (13%), and a small minority make use of presentation software.

A similar pattern of non-use by most learners emerges when examining how their teachers report on their learners' use of ICT in their lessons.

Figure 19   Purposes of Learners' Use of ICT
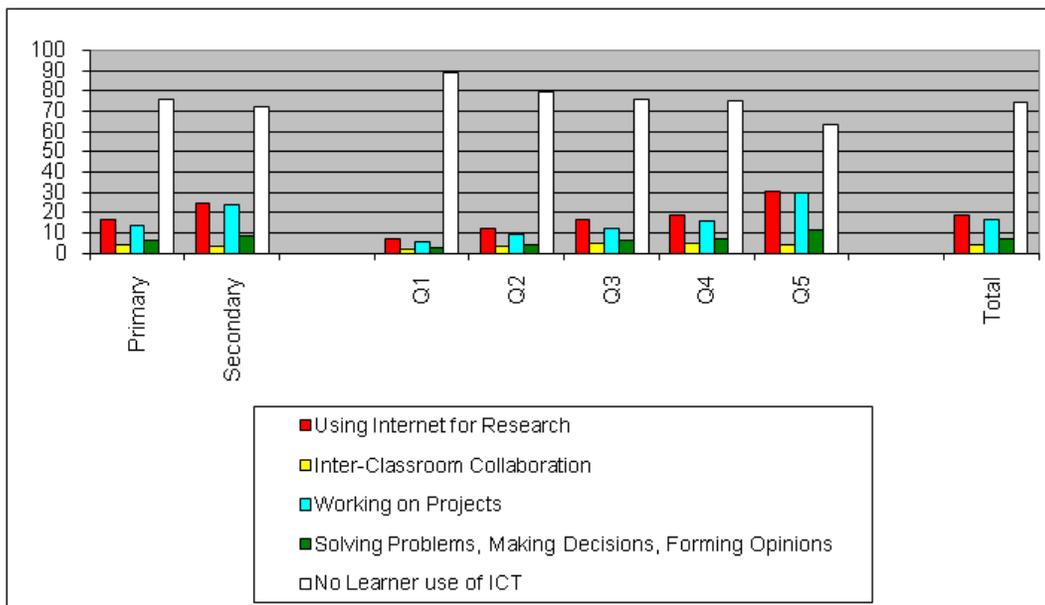
Learners use ICT for 'research' with 18.7% of teachers, for 'projects' by 16.3%, for 'problem-solving' by 7%, and by a small minority (4%) report for 'inter-classroom collaboration'. Again, on average, three in four teachers report not using ICT at all with their learners. The percentages of teachers reporting no use of ICT with learners decrease by quintile value. However, even in quintile 5 schools, approximately two thirds of teachers report not using ICT at all with their learners.

ICT Skills Development

One may expect that in secondary schools, learners are using ICT in subject areas that formally require it, most notably CAT and IT. As such, an indication of the percentage of schools offering these subjects should provide an additional indication of learner ICT use. In total, 38% of secondary schools offer CAT and 18% offer IT. There is a high range in percentages of schools offering these subjects across the quintiles, with the likelihood of these subjects being offered increasing with the quintile value and the fee level of the school**.** For example, while CAT is only offered in 3% of quintile 1 schools, it is a subject offering in 80% of quintile 5 schools. There is a far higher incidence of schools offering CAT amongst schools charging high fees (where 88% offer CAT) than amongst low-fee and no-fee schools (where only 16% offer CAT). There is a strong correlation between the existence of an ICT Coordinator in a school and offering of CAT at a school. Secondary schools with an ICT Coordinator are twice as likely (44%) to offer CAT as those with no ICT coordinator (22%). However, it is unclear what the causal nature of this relationship is (i.e. whether appointing an ICT Coordinator increase the likelihood of CAT being offered or whether the presence of teachers able or willing to offer CAT increases the likelihood of ICT Coordinators being appointed).

The subject of IT is offered by, at most, 1 in 20 schools in quintiles 1-4 (2% of quintile 1 schools, 3% of quintile 2 schools, and 5% of quintile 3 and 4 schools). The majority

of schools offering IT are in quintile 5 (with 53% of such schools offering this subject). As with the CAT schools, the presence of an ICT coordinator increases the likelihood of the subject being offered (23% of schools with an ICT Coordinator offer the subject compared to 9% of those without), although the caveat noted about causality again applies here.

Another indication of learner use of ICT is provided by examining whether or not schools offer Computer Literacy classes to their learners. Figure 20 depicts the average for each school type in relation to which grades are offered computer literacy classes:

Figure 20   Percentage of Schools Offering Computer Literacy Classes to Learners
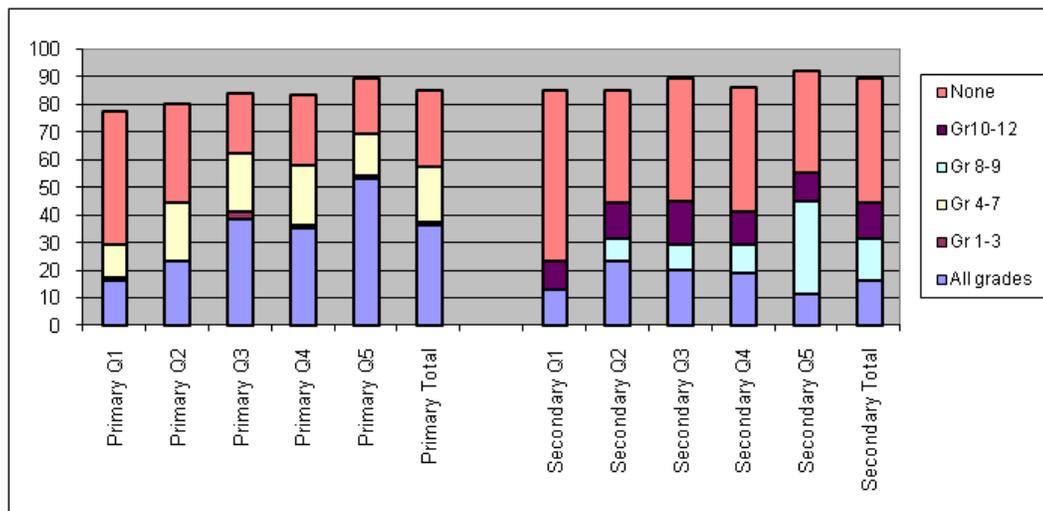
There is a higher incidence of computer literacy classes offered in secondary schools than IT and CAT. As one might expect, there are higher percentages of primary schools (where CAT and IT are not an option) offering computer literacy classes (55%) than in secondary schools (45%). Across both primary and secondary schools, the percentages of schools offering computer literacy classes differs markedly by quintile, with the likelihood of computer literacy classes being offered decreasing with quintile value. Amongst quintile 1 secondary schools only about one in four schools is likely to offer computer literacy classes.

Some prioritization in relation to grade levels targeted for computer literacy classes is evident in the above figure. Primary schools (36%) are more likely than secondary schools (16%) to offer computer literacy classes to all grade levels. In secondary schools, there is slightly more emphasis on computer literacy classes for grades 10-12 (although this prioritization of FET over senior phase is reversed for Quintile 5 schools). For primary schools, where priority is given to certain grade levels, the emphasis is far more likely to be on Grades 4-7 than on Grades 1-3.

Relatively high percentages of schools offer no computer literacy classes (in a context where there are high percentages of schools with computer laboratories). Overall, 26% of all primary schools offer no computer literacy classes, while this is the case for half of the schools in quintile 1. Overall, 45% of all secondary schools offer no literacy

classes, while this is the case for 60% of quintile 1 schools (although interpretation of secondary school data should take into account parallel delivery of IT and CAT).

Informal Learner Use

A final indication of learner use of ICT comes from considering the numbers of schools that provide learners with access to computers outside of formal schools hours. This is referred to as informal learner use.

Half of secondary schools (50%) and a third (32%) of primary schools make provision for learners to use computers after school hours. In secondary schools, there is also relatively high provision of access to computers during break times (at 51% of schools). Break-time learner access is less prevalent in primary schools, where 25% provide this option to their learners. About 10% of schools go even further in encouraging informal learner access by allowing learners to use computers before school and on weekends. This is more prevalent amongst secondary schools than amongst primary schools. The likelihood of providing access to computers for informal use by learners increases by quintile value (Figure 21).

Figure 21   Schools Providing Opportunities for Informal Learner ICT Use
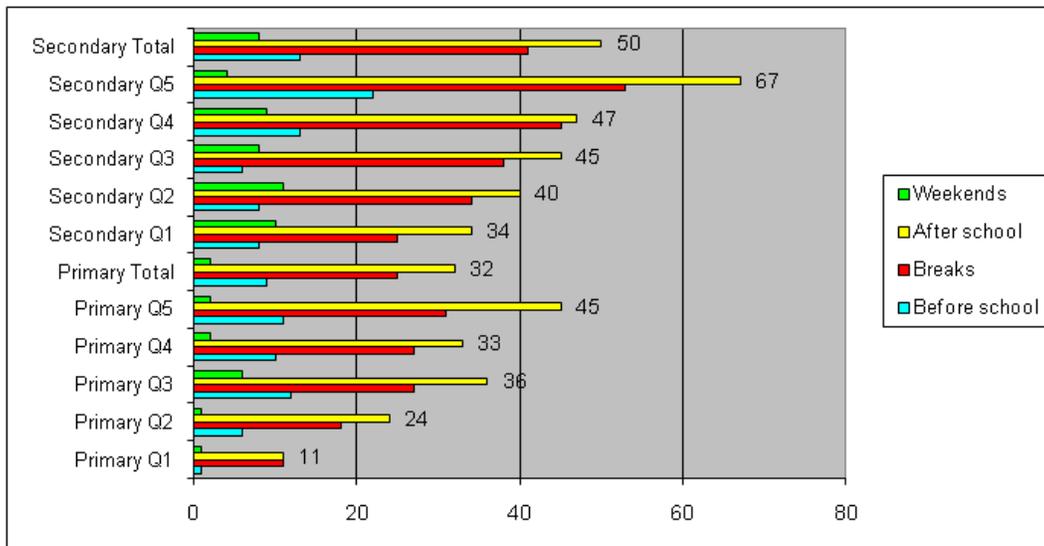
ICT Security and Ethics

Introducing ICT to learners has risks and ethical considerations. This is not a reason to limit ICT access or prohibit its use, but rather an opportunity to teach learners about the appropriate use of ICT. Despite this, 60% of schools do not teach about copyright, plagiarism, acknowledging sources of safety, and security on the Internet. The percentages of schools that do teach about one or more of these issues are very small (fewer than 20% in primary schools and fewer than 40% in secondary schools). The likelihood of these issues being taught increases with the quintile value of the school. Across the board, security and safety on the Internet is the topic that is least taught.

Implications for Future Planning

The ICT infrastructure and learner access data reveals that there is a relatively high availability of computers. However, calculations on theoretical learner access reveal that computer laboratories should be under pressure (assuming all learners potentially have access and that they are in use for six hour per day). However, the above learner use data may reveal that this pressure on computer laboratories may only be theoretical in some schools. There are two possible explanations for this: either computer laboratories in these schools are standing empty rather than being optimally used or computer laboratories are only being used by a small minority of learners.

One may assume that in schools where CAT and IT are offered, the learner computers are largely restricted to use by learners who take these subjects. In primary schools, given that IT and CAT are not offered, one would expect that a wider range of learners would report using ICT at school. However, the opposite is the case – very high percentages of primary school learners are reported as not using ICT when queried on the packages they use, or their purposes for use.

Conclusion

The above analysis has provided a detailed quantitative picture of patterns of ICT access and use in Gauteng schools. There are several very positive observations from the above, particularly regarding the significant gains in access to ICT that the Gauteng schooling system has registered. However, there are clearly also several challenges, which – having been identified – can usefully guide future planning by the GDE. However, before considering recommendations emerging from the above analysis, it is important to supplement the above quantitative assessment with the more nuanced, anecdotal data emerging from the 25 case studies conducted for this report. This is presented below.

E-Readiness

Introduction

To ascertain the extent to which a school is considered to be 'e-ready', an e-readiness index was calculated.

In order to do this, it was necessary to determine the main components that need to be present to formulate a measure of the school's degree of e-readiness. Therefore, questions were selected from the three questionnaires (Audit, Teacher Survey, and Group/SMT interview) for the index, based on discussions with the team and with the GDE.

The items included in the e-readiness calculation are listed below, together with the weighting assigned to them. Items were weighted by a 1, 2, or 3, with 3 being more important than 1. The overall index was then rendered as a score between 0 and 20, and an overall percentage was obtained. This is documented in the table below.

Table 4 Items in the e-Readiness Index

Item	Description	Weighting
1.	The number of minutes per learner per computer per day (Using Audit for number of learners and Audit Q16.1 plus Q16.2 plus Q16.3 for number of learner computers): • Taking a 6 hour day (360 minutes) into consideration, then the number of minutes per learner per computer per day is (360 * number of learner computers)/number of learners = X. • The best case scenario for the number of minutes per learner per computer per day was chosen as 40 minutes for primary schools (where 3% of primary schools scored above this) and 45 minutes for secondary schools (where 4% of secondary schools scored above this), based on data distribution. • The final calculation was (X/40) * weighting for primary schools and (X/45) * weighting for secondary schools. • Schools scoring above the best cases (above 1) were capped at 1 so that individual scores would not be over the maximum.	3
2.	The number of minutes per teacher per computer per day (using Audit for the number of teachers and Audit Q42 for the number of computers for dedicated for teacher use): • Taking a 7 hour day (420 minutes) into consideration, then the number of minutes per teacher per computer per day is (420 * number of dedicated teacher computers)/number of teachers = Y. • The best case scenario for the number of minutes per teacher per computer per day was chosen as 160 minutes for both primary schools and secondary schools (where 10% of primary schools scored above this	3

Item	Description	Weighting
	and 12% of secondary schools scored above this), based on data distribution.	
	• The calculation was (Y/160) * weighting.	
	• Schools scoring above best case (above 1) were capped at 1 so that individual scores would not be over the maximum.	
3.	The number of minutes per admin staff per computer per day (Using Audit for the number of administrative staff and Audit Q16.5 for the number of administrative staff computers):	2
	• Taking a 7 hour day (420 minutes) into consideration, then the number of minutes per administrative staff per computer per day is (420 * number of admin computers)/number of admin staff = Z.	
	• The calculation is then the best case scenario for the number of minutes per admin staff per computer per day and in this instance it was chosen as the full 420 minutes – i.e. the best case scenario would be a full day.	
	• The calculation was (Z/420) * weighting	
	• Schools scoring above best case (above 1) were capped at 1 so that individual scores would not be over the maximum.	
4.	The school has a ICT coordinator (Audit Q11):	1
	• Schools that had an ICT coordinator scored a 1.	
5.	The school has an ICT policy/plan (SMT/Group Q5.2, Q5.3):	1
	• Schools that had either an ICT policy or an ICT plan scored a 1.	
6.	The school has at least one printer (Audit Q23.3):	1
	• Schools that had at least 1 printer either in use or in working order scored a 1.	
7.	The frequency of the internet connectivity in the school over a period of a month (Audit Q 28)	1
	• Schools that had no connectivity scored a 0;	
	• Schools with connectivity 25% of the time scored 0.25;	
	• Schools with between 26% and 50% of the time scored 0.5;	
	• Schools between 51% and 75% scored 0.75; and	
	• Schools between 76% and 100 scored a 1.	
8.	Teachers in the school have confidence using a computer (Teacher Survey Q8.1-3 - average):	2
	• The number of teachers that answered the questions relating to confidence (if someone is there to support you, on your own, and to teach students) were divided by the number of teachers that answered the questionnaire, and an average of the 3 was obtained.	
9.	Learner access to computers outside class (Audit Q40.1 to Q40.4 – average):	3
	• Schools with learners who had access to computers before school, during breaks, after school and/or on weekends were given an average of the 4.	
10.	SMT use of ICTs as measured by (SMT/Group Q4, 2-6 – average):	1
	• Use of ICT was measured by schools that were developing a school timetable, communicating with colleagues, generating learner reports,	

Item	Description	Weighting
	preparing the school development plan, and/or working on school finances were given an average of the 5.	
11.	The school has some form of IT support (Audit Q32), • Schools that provided daily, weekly, or as needed support were given a 1, schools that provided monthly support were given 0.5, and schools that provided no support were given a 0. • This was averaged out between network, hardware maintenance and user support for teachers and learners.	2
	Maximum score	20

For those schools that did not submit information on the number of learners, teachers, or administrative staff, these criteria were left as missing values and the total for the index was calculated and then was converted to a score out of 20.

Results

The graph below presents the overall results of the index, by school type and quintile.

Figure 22   E-readiness Index Percentage Score, Analysis by School Type and Quintile
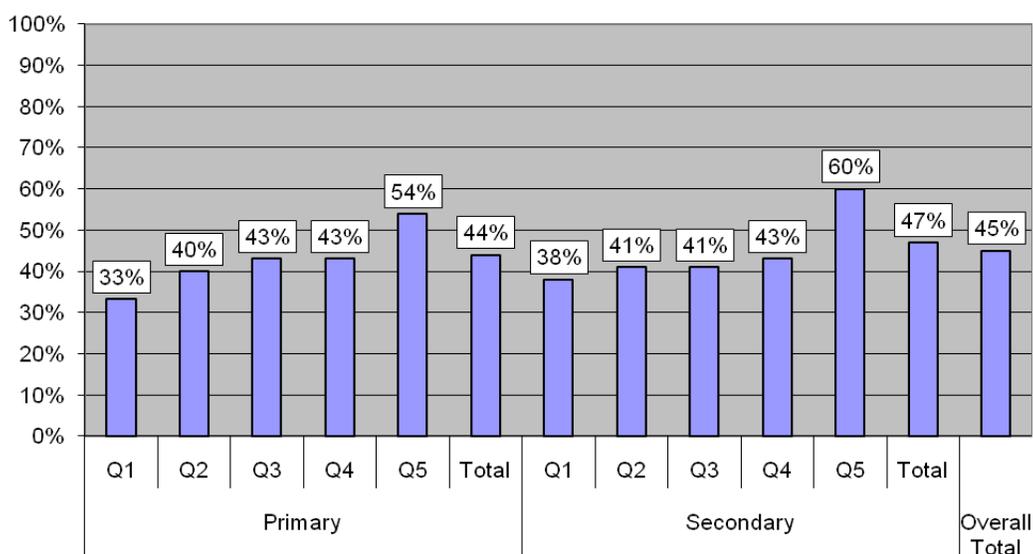
The results show that primary schools scored 44% on average and secondary school results were similar in that they scored 47% on average, showing only a moderate level of e-readiness overall. Schools in quintile 5 scored 54% in primary schools and 60% in secondary schools. Schools in quintiles 2, 3, and 4 scored in the 40s in both

primary and secondary schools, and schools in quintile 1 in primary schools only scored 33%, showing low e-readiness overall.

The table below presents the mean scores in ranges of 5 and their accompanying distribution across quintiles.

Figure 23   E-readiness Mean Score in Ranges, Analysis by School Type and Quintile

School Type	Mean Score Range (out of 20)	Quintile					Total
		1	2	3	4	5	
Primary	0 to 5 score	33%	18%	10%	13%	2%	13%
	5.01 to 10 score	52%	59%	59%	56%	38%	52%
	10.01 to 15 score	15%	22%	29%	30%	53%	33%
	15.01 to 20 score		1%	2%	1%	6%	2%
Secondary	0 to 5 score	25%	15%	16%	11%	1%	11%
	5.01 to 10 score	53%	59%	61%	58%	24%	48%
	10.01 to 15 score	22%	25%	22%	30%	64%	37%
	15.01 to 20 score	0%	2%	1%	1%	11%	4%

Figure 24   E-readiness Index - Scores in ranges of 25%
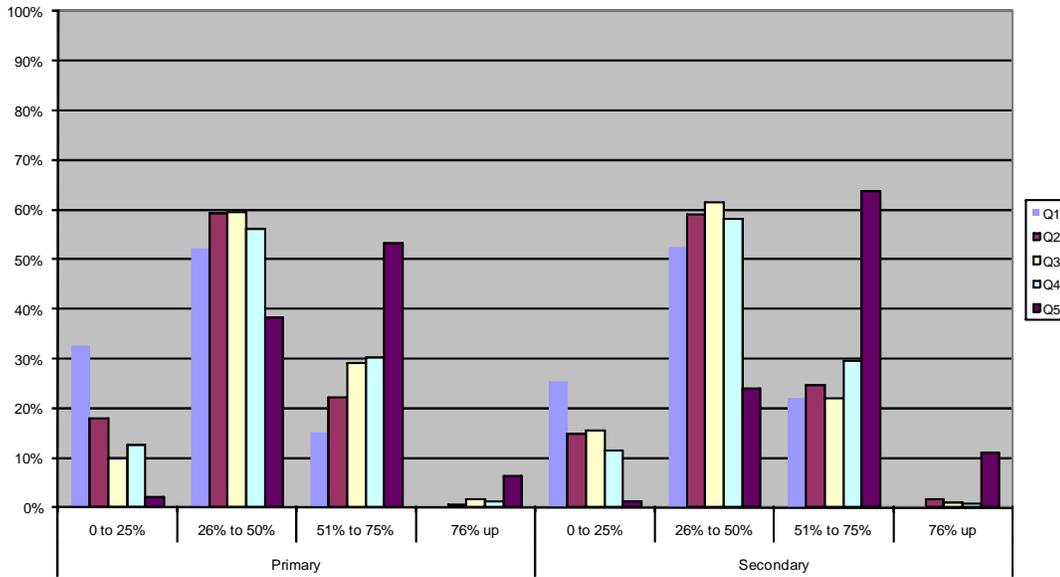
The above graph illustrates that 33% of primary schools in quintile 1 scored between 0 and 25%, indicating that they had low e-readiness. If one looks across the quintiles 1 to 4, it is observed that just over half of the schools scored between 25% and 50% in quintiles 1 to 4, in both primary and in secondary schools.

Thirty percent of quintile 4 schools (both primary and secondary) scored between50% and 75%, showing a moderate level of e-readiness. However, 53% of primary schools in quintile 5 and 64% of secondary schools in quintile 5 scored between 50% and 75%, showing higher e-readiness than the other quintiles.

The final graph presents a summary distribution of the index across primary and secondary schools.

Figure 25   E-readiness Index - distribution of overall score
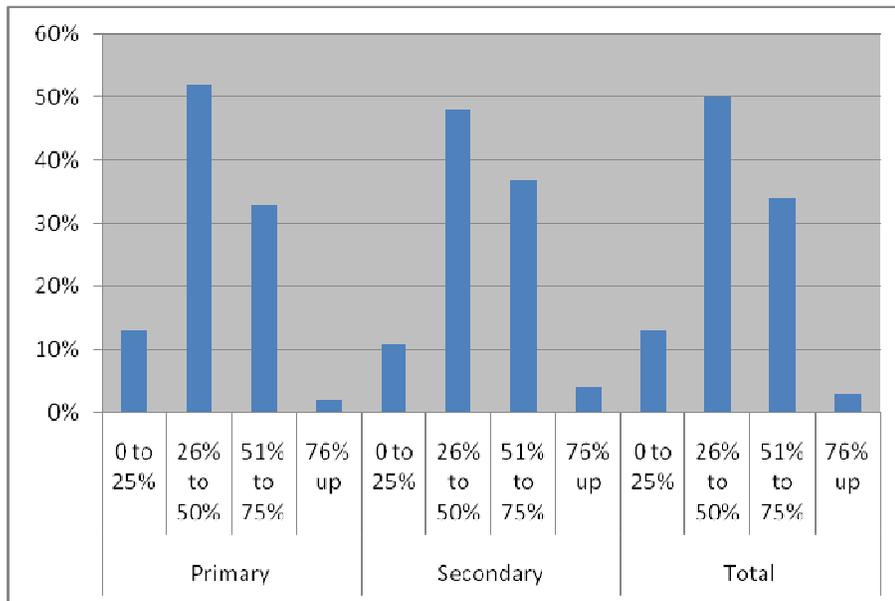
Illustrative School Examples

An analysis of some example schools is provided in order to illustrate how the e-readiness index has been calculated, and how it can be used as a means of understanding the school's situation.

School 1 is a primary school in quintile 5. This is a school with 623 learners, 19 teachers, and three administrative staff. This school scored 93% on the e-readiness index.

The school reports that it has 65 computers in computer classrooms/laboratories, 19 of which are dedicated for teacher use only and three for administrative purposes. This mean that the score for learners minutes per computer per day is high, and there is full learner access to computers outside of formal teaching hours. The scores for teacher minutes per computer per day and administrative minutes per computer per day is also high.

The school has an IT coordinator, a policy or implementation plan, and there is full use of IT by the SMT. There is support for IT in the form of hardware, network and maintenance support. The school has good internet connectivity and at least one printer.

Administrative and preparation use of IT is average, but teacher confidence is somewhat low, and there is little teaching and learning use of computers.

School 2 is a secondary school in quintile 5. The school has 725 learners, 43 teachers, and ten administrative staff. The school scored 83% on the e-readiness index.

The school indicate in the questionnaire that it has 128 computers in computer classrooms/laboratories, seven of which are dedicated for teacher use only and 16 for administrative purposes. This means that the score for learner minutes per computer per day is high, and there is some learner access to computers outside of formal teaching hours. The teacher minutes per computer per day are moderate, while the administrative minutes per computer per day are high.

The school has an IT coordinator, a policy or implementation plan, and there is full use of IT by the SMT. There is support for IT in the form of hardware, network, and maintenance support. The school has good internet connectivity and at least one printer.

Administrative use of computers is very high. Teacher confidence is moderate, with preparation use of computers high. Teaching use of computers is moderate, with learner use of computers slightly lower.

School 3 is a primary school in quintile 3. This is a small school with 362 learners and ten teachers and two administrative staff members. This school scored 58% on the e-readiness index.

The school reports that it has 24 computers in a classroom or computer laboratory for learners, but states in response to a different question that 24 computers are available for dedicated teacher use (which could therefore be the same computers in the computer laboratory). This means that the school scores high for learner and teacher minutes per computers, but it seems appropriate that the school scored high on this dimension as the average minutes per learner per computer and average minutes per teacher per computer are high. Learners have good access to computers outside of formal teaching periods.

The school states that it has only one administrative computer, and so the one computer would be shared between the two administrative staff members and therefore, in contrast to many other schools, this school scores lower for administrative minutes per computer.

There is no internet connection at the school. Administrative and preparation use is low. Teacher confidence is low and there is no teaching and learning use of computers. There is no ICT coordinator, no policy or implementation plan and no SMT use. There is only a moderate form of ICT support.

School 4 is a secondary school in quintile 2. This is a moderate school with 768 learners, 20 teachers and 2 admin staff. This school scored 48% on the e-readiness index.

The school reports that it has 36 computers in computer classrooms/laboratories, no computers are dedicated for teacher use only and there are 2 admin computers. This mean that the score for learners minutes per computer per day is low and there is no learner access to computers outside of formal teaching hours. The score for teacher

minutes per computer per day is zero, and for admin minutes per computer per day is high.

The school has an IT coordinator, a policy or implementation plan and there is some use of IT by the SMT. There is moderate support for IT in the form of hardware, network, and maintenance support. The school has some internet connectivity and at least one printer.

Administrative and preparation use of IT is low. Teacher confidence is low, and there is no teaching and learning use of computers.

School 5 is a primary school in quintile 5. The school has 1,246 learners, 40 teachers and 7 administrative staff. The school scored 44% on the e-readiness index.

The school reports that it has no learner computers, few computers dedicated for teachers, and seven computers for administrative staff. The score for learner minutes per computer per day is zero, with no learner access to computer outside of formal teaching hours. The score for teacher minutes per computer per day is zero, whilst the score for administrative minutes per computer per day is high.

The school has an IT coordinator and there is IT support for network, hardware maintenance and user support. The school has relatively frequent Internet connectivity. There is no IT policy or plan, but there is some use of IT by the SMT.

Teacher confidence is low. There is some admin and preparation use, but there is no teaching and learning use of IT.

School 6 is a secondary school in quintile 1. The school has 1,015 learners, 33 teachers, and three administrative staff. The school scored 40% on the e-readiness index.

The school has a computer laboratory with 24 computers, no computers for teachers, and two computers for administrative staff. This means that learner minutes per computer per day is low, but learner access to computers outside of formal teaching hours is high. Teacher minutes per computer per day scores a zero, whilst administrative minutes per computer per day are average.

The school has an IT coordinator and there is some IT support, but there is no SMT use of IT in the school. The school has some internet connectivity and at least one printer.

Administrative use of computers is good, but preparation use of computers is low. Teacher confidence is moderate, but there is no teaching and learning use of computers.

School 7 is a primary school in quintile 3. This is a school with 665 learners, 26 teachers, and three administrative staff. This school scored 4% on the e-readiness index.

The school has only four computers in classrooms for learners (with no learner access outside formal teaching hours), one computer dedicated to teacher use and one computer in the principal's office. The school reports no computers for administrative staff. Scores for learner minutes per computer per day and teacher

minutes per computer per day are low, and results for administrative minutes per computer per day are zero.

There is no ICT coordinator and no ICT support. There is no ICT policy or plan and no SMT use of ICTs. There is no printer and no internet connection

Teacher confidence is very low, and so is administrative and preparation use, with no teaching and learning use of computers.

Timetabling to E-readiness and other teacher use indicators

Although the illustrative examples above show some case-by-case differences between schools which may have similar e-readiness scores, there is at least one variable that shows a marked relationship with the e-readiness index, as well as the teacher use indicators (administration, preparation, and teaching and learning).

This variable is the presence of a timetable for the computer laboratory for teaching and learning in the school. The figure below shows the differences in scores for schools that have a timetable.

Figure 26 Presence of Timetable for Computer Laboratory against e-readiness and teacher use indicators
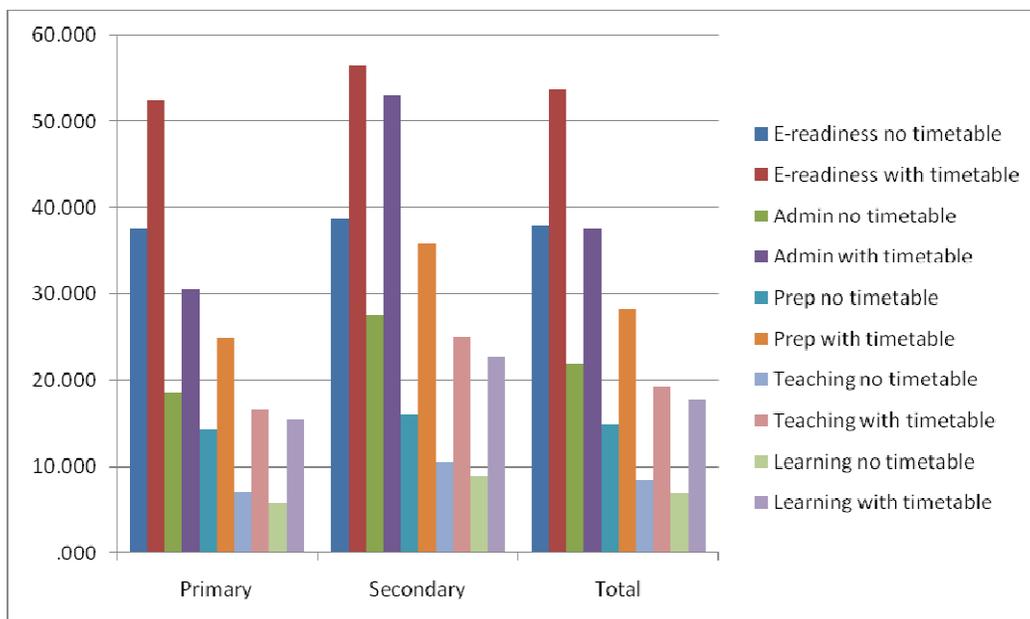
Schools with timetables for computer laboratories scored 53% on e-readiness, whilst schools without timetables scored 38%. Similar trends are observed for the teacher use – schools with timetables scored 38%, 28%, 19%, and 18% for administration, preparation, teaching and learning respectively and schools without timetables scored 22%, 15%, 8%, and 7% for administration, preparation, teaching and learning respectively. Secondary schools with timetables scored slightly higher than primary schools on the e-readiness and teacher use indicators.

Conclusion

The e-readiness index, calculated from selected questions covering infrastructure, management, learner access and teacher confidence shows a school's overall level of e-readiness.

The schools scored 45% on average, with schools in quintile 5 scoring higher than schools in the other quintiles, especially quintile 1.

However, the presentation of example schools illustrates that reasons for scores differ on a case-by-case basis and so scores should be interpreted carefully and specific areas of improvement identified through an analysis for each individual school.

Trends showed that schools with low to average e-readiness exhibit low administration and preparation use and almost no teaching and learning use, but schools with higher e-readiness may not necessarily have higher administrative, preparation, teaching and learning use.

Case Study Findings and Analysis

Introduction

This section presents a summary analysis of the 25 case studies conducted as part of the e-readiness/e-maturity project commissioned by the GDE. It includes a brief description of each of the 25 cases, as well as a thematic write up and analysis.

Case studies were completed of 25 schools spread across different Gauteng regions, including schools from all quintiles and reflecting schools with different levels of e-readiness and e-maturity. The case studies were selected to include a range of levels of ICT use, as well as covering the various quintiles and different types of schools. Three of the primary school case studies were purposively selected to reflect 'best practice' ICT use.[6]

The case study selection incorporated schools with differing fee structures, from no-fee schools to schools charging fees of about R11 000[7]. It also included a range from schools not performing well to those performing extremely well as indicated by national and provincial numeracy and literacy tests, as well as grade 12 examination results. The initial case study framework included standardized questions designed to guide the general line of questioning, but researchers were encouraged to probe on specific issues as they arose at a particular school. As such, each case study is slightly different, reflecting on the particular attributes of the specific school concerned. As such case, study schools cannot be directly compared on a question by question basis.

While most schools were easily contactable and cooperative, there were a few cases in which schools were not contactable by telephone and some where interviews requested were difficult to obtain. A few schools refused to allow researchers to interfere with 'time on task' and requested that interviews take place after school (i.e. some schools refused to allow teachers to participate during their teaching time and requested that the researcher conduct the research after school hours). In addition, while researchers made all possible arrangements prior to school visits, and some school visits were organized and had scheduled arrangements, others worked on an ad hoc basis, meeting with the relevant interviewees as and when needed and possible.

In order to present the findings from the case study research two approaches have been adopted. First, a table summarizing all the case studies has been compiled. This enables easy comparison of the key features of each school. This overview is

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[6] Selection of case study schools is described in detail in the methodology section.

[7] The survey indicates that 16% of schools charge more than R4000 per annum, and 44% are no fee schools. Also 70% have full section 21 status and 18% have partial status.

intended to provide a snapshot of the particular context and attributes of each case study school.

Second, analysis has been conducted across the case studies to identify common themes and key differences that emerge when looking at all the case studies. This section is organized by themes, in line with the conceptual framework and portrays critical information on the school's use of ICT.

Summary of Case Studies

This section presents a summary for each of the 25 case study schools in relation to key features. Detailed write-ups are presented in Appendix Three of the report. The summary of key features for the case study schools includes the e-readiness index for each case study school, which was calculated from the survey data. This provides a quantitative measure of relative effectiveness of ICT access, adoption and use at each school.

Primary schools are presented first (ordered by quintile), followed by secondary schools (also ordered by quintile), followed by other types of schools (special needs, ABET).

Table 5   Summary of Case Study School Findings – Primary Schools

School 1: Primary school, Quintile 1, Full Section 21 status, No school fees, 1,242 learners, 35 teachers	
Computers	GoL and 15 other computers donated but not set up.
Organization/ Leadership	ICT not strongly driven by SMT. Focus on use by administrators. Teachers have to request the key to use the computer room from the principal and some felt that this did not work.
Policy/Plans	No policy and no timetable for using the laboratory.
Admin	SASAMS used for administration.
ICT coordinator	Part-time ICT coordinator exists in name only but not in action as she is not clear about her role.
Teacher beliefs/ attitudes	Limited understanding of potential of ICT. Teachers divided regarding interest in the laptop project because of security and financial concerns. They blame their lack of use of ICT on lack of training.
Teacher Use	Teachers do not use computers.
Teacher Training/skills	Teachers received two basic training sessions. They feel that the training was not sufficient.
Learner use	Limited use with only one teacher known to teach learners using Encarta.
e-Readiness index from survey data	32%

School 2: Primary school, Quintile 3, Partial Section 21 status, No school fees, 1,205 learners, 30 teachers	
Computers	GoL laboratory recently re-installed.
Organization/ Leadership	Principal sees importance of ICT but this is mainly linked to its power in administration.
Policy/Plans	Timetable exists, but is not being implemented. The school does not have an ICT plan.

School 2: Primary school, Quintile 3, Partial Section 21 status, No school fees, 1,205 learners, 30 teachers	
	There are rules for behaviour in the laboratory (e.g. 'strictly no food and drinks to be taken into the lab' etc).
Administration	There are some administrative computers and the administrator was trained to use SASAMS, but is not using it because the available computers are not of good enough quality.
ICT coordinator	Part-time coordinator provides on-site support to educators and learners.
Teacher beliefs/ attitudes	For the few who use ICT, there is a limited vision of ICT and poor links to teaching and learning. Teachers indicated that they are interested in ICT, but requested more training. Most teachers indicated support for the laptop project despite concerns about how much they could afford per month.
Teacher Use	Only three teachers were evidently using ICT for basic research of their lessons. For example, they look up concepts such as acids and bases in science. A few teachers are using ICT for personal tasks.
Teacher Training/skills	One introductory training session provided by GoL. Grade 7 Learners were exposed to ICT and teachers were given e-mail addresses through a mobile computer bus travelling through the area. The teachers are unsure how regularly this bus will return to support them.
Learner use	Ad hoc learner use for computer literacy.
e-Readiness index from survey data	35%

School 3: Primary school, Quintile 3, Full Section 21 status, School fees R400 per year, 658 learners, 30 teachers	
Computers	GoL laboratory.
Organization/ Leadership	ICT not a clear priority. Important ICT issues are left to the coordinator. Leadership has no vision or plan in place to promote ICT use. Teachers are not using the dedicated Banapele computers.
Policy/Plans	No policy, plan, or timetable.
Administration	SASAMS and Banapele.
ICT coordinator	Part-time ICT coordinator.
Teacher beliefs/ attitudes	Limited understanding of potential of ICT. Only understanding linked to neat documents, learner enthusiasm, and research.
Teacher Use	None to very little use of ICT by teachers. Some have introduced basics (e.g. switch on switch off) to foundation phase learners.
Teacher Training/skills	Teacher skill levels are low. They received basic training, but perceived it as inadequate. They also indicated that training was the stumbling block in their performance.
Learner use	Very limited ad hoc use for research and literacy.
e-Readiness index from survey data	39%

School 4: Primary school, Quintile 3, Full Section 21 status, No school fees, 592 learners, 18 teachers	
Computers	GoL computers stolen, but recently replaced. There are also some laptops purchased by the school.
Organization/ Leadership	SMT is committed to ICT use. For example, SMT has agreed to only distribute typed documents to set an example. The school also purchased some laptops and has a data projector. Budget and time for teachers to get training has been committed and the school employed a dedicated ICT coordinator. There is a very strong vision for ensuring academic performance, but limited vision of the potential of ICT.

School 4: Primary school, Quintile 3, Full Section 21 status, No school fees, 592 learners, 18 teachers	
Policy/Plans	No policy or plan but timetable for learner use has been set up.
Administration	Some administrative computers, but administrators do not use SASAMS because they indicate that they don't know how to. Training was given, but was apparently insufficient.
ICT coordinator	Full-time ICT coordinator who assists staff with typing worksheets and also provides some informal training for staff. A computer laboratory committee decides on ICT issues.
Teacher beliefs/ attitudes	Teachers see value in using ICT with learners and for themselves, but have a limited vision of its use. Teachers are willing to participate in laptop project and are willing to be trained.
Teacher Use	Teachers use computers for administrative purposes (e.g. for mark lists) but some teachers not use computers at all. Even though e-mails are sent to all of them, many still do not respond by e-mail.
Teacher Training/skills	Principal attended Microsoft leadership course. Teachers only received one formal training session from GoL, but considered it to be insufficient and reportedly only learnt to use the mouse
Learner use	Some classes are exposed to limited computer literacy classes. Learners in Grades R-4 are offered computer classes; these have an ICT coordinator and teacher in attendance. They use some web sites that offer free content for literacy and numeracy skills development, but many of these sites provide a few minutes free and then require payment, so use is limited. Some learners are allowed to conduct research on computers on given topics.
e-Readiness index from survey data	41%

School 5: Primary school, Quintile 3, Full Section 21 status, No school fees (feeding scheme for all learners including breakfast and sandwich for lunch), 900 learners, 25 teachers	
Computers	GoL laboratory.
Organization/ Leadership	No vision for ICT use in education. The school has other priorities that the leadership feels should be prioritized over ICT.
Policy/Plans	No policies, plans, or timetable except that learners are asked to bring R1 every Monday for general fundraising.
Administration	Some administrative computers. Administrative staff use SASAMS but not for learner tracking or marks because the programme is only loaded on one computer.
ICT coordinator	Two part-time ICT coordinators.
Teacher beliefs/ attitudes	While teachers indicate support for ICT, this is not seen in practice. They are keen to participate in laptop project.
Teacher Use	Limited use by a few teachers for personal tasks and research.
Teacher Training/skills	Principal underwent a management course with GoL. Teachers have limited ICT skills, but did receive some training.
Learner use	Learners have access to computer literacy classes.
e-Readiness index from survey data	39%

School 6: Primary school, Quintile 3, Full Section 21 status, No school fees, 700 learners, 20 teachers	
Computers	GoL laboratory and resource centre.
Organization/ Leadership	Principal is a strong disciplinarian (e.g. no interviews during teaching time). Despite strong leadership on other levels, ICT is not a priority. Principal refuses to let teachers

School 6: Primary school, Quintile 3, Full Section 21 status, No school fees, 700 learners, 20 teachers	
	use memory sticks in administrative computers. Leadership focuses mainly on use in administration.
Policy/Plans	Timetable for laboratory, but no policy or plan.
Administration	SASAMS in administration.
ICT coordinator	Part-time ICT coordinator and two other educators are responsible for ICT. Their role is mainly ensuring that the laboratory is functional and providing support for those who request it.
Teacher beliefs/ attitudes	While teachers indicated understanding of importance of ICT, this seemed to be rhetoric without substance. Teachers have very little understanding of its possible uses and potential in education.
Teacher Use	Low and sporadic use by teachers for teaching. Use is limited to Encarta. Some administrative use (e.g. in recording marks).
Teacher Training/skills	While teachers felt that ICT was important, this was not evident in their understanding of possibilities and potential use in teaching and learning.
Learner use	Limited use mainly to research and use of Encarta.
e-Readiness index from survey data	48%

School 7: Primary school, Quintile 4, Full Section 21 status, School fees under R400 per year, 274 learners, 8 teachers	
Computers	GoL laboratory, but out of commission for 5 months.
Organization/ Leadership	Leadership believes that teachers are too old to change. However, the principal is interested in getting learners computer literate and believes this can only be done if the school gets a dedicated computer teacher.
Policy/Plans	No policies, plans, or timetable.
Administration	Some administrative computers fitted with SASAMS, which principal and administrators use for school records.
ICT coordinator	No ICT Coordinator.
Teacher beliefs/ attitudes	While teachers indicate an interest, this does not result in usage. Instead they give many reasons why they are not using computers (e.g. inadequate training, work overload etc). There is no vision of its use in educational contexts.
Teacher Use	Teachers do not use computers at all.
Teacher Training/skills	Teachers did receive training but complained that it was insufficient: too fast paced, it assumed they knew something about computers, and did not focus on teaching and learning ideas and approaches.
Learner use	Learners received computer literacy in the past when there were interns doing the training in the school but this ceased with their departure.
e-Readiness index from survey data	47%

School 8: Primary school, Quintile 5, Full Section 21 status, School fees R4,800 per year, 603 learners, 23 teachers	
Computers	GoL laboratory and one other laboratory.
Organization/ Leadership	Strong leadership and high academic performing school. SMT believes that academic success in numeracy and literacy can be attributed to learners using computers. There is support for ICT use, but this is limited by school's conception of ICT use.
Policy/Plans	No policies other than the paying of R50 fees for computer use by learners.
Administration	Some computers for administrative use. Administrative staff are using the EduPac

School 8: Primary school, Quintile 5, Full Section 21 status, School fees R4,800 per year, 603 learners, 23 teachers	
	software to track and update learner records. Administrative staff also type examination papers, reports, etc.
ICT coordinator	Part-time ICT coordinator who is a student teacher and focuses on teaching learners computer literacy.
Teacher beliefs/ attitudes	Limited sense of use for educational purposes.
Teacher Use	Very little teacher use. Only some limited administrative tasks completed with the computers.
Teacher Training/skills	Teachers received basic training on one occasion from a volunteer community member.
Learner use	ICT coordinator teaches learners to use computers: Focusing on Microsoft Office. Learners also used some educational software for Mathematics and for Science with the ICT coordinator.
e-Readiness index from survey data	43%

School 9: Primary school, Quintile 5, Full Section 21 status, School fees R6,000 per year, 944 learners, 29 teachers	
Computers	GoL laboratory and some administrative computers, plus a range of ICT related equipment.
Organization/ Leadership	Strong support by SMT for ICT integration, even though principal does not use ICT. SMT uses ICT for administration and communication. SGB has important role in decisions around ICT, informed by the ICT coordinator. There is also a strong champion in the deputy principal. SMT is also involved in ICT planning and conducts sessions to reflect on ICT. Every teacher is provided with a laptop. School has website.
Policy/Plans	No policy or plan but timetable for computer literacy is in place.
Administration	Administrative computers are available, but the school is not aware of SASAMS. School uses another software package (Microscope) for administration. SMT uses computers to send letters to parents, preparing school plans etc.
ICT coordinator	ICT coordinator is paid by SGB and focuses on teaching learners and teachers to use computers.
Teacher beliefs/ attitudes	Teachers indicate enthusiasm to use ICT and develop their skills. They indicate that classrooms are not conducive to using the data projector because they have no curtains and because moving the equipment around the schools is a logistical challenge.
Teacher Use	Some teachers use computers in lesson preparation, but very few use computers for teaching and learning. Even for those who do use computers for teaching and learning, this is largely about searching for information and sometimes to show DVDs.
Teacher Training/skills	Coordinator provides training to learners and teachers on basic ICT use including information literacy.
Learner use	Learners receive basic computer literacy lessons and are accompanied by the ICT coordinator in these timetabled classes.
e-Readiness index from survey data	59%

School 10: Primary school, Quintile 5, Full Section 21 status, School fees R9,950 per year, 622 learners, 28 teachers	
Computers	School funded computer laboratory, library computers, and laptops for SMT members.
Organization/ Leadership	There is a strong culture of discipline and this is well functioning school. Strong support for and leadership in ICT. The school has a website. There is strong parental participation and good communication with parents. For example, communication

School 10:	Primary school, Quintile 5, Full Section 21 status, School fees R9,950 per year, 622 learners, 28 teachers
	between the SMT and parents is by e-mail. The school purchased its own computers, there is no GoL lab. Strong focus on administration and on use of educational software. Teachers have dedicated computers for use in the library. PowerPoint is used at assemblies.
Policy/Plans	Computer venues have timetables. The one laboratory is used by learners accompanied by an ICT coordinator. The other laboratory in the library allows for teacher use.
Administration	There are some administrative computers loaded with SASAMS (these are the only GDE funded computers). However even though GDE did training on SASAMS, school uses EDUPAC.
ICT coordinator	The ICT Coordinator is the deputy principal.
Teacher beliefs/ attitudes	Teachers have limited understanding of the potential of ICT use in education, but there was a keen interest in using it anyway. Teachers know very little about the laptop project.
Teacher Use	Teachers' use focused on creating worksheets, some use of e-mail, and intranet for communication, as well as some use of educational software. There is informed decision-making about what is good software. Teachers indicated competence in using ICT for administrative purposes.
Teacher Training/skills	15 teachers received Intel Teach to the Future training.
Learner use	Computer literacy and use of some educational software for learners. Because the laboratory is mostly used by learners with the ICT coordinator, teachers do not have an opportunity to use computers with their learners. No connectivity for learners because of online safety concerns and fear of viruses. Safety issues are also limiting.
e-Readiness index from survey data	74%

School 11:	Primary school, Quintile 5, Full Section 21 status, School fees R8,000 per year, 1,240 learners, 41 teachers
Computers	There are two school-funded laboratories, but no GoL laboratory. There are smart boards in some classrooms, computers in administrative offices and in resource centre. There are also two dedicated computers in the staff room for teachers.
Organization/ Leadership	Leadership has very strong views about the importance of ICT and has committed a large annual budget to upkeep of ICT in the school. Management promotes use of ICT for all aspects of management. SMT uses ICT to communicate with parents, school has a website and PowerPoint is used at assembly.
Policy/Plans	No official policy, but many undocumented policies based on the White Paper on E-Learning. There is scheduled time for the laboratories in the school timetable. There is a large budget for ICT.
Administration	School does not use SASAMS, instead it uses Pencilbox and Action Commercial Technology software.
ICT coordinator	The ICT coordinator is the deputy principal, who also teaches physical education. There is a person who comes to offer technical support twice a week. The ICT coordinator provides support to teachers as requested and provides training to learners.
Teacher beliefs/ attitudes	Teachers are supportive of ICT use.
Teacher Use	All teachers use ICT for administrative purposes, such as report writing and preparation of lessons. In addition, some use smart boards to present lessons. Teachers also give learners project work which requires them to do some research using the Internet.
Teacher Training/skills	Teachers who run the computer laboratories and teach learners CAMI and computer literacy are student teachers studying B. Ed degrees. The rest of the staff have computer skills based on personal exposure and have not been trained by the GDE or

School 11: Primary school, Quintile 5, Full Section 21 status, School fees R8,000 per year, 1,240 learners, 41 teachers	
	school (except some who have been informally trained by the ICT coordinator).
Learner use	All learners use the ICT laboratory 2-3 times per week. One slot is allocated to computer literacy, while the other is allocated to CAMI Maths or CAMI literacy software programmes. In addition, learners have access to the resource centre computers during breaks and the laboratories on some afternoons.
e-Readiness index from survey data	75%

Table 6   Summary of Case Study School Findings – Secondary Schools

School 12: Secondary school (Grades 10-12), Quintile 1 school, Partial Section 21 status, No school fees, 1,104 learners, 44 teachers	
Computers	There are 3 computer laboratories, of which 1 is GoL and the other two externally funded. Nampak funded one of the laboratories. In addition, there are a few administrative computers.
Organization/ Leadership	The leadership has an interest in using ICT and believes in it, particularly with regard to its efficiency. The school uses SASAMS for reports and student records. Leadership views it as important for learning and believes that ICT offers information that can be used to enhance learning in different subjects. There is a mandated coordinator to develop polices and plans for the school.
Policy/Plans	No policy, no timetable.
Administration	School uses SASAMS. Principal and 2 administrative staff were trained in use of the software.
ICT coordinator	ICT coordinator is part-time and teaches accounting.
Teacher beliefs/ attitudes	Teachers support ICT and indicated that it makes their administrative work more efficient and that they can prepare lessons and marks faster.
Teacher Use	Teachers use ICT for administrative work and lesson preparation. In some instances, teachers have taken learners to the laboratory for research. At least one Science teacher uses the smart board in class with her learners.
Teacher Training/skills	Teachers did receive GoL training, as well as training from NAMPAK
Learner use	Only grade 12 learners were using the computers for literacy on an ad hoc basis. The school does not offer CAT or IT subjects.
e-Readiness index from survey data	43%

School 13: Secondary school, Quintile 2, Full Section 21 status, No school fees, 1,280 learners, 60 teachers	
Computers	There are 3 laboratories, one from GoL and the other 2 school funded. There are also SASAMS and Banapele computers, as well as a smart board in the school.
Organization/ Leadership	Leadership focus is on administration. They are using administrative computers to develop the school timetable which makes the task less tedious. The school is also interested in CAT. SMT is aware that there is no space for teachers to use technology in this environment.
Policy/Plans	There is no ICT policy. There is a timetable for use of the three labs for CAT.
Administration	The school uses SASAMS and the administrative staff were trained in this.
ICT coordinator	The ICT coordinator is coordinator of the CAT course.
Teacher beliefs/ attitudes	Teachers indicated that ICT was very important because it can improve their administration. They could do marks and reports. They also indicated that learners

School 13: Secondary school, Quintile 2, Full Section 21 status, No school fees, 1,280 learners, 60 teachers	
	can find information on computers.
Teacher Use	Teachers had little access to computers. They could not use them during class time because they were fully booked for learners. They used them for lesson preparation and administration when they could.
Teacher Training/skills	Teachers received GoL training but this was reportedly too rushed and generally they are still not computer literate. Some teachers also had SchoolNet training but have not had the opportunity to practise what they learnt.
Learner use	Learners in grades 10, 11 and 12 were offered CAT. All other learners have ICT access for project work during breaks.
e-Readiness index from survey data	32%

School 14: Secondary school, Quintile 2, Full Section 21 status, No school fees, 1,200 learners, 36 teachers	
Computers	There is a GoL laboratory and some administrative computers. Other ICT equipment includes a digital camera, digital screen, television, and a laptop. The school also has old GoL computers but no additional secure space to create a second laboratory.
Organization/ Leadership	Leadership shows a keen interest in ICT. The school made its own fund allocations for ICT and seems to encourage its use and expansion.
Policy/Plans	No ICT policy, but there are some rules when using the laboratory. No structured timetable for learners and teachers to use the laboratory.
Administration	The school does not use any particular software system for administration.
ICT coordinator	There are two ICT coordinators, both part-time, one the HOD of life science and the other HOD for English. There are also 5 interns who are previous learners. ICT coordinators play a champion's role, promoting ICT amongst teachers and seem to understand its link to educational integration.
Teacher beliefs/ attitudes	Teachers indicate support for ICT.
Teacher Use	Teachers use computers for administration, lesson preparation, and personal tasks. They use ICT with learners, assisted by the interns. They also use computers during breaks and after school on Tuesdays.
Teacher Training/skills	No GoL training, but teachers did go on a crash course of some sort. They believe that more training will go a long way towards improving their knowledge.
Learner use	Learners are taken to the laboratory on a regular basis during school time and do research on projects. The school does not offer computer literacy. Learners also use computers during breaks and after school, a process which is managed by the interns.
e-Readiness index from survey data	Cannot be calculated as no data on teacher confidence

School 15: Secondary school, Quintile 3, Full Section 21 status, No school fees, 1038 learners, 34 teachers	
Computers	There are 30 computers in a strong room which are not being used. There is no computer room at this stage. The school previously had a few computers in a resource room/staff room, but these are now broken. There are a few computers for administrative use.
Organization/ Leadership	There was initially enough leadership support to raise funds to purchase 30 computers, but leadership currently has no interest in computers, and seems disillusioned by non-arrival of computers. Administrative staff do the principal's computer-related work. The school produces learner reports and uses the computers for finances.
Policy/Plans	No policies, no plans, no timetable.

School 15: Secondary school, Quintile 3, Full Section 21 status, No school fees, 1038 learners, 34 teachers	
Admin	The school uses SASAMS but also uses Excel where it is easier to do so.
ICT coordinator	The Deputy principal serves as ICT coordinators
Teacher beliefs/ attitudes	Not specified.
Teacher Use	Teachers have little access to computers. There is however access to one computer with Internet connectivity and this is used for administration and mark schedules, etc.
Teacher Training/skills	Teachers did receive training a few years ago, but there has been no further training since then. Two teachers are studying through the university of Johannesburg in this field.
Learner use	No learner access and use of computers.
e-Readiness index from survey data	29%

School 16: Secondary school, Quintile 3, Full Section 21 status, School fees R370 per year, 1,001 learners, 33 teachers	
Computers	1 GoL laboratory, a few administrative computers including 2 laptops and a computer in the staff room, GoL and 1 SASAMS computer were paid for by GDE and the others by school funds. 30 donated computers cannot be housed due to space constraints. School also has data projector and television.
Organization/ Leadership	Leadership supports ICT use, with an emphasis on improving school administration. Leadership has allocated some computers to teachers to encourage their use. An ICT coordinator provides support on request. Leadership has not yet developed timetables for use of the laboratory.
Policy/Plans	ICT use is not formally planned. There is no policy, although there is a plan to erect a new computer centre. There is no school timetable for laboratory use.
Administration	The school uses SASAMS.
ICT coordinator	The ICT coordinator provides support to teachers and oversees general ICT issues in the school.
Teacher beliefs/ attitudes	Teachers indicate support for ICT.
Teacher Use	Teachers use ICT for lesson preparation, administration, and personal use.
Teacher Training/skills	Teachers received basic training from GoL.
Learner use	Learners use the laboratory occasionally on an ad hoc basis to source information.
e-Readiness index from survey data	41%

School 17: Secondary school, Quintile 3, Full Section 21 status, No school fees, 809 learners, 44 teachers	
Computers	1 GoL laboratory, 4 administrative computers
Organization/ Leadership	Leadership views are limited to use of computers for school and educator admin.
Policy/Plans	No policy for ICT and no timetable.
Administration	Administrators use SASAMS.
ICT coordinator	The ICT coordinator is also responsible for SASAMS induction to clerks.
Teacher beliefs/ attitudes	Teacher views were that computers could be used for CAT, accessing ENCARTA, and research.
Teacher Use	Limited use with learners, mostly used for teacher admin.
Teacher Training/skills	Current teachers are not fully trained as training was interrupted when monitors were stolen.

School 17: Secondary school, Quintile 3, Full Section 21 status, No school fees, 809 learners, 44 teachers	
Learner use	The school used to offer CAT, but lost the teacher. Now there is very limited learner access, mainly for research purposes for some classes.
e-Readiness index from survey data	62%

School 18: Secondary school, Quintile 4, Partial Section 21 status, School fees under R400 per year, 1,430 learners, 44 teachers	
Computers	There is both a GoL laboratory and a CAT laboratory. There are 4 administrative computers and 2 for teacher use, as well as a white board and television.
Organization/ Leadership	SMT supports ICT, feeling that it makes work better and faster. Management supports administrative use and promotes doing marks and reports electronically.
Policy/Plans	School has an ICT policy and there is a timetable for the CAT laboratory but not for the other laboratory.
Administration	The school uses Microscope not SASAMS because it receives more support through Microscope.
ICT coordinator	The CAT and computer literacy teacher is also the ICT coordinator.
Teacher beliefs/ attitudes	Teachers indicate that computers can be useful for administration and research.
Teacher Use	Teachers use ICT for administrative purposes, very few use it for sourcing information for lessons or taking learners to the laboratory for projects. They do not use ICT much for teaching and learning.
Teacher Training/skills	Teachers received some training from GoL, but considered it ineffective and seemed to have forgotten what they had learnt.
Learner use	CAT and computer literacy is provided as an option for learners in grades 10 and 11.
e-Readiness index from survey data	42%

School 19: Technical secondary school, Quintile 4, Section 21 status unknown, School fees under R400 per year, 1494 learners, 58 teachers	
Computers	GoL laboratory and a few administrative computers, also 3 data projectors.
Organization/ Leadership	Leadership feels that ICT is important but say that GoL laboratory does not work most of the time, which affects its use in the school.
Policy/Plans	No policy, no timetable.
Administration	School uses SMART software for administration, not SASAMS.
ICT coordinator	There is a part-time ICT coordinator who teaches mathematics and athletics.
Teacher beliefs/ attitudes	Teachers support ICT use and use it for their administrative work.
Teacher Use	Teachers use ICT for administrative purposes. Some use it themselves and others refer tasks to administrative staff to do for them. Teachers also use ICT to support project work and some had used Wikipedia.
Teacher Training/skills	Teachers received GoL training and some reported receiving training during their pre-service teacher training. The ICT coordinator does not offer training in the school.
Learner use	No computer literacy. Learner use of computers is limited to some teachers sometimes taking learners to the laboratory.
e-Readiness index from survey data	43%

School 20: Secondary school, Quintile 4, Full Section 21 status, School fees R100 per year, 720 learners, 29 teachers

Computers	GoL computer laboratory and some administrative computers.
Organization/ Leadership	SMT indicates support for ICT as a time and labour saving device, although the principal indicated that he is technophobic. There is no evidence that leadership drives and supports ICT use.
Policy/Plans	There is no policy or timetable for ICT at the school.
Administration	School has SASAMS and received SASAMS training, but it does not seem to be used.
ICT coordinator	There is no ICT coordinator, but the accounting teacher takes care of some issues such as security of the laboratory.
Teacher beliefs/ attitudes	Teachers don't reflect strong views about using ICT.
Teacher Use	Teachers don't use ICT for administration, teaching and learning, or lesson preparation. They indicate that they have not received training from GoL and say that the laboratory is offline.
Teacher Training/skills	No training has been provided to teachers.
Learner use	School does not offer IT and CAT nor computer literacy programmes in the laboratory. Some learners look for information using Encarta.
e-Readiness index from survey data	43%

School 21: Secondary school, Quintile 4, Full Section 21 status, School fees under R400 per year, 1,248 learners, 40 teachers

Computers	GoL laboratory recently re-installed.
Organization/ Leadership	Leadership is restrictive in terms of laboratory use. They seem to be afraid of breaking things. There is minimal interest or support for ICT use.
Policy/Plans	There is no ICT policy or timetable.
Administration	No administrative software and the school reportedly has never heard of SASAMS.
ICT coordinator	There are two part-time ICT Coordinators; one teaches mathematics and the other English.
Teacher beliefs/ attitudes	Teachers are keen to use ICT and indicate that it keeps teachers and learners informed.
Teacher Use	Administrative staff use ICT on behalf of teachers for recording marks, while teachers do not use ICT much.
Teacher Training/skills	Teachers have received no training. GoL apparently promised to train them, but this has not happened.
Learner use	No computer literacy classes for learners but some have used computers for projects on an ad hoc basis.
e-Readiness index from survey data	47%

School 22: Secondary school, Quintile 5, Full Section 21 status, School fees R6,742 per year, 1,429 learners, 59 teachers

Computers	3 labs, no GoL lab, 3 computers in staff room and some in administration area. There are also data projectors, digital cameras, televisions, and software for technical subjects. All managers have computers in their offices.
Organization/ Leadership	The school has budget for ICT, the SMT uses it for communication, and other administrative tasks. School management sees the value and importance of ICT, mainly for administration but also for teaching and learning.
Policy/Plans	The school has a policy which spells out the need for ICT literacy and the benefits of application in educational contexts. There is a timetable for CAT and IT.

School 22: Secondary school, Quintile 5, Full Section 21 status, School fees R6,742 per year, 1,429 learners, 59 teachers

Administration	The school has been using SASPAC for administration for the past 17 years.
ICT coordinator	The ICT coordinator is also the deputy principal. Together with the CAT and IT teachers, they form the decision making group on ICT issues. The ICT coordinator provides training for teachers on some afternoons.
Teacher beliefs/ attitudes	Teachers display strong support for ICT.
Teacher Use	Teachers use it for administration, typing reports, schedules and marks. They also use it for lesson preparation. Some teachers use biology and science software to show learners body parts and simulate circuits.
Teacher Training/skills	Teachers did not receive formal training, but they are ICT literate. The ICT coordinator provided training and support after school, but this training programme was suspended in 2009 as a result of too many extra curricula activities.
Learner use	Learners may take CAT and IT as subject choices. All laboratories are used for this. Learners do not have access during breaks and lunch, but rather during school time and after school. After school, they use it for their own work and during school the laboratories are used for CAT and IT.
e-Readiness index from survey data	55%

School 23: Secondary school Quintile 5, Full Section 21 status, School fees R9,850 per year, 1,265 learners, 50 teachers

Computers	4 Computer labs, 1 with connectivity, computers for SMT and principal and a range of other equipment. School uses e-beam rather than Smart board.
Organization/ Leadership	School leadership has strong beliefs in computers. The school supports a project to assist teachers to purchase computers, and has a vision of setting up an Internet café. School leadership commits a budget to technology when presented with a good case for doing so. School indicated that the timetable was a 'big headache' until it started using ICT.
Policy/Plans	There is no ICT policy, but there is a set of rules for using the computer room.
Admin	School uses SMS to communicate with parents and buys bulk SMS. PowerPoint is used by leadership with learners in assemblies and with parents at meetings, etc. The school has a website, which is updated once a week by a volunteer parent. The school uses EDUPAC software for its administrative work.
ICT coordinator	There is an ICT coordinator and an informal ICT committee representing teachers who teach CAT. The ICT coordinator teaches IT and CAT, he provides a strong technical support role and is also responsible for producing the school's marketing documents and PowerPoint for assemblies etc. He supports teachers when they request assistance. In order to cope with requests, he sometimes uses learners to help teachers.
Teacher beliefs/ attitudes	Teachers support ICT use. Many participated in the laptop project offered by the school and therefore have their own computers.
Teacher Use	Teachers often use e-beam for lessons. One teacher indicated that using this for geometry is much better because she cannot draw accurately and now the computer does it for her. Another teacher used it to show history clips and images of war.
Teacher Training/skills	Teachers have not received formal training in the school. It appears that they have taught each other and now there is a critical mass so it is easy to get on with work that needs ICT.
Learner use	Learners have to submit assignments using e-mail, and participate in lessons with the e-beam. Because of CAT and IT, computer labs are fully occupied during school time. Learners can use them after school and during breaks for project work. The school offers computer literacy as a formal subject at grades 8 and 9 and learners who take it undergo structured learning and examinations. Additional classes in AutoCad are also given two evenings a week.

School 23: Secondary school Quintile 5, Full Section 21 status, School fees R9,850 per year, 1,265 learners, 50 teachers	
e-Readiness index from survey data	61%

Table 7   Summary of Case Study School Findings – Special Needs School and ABET

School 24: School for special needs children (initially school focusing on learners with cerebral palsy, then later general focus on learners with disabilities), not classified in quintiles but historically advantaged, well-resourced school, Full Section 21 status, School fees R8,000 per year, 326 learners, 30 teachers	
Computers	2 laboratories and a range of other computers located in the administration offices, as well as in the Occupational Therapy and Speech Therapy offices. In addition, there is a range of specialized technologies for learners with disabilities.
Organization/ Leadership	Leadership is supportive of ICT use and ensures that there is a budget for ICT. The focus is on using ICT to integrate learners with disability into the learning environment. This involves the use of specialized technologies and software.
Policy/Plans	No official documented policy, although there are undocumented policies. There is a timetable for use of the computer laboratory.
Admin	School has administrative software, which is not SASAMS.
ICT coordinator	The ICT coordinator is the deputy principal and the laboratory coordinator. Technical support is available once a week from an external person.
Teacher beliefs/ attitudes	Teachers display strong support for ICT use in their school. They cannot see how they would integrate some learners into the learning environment without the support of technology.
Teacher Use	Teachers use ICT for lesson preparation and to support individual learners who are unable to learn through traditional means (e.g. a learner who cannot talk or write who needs ICT to communicate). Other staff such as speech therapists use ICT software to work with learners with learning disabilities.
Teacher Training/skills	Teachers have basic ICT skills, but have received no training and very little support.
Learner use	Learners use the computer room for very basic mouse and keyboard manipulation. In addition some learners use it in class.
e-Readiness index from survey data	59%

School 25: Public Adult Learning Centre - Adult education centre with 7 satellite campuses. Provides education for learners over 18 or those who failed grade 12. Not quintile specific, Not Section 21, Fees of R100 per year, as well as examination registration fees, 1034 learners, 38 staff members.	
Computers	1 GoL laboratory, a few administrative computers.
Organization/ Leadership	Leadership views ICT as very important for learners and the school. The priority was literacy for learners.
Policy/Plans	No policies or timetable for the laboratory.
Administration	This school does not use SASAMS although the leadership reports that they have been promised this.
ICT coordinator	The ICT coordinator also teaches biology and English. Three educators provide computer literacy for learners.
Teacher beliefs/ attitudes	Teachers clearly support ICT.
Teacher Use	Teachers use computers for administration and finding information. No teachers use ICT with learners.
Teacher Training/skills	Teachers did not receive any training.

School 25: Public Adult Learning Centre - Adult education centre with 7 satellite campuses. Provides education for learners over 18 or those who failed grade 12. Not quintile specific, Not Section 21, Fees of R100 per year, as well as examination registration fees, 1034 learners, 38 staff members.	
Learner use	Learners receive two computer literacy lessons per week.
e-Readiness index from survey data	35%

Findings from the Case Studies

The case studies summarized in Table 2 demonstrate a wide range of types of use of ICT, from environments where use is minimal and generally unsupported by school leadership (as evident in School 15, which has an e-readiness index of 29%) to schools where ICT integration is moving into relatively advanced phases of e-maturity (as is evident in School 11, which has an e-readiness index of 75%.) Although there seems to be some connection between quintile levels and levels of ICT integration, this is not uniform. The case schools that have e-readiness indices above 50% are:

- School 11, Quintile 5, e-readiness index of 75%;

- School 10, Quintile 5, e-readiness index of 74%;

- School 17, Quintile 3, e-readiness index of 62%

- School 23, Quintile 5, e-readiness index of 61%;

- School 9, Quintile 5, e-readiness index of 59%; and

- School 22, Quintile 3, e-readiness index of 55%.

Consistent with the survey findings, most of the case study schools above 50% are in Quintile 5. However, there are also two Quintile 3 case study schools which are above 50%. The average trend of higher quintiles generally being making better use of ICT is not uniform, therefore, and there are clear exceptions amongst lower quintile schools.

Some schools, like schools 17 and 22, in the lower quintiles are demonstrating relatively sophisticated use of ICT and access to quite extensive ICT infrastructure School 12 is also worth highlighting, as it is a Quintile 1 school which has a leadership that is committed to ICT, teachers that make use of ICT for their administrative roles, and limited computer access for learners through computer literacy. It falls short of 50%, with a 43% e-readiness index, but is rated similarly or better than 13 other case study schools. The converse also holds true: there are some schools in quintile 5 (such as School 8, with an e-readiness index of 43%) which make relatively little use of their available ICT infrastructure.

Many schools seem to believe in the importance of ICT, but often appear to be struggling to convert this rhetoric into practice. This is for a variety reasons, ranging from unsupportive leadership to lack of training. Uniformly, schools where ICT leadership was weak demonstrated weak use of ICT.

Despite this situation, there is certainly evidence of ICT use in schools. Of course, the nature and extent of use varies across and within schools. The case studies suggest

that there are widely varying different focuses, but some common themes. Some schools focus on administration (as is the case for schools 7, 13, and 17), others on teacher preparation and administrative educator roles (as evident in Schools 10, 11, 12, 14, 16 and 23, for example), others on computer literacy or CAT for learners (as in schools 4, 5, 9, 11, 12, 13, 18, 22, 23, and 25) and some on using educational software (such as schools 1, 8, 9, 10, and 22). The Special Needs school makes use of specialized ICT uses for work with its learners. We found examples of schools that use ICT for communication and marketing. Schools 10 and 23 provide good evidence of this type of use of ICT. However, consistently, the most common practices were use of ICT for administration (school and teacher), ICT literacy and teaching of IT and CAT, and – to a lesser extent – lesson preparation and administration by teachers. In these cases, the use by teachers was in support of their educator roles as interpreter and designer of learning programmes and materials; scholar, researcher and lifelong learner; and assessor.

The case studies indicated that, while the nature and extent of use varies, ICT use to create new knowledge and develop critical thinking and problem-solving skills is largely absent, while there is only very limited evidence of use of ICT to teach subjects other than IT and CAT.

Also striking, is the high proportion of case study schools that, while having ICT available, are not making any meaningful use of it. School 3 has a GoL laboratory, but makes very little use of it for either teachers or for learners. Schools 1 and 6 are in a similar situation. Both have a GoL laboratory and there is at least a timetable for school 6, but ICT use is limited to ad hoc research and Microsoft Encarta access for learners. Schools 1 and 15 have been provided 15 and 30 computers respectively, but these have never been set up for use. Several schools have a GoL laboratory that is either not functional or not being used. For example, School 7 has a GoL laboratory which had not been functional for five months. School 19 also has a GoL laboratory, but educators report that most of the time it is not functional. In School 21, the GoL laboratory has been recently re-installed but is seldom used, except on an ad hoc basis. School 17 and School 20 have GoL laboratories, but have no timetable, and the laboratories are used occasionally for learner use of Encarta or for research. School 16 encourages teacher use of ICT, but, despite having a GoL laboratory, does not yet have a timetable, and there is only occasional use of the laboratory by learners, on an ad hoc basis. So, amongst the 25 case study schools, nine are not making meaningful use of their GoL laboratory.

A key observation emerging from the case studies is that practices vary considerably across and within schools. There are few common strategies or practices across all schools (or sometimes even within them). This suggests that ICT use is fragmented or disparate. While such fragmentation is useful in initial stages of piloting innovative ideas, this level of fragmentation is not necessarily useful in system-wide initiatives. There may now be value in defining a clear, common, and focused vision and directive across schools driven by the Department centrally and by SMTs within schools.

There are schools in the study that are making significant efforts to integrate technology into various aspects of the school's functionality for both administrative

and teaching and learning purposes. For example School 9 makes use of ICT for administration, teacher preparation and for use of educational software by learners; and School 16 makes use of ICT for administration, communication, teacher preparation, educational software, CAT and IT.

As noted, these schools are not necessarily only those with the greater resources. Some highly resourced schools are not using the technology particularly innovatively. While there is evidence of some poorer schools engaging effectively with ICT. For example, School 14 is a Quintile 2, no fee school and makes effective use of interns to support teachers in lesson preparation using ICT, and managing their GoL laboratory for learner use. This school also has a wide range of ICT equipment types, and its leadership is supportive of ICT and has allocated its own funds towards an ICT budget. School 22 is a Quintile 5 school that has also demonstrated effective use of ICT.

Leadership and Management of ICT: Perception and Use

Leadership and organizational culture are central tenets of an effective ICT environment. This includes the perception of leaders concerning the importance of ICT, their use of ICT, and their ability to create a supportive and enabling environment for effective use of ICT in school contexts.

Much like teachers, managers at all but one school indicated that ICT was critically important to their school environment. Some indicated that it is 'necessary for the modernizing world', that 'learners have to be ICT literate for the future', and that learners 'need to develop 21st century skills'. One principal put it aptly when he said that 'we cannot live without it as this affects all aspects of our lives as educators'. Clearly, leadership appears, with a few exceptions, to have bought into the idea that ICT has an important role to play in their schools. It is, however, hard to assess whether they really believe in its power and are convinced by the rhetoric or they simply felt obliged to articulate these positive attributes given the nature of this study. Unfortunately, in many instances, this positive articulation has not yet resulted in any serious use or support of ICT use.

Another aspect of leadership focuses on how leaders' beliefs affect their practice. In some schools, managers are quite supportive of ICT use in practice, while, in others, they demonstrate no practical interest in its use. In cases where management practices show no support for ICT use, this is reflected in the ways in which ICT is sidelined. A trend observed in this regard is that ICT is not integrated into the core business of the school, but is seen as an add-on activity that is 'nice to have'. In these instances, responsibility for ICT is handed over to a coordinator and does not form part of the long- or short-term concerns of SMT. Some managers felt that there were many other priorities, rather than seeing ICT as part of a strategy to deal with these priorities. As one school manager noted, 'When you talk of a computer lab – that is a luxury to us'.

There are still some schools in which management appears determined to keep computers in good condition by discouraging their use. In one case study, the researcher reported that the computer room was scrupulously clean and tidy. There

were plastic covers on all machines and the keyboards had fixed plastic covers indicating that keyboards had not been frequently used. One teacher commented that there had been subtle threats about negative consequences 'if the computers get broken' and claimed that they were told by management 'don't touch, don't break, you are bringing viruses.' This teacher concluded that 'now the computers don't even have fingerprints because they are not being used'.

In another case, the school principal indicated that, while he is interested in ICT, he is technophobic. He stated that he was very supportive of ICT use at the school, but confessed that he was technophobic and furthermore that most teachers were not computer literate, which accounts for the lack of ICT practice.

School Administration

In schools where managers and leaders truly believe in the importance of ICT, this tends to be reflected in a number of practices. The first is focus on the importance of technology in improving the school's efficiency by integrating technology into administrative components of school life. A strong view was that ICT can make work faster and better. Principals and management referred to the fact that:

- *It is very important because it will increase the level of planning, reduce paperwork and record keeping.*
- *We mostly use computers for administrative purposes only.*
- *It's brilliant for planning and schedules and reports.*

Many schools are now using ICT for administrative purposes, although the extent of this varies in terms of nature and extent of use, as well as the kinds of models applied. Therefore, schools promote use of technology for administrative purposes in various ways. For instance, in School 8, the SMT hands out typed documents in order to set an example and encourage ICT use by teachers ('we don't do handwritten documents anymore'), while in other schools (such as School 19, for example) administrators carry out administrative tasks on behalf of the school and teachers. In the latter case, this is often the case because of lack of skills amongst teachers and lack of computer access for teachers:

> *What I've done, which we agreed with the SMT, is that work schedules are going to be done by administrators using ICT. When teachers submit their work, the SMT gives it to admin and they will gather that information.*

In one instance, there is only one administrator, who captures data, types examination papers, and enters examination marks:

> *Data capturing is currently very slow. There is one administrator and one computer. It is time consuming to input data and no one else can help. Once, the info just disappeared when the system crashed.*

Furthermore, the nature and extent of use in administration also varies. In some cases, the school uses computers to type up reports, while in others, they use fully fledged management systems to deal with reports, marks, timetabling, and other key management functions. Some schools use ICT to do very rudimentary administration, while others use specialized software. For those that were using

specialized software, EDUPAC, Microscope, SMART software, and SASAMS emerged as key packages. It seems that historically advantaged schools started using these systems before the arrival of SASAMS, which may account for their continued use of those applications. However, some historically disadvantaged schools are also using software other than SASAMS, often, they say, because the service providers offer better support than they receive on SASAMS.

In terms of training, some schools indicated that SASAMS training was sufficient, while others indicated that it was inadequate. One principal, for example, noted that, although he and the administrators had attended training on SASAMS at the district level and had received the requisite software from the GDE regarding SASAMS, the school was unable to implement SAMS as 'the training was inadequate'. Other principals indicated that they 'don't have quality computers' for installing SASAMS. For example:

> The old GoL computers are three Pentium 2 computers in the administrators' offices, which are not compatible with the SAMS software.

> Currently we are unable to submit reports. We were supposed to submit yesterday and I told them that we had a problem to open the disks.

Communication

In addition to administration, a few schools used ICT for communication with parents and their staff. For instance, some schools had websites, and communicated to parents and School Governing Board (SGB) members using e-mail and intranet facilities for staff. For example, school 23 buys bulk SMSs to communicate with parents. Some schools use ICT to communicate with learners during the assembly and indicated that digital presentations:

> Are powerful when you have a data projector and a computer – we use PowerPoint in our assemblies.

These types of use tended generally to take place at better resourced schools.

Some schools that use ICT for communication expressed disappointment that district offices do not encourage or model effective computer use in their work. They believe that if leadership models use of ICT, this will encourage others to do so:

> They (district officials) are not doing it, that's why we are not doing it. We have schedules upon schedules and paperwork upon paperwork. We cannot even communicate with them via email - it is nonexistent. We have to phone them...they are not ICT friendly and they don't allow us to be. They should get a few lessons.

Beyond Administration

A third aspect of leadership and management is how SMT and principals perceive and encourage ICT use in educational matters beyond school administration. The case studies reflected different perspectives about what is considered good educational use. One perspective is that teachers should use technology to enhance their preparatory work; for example, developing worksheets and surfing the Internet:

- *Yes they are making more use.... there are a lot more worksheets. They don't hand write them anymore.*
- *Teachers can use the information from the Internet to improve their knowledge and lessons.*

Another perspective is that ICT is best used to develop ICT literacy skills amongst learners, as reflected in the following quotations:

- *The schools that our learners go to in high school are very happy with the level of literacy skills amongst the learners.*
- *The teachers will not change, what I am worried about is getting the learners computer literate.*

Linked to this is use of laboratories for CAT and IT, including dedication of computer laboratories for this purpose. The decision to reserve laboratories almost exclusively for CAT and IT is a policy decision taken by the management of some schools.

Yet another perspective is that deployment of educational software such as CAMI or other literacy and numeracy software is the best way to use ICT, as is evident in School 11 for example. Use of such software has sometimes been associated with drill-and-practice activities. For instance, in one case, the principal felt that learners at the school did so well because 'we drill them hard.' He went on to note that 'CAMI Maths is absolutely fantastic I tell you'.

Budget Allocations

The fourth component of leadership and management perceptions focuses on expressing commitment to technology by making it a core activity of the school for which budget will be allocated (even if it is small). Of course, since South African schools do not operate on a level playing field, this commitment tends to be skewed in favour of well-resourced schools. For example, some schools set aside annual budgets for ICT and obtain these from a combination of school funds and donor funding.

With regard to this, School 9 purchased laptops for its teachers through a laptop project:

> *We (the school) sponsored them with laptops so that they can do things easier. Every single person or staff was issued with a laptop.*

This project offered laptops to the teachers on the basis of three options:

1) Teachers buy the laptop cash, and the SGB pays the teachers R130 'rent' a month.

2) The SGB buys the computer for R4,000, and the teacher pays a monthly instalment of R80. If the teacher leaves, then the entire amount is due.

3) Teachers use their own personal computers, and the SGB pays the teacher R130 per month as the teacher is using the computer for school purposes.

However, there is not a direct correlation between greater availability of financial resources and greater commitment. In another school, they organized funds to purchase a few laptops for the principal and administrators. This was a less well-

resourced school, which nevertheless clearly reflected an interest in using the technology:

> *We have about three laptops for the principal and administrators, teachers can also use it.*

In yet another case, the school purchased a few laptops for members of the SMT, but this became a point of contention in the school as teachers also wanted computers.

It is interesting to note that, while a school's SMT and heads often indicate strong commitment to ICT use in their schools, these schools do not always have dedicated teacher spaces for computer use[8]. Thus, computers are typically defined in terms of development of learner literacy, use of educational software by learners, or administrative use. As a result, schools typically do not have adequate computer access for teachers. Several teachers reported that they do not have access to computers for lesson preparation or administration because the labs are 'fully time-tabled for learners' and the administration computers are located in administrative offices, which are not easy to access.

Perceived Challenges

When asked about challenges to successful use of ICT in schools, SMT members and school leaders suggested, amongst other obstacles, that teachers themselves are a key obstacle to successful ICT integration. They cited lack of teacher skills and lack of teacher effort to transform their old ways as key challenges:

- *ICT is the way to go because in other countries they are very far advanced and most of their teaching is done through ICT because it makes the job to be simpler and better so probably a lot has to a change of the mindset of our teachers because they still have a phobia about computers.*

- *Some are not comfortable enough with computers. It has to be your passion.*

- *This is all due to ignorance. Some don't want to develop. They are afraid of expressing themselves – it is about fear. Maybe it has to do with age. They are people who don't want to be developed to get new information that is needed in this day and age. We also had the problem of the computers not functional.*

- *We need to change their insight on computers.*

- *We have the facility but it is a white elephant. Even when we had the computers before, we didn't use them. We still write out our marks and tests by hand and the clerks type them. Nothing has happened in the last 10 years.*

However, it should be remembered that lack of teacher access to computers is likely to be at least part of the explanation for these kinds of problems. This is therefore influenced either by lack of funds, limiting ICT installation to computer laboratories, and/or limited school visions about what good ICT use and access is in a school.

In one case, the principal implied that providing too much access to teachers would result in teachers abdicating their teaching responsibilities. He had some reservations about ICT: 'How can we control this if teachers are on Facebook the whole day?'

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[8] This is with the exception of the school that purchased laptops for teachers.

For another school, concerns related to teachers being absent from their classes because they may be in the computer room. In this instance, the computer room is 'out of bounds' for teacher use (but not if teachers bring their classes with them to the computer room). In other words, teachers in this school are discouraged from spending time in the computer room, particularly if they are supposed to be teaching: 'this is done to prevent bunking [by teachers]'.

Finally while many leaders showed support for using ICT in some or other way in their schools, in one case the principal supported and promoted ICT but did not use it himself. As he noted, 'I don't use computers. I've got secretaries. They do all my work. I manage people in administration.' This reflects an understanding that technology cannot assist him to lead the institution. It may be worth noting that this school also has a laptop project for its teachers and many teachers in that school use computers in some way.

This indicates that a principal does not necessarily need to use ICT in order to champion it, but that he or she has, at least, to avoid becoming an obstacle to ICT use and put into place the relevant structures to enable it. Case studies indicate that the champion can be anybody. In some cases, it was the deputy principal, in some a teacher, and in others the ICT coordinator.

While management beliefs about the importance of ICT are an indicator of buy-in and a necessary condition for successful ICT use, in themselves they are insufficient to indicate whether or not ICT will be used in a school. In order to lead and drive ICT use, the leadership must view ICT use as integral to its overall vision and direction. If this does not occur, then ICT can become a sideshow or add-on and may not be effectively integrated into the work of the school.

Leadership and Management: Policies, Plans, and Timetables

Policies and plans are regarded as important requirements to provide a framework and guidelines for ICT use in schools. None of the case study schools examined had comprehensive policies or plans. However the case studies can be grouped into schools that had no policies and plans at all, those that had some practices indicative of informal policies and plans, and those that had basic rules for the laboratory use that could be construed as policies. The first group of schools had no policies and plans and no practices that were evident of potential plans and policies. The second group had a number of practices that could be relatively easily translated into policies. For example, dedication of computer rooms to learners during school hours; a requirement that all grades must receive some computer access per week; that a school would not provide Internet connectivity in their laboratory; or that computers would be upgraded every three years; are all examples of policy positions. In the third group, schools had some rules for using laboratories. An example of this is presented below:

- *Strictly no food /liquids allowed in the laboratory.*
- *The LAB is available to all educators.*
- *The lab is open five days a week during school hours.*

- *No learners are allowed in the lab without supervision of the relevant educator.*

- *When you leave the Lab make sure that everything is in good order.*

- *The usage of the Lab is in accordance with the school time.*

- *No item should be taken out of the computer lab without authorisation.*

- *Keys for the lab should be kept at the principal's office after locking.*

- *The security code must be known only by the committee members.*

- *The computer lab should be kept clean at all times.*

Some schools are performing fairly well despite not having policies in place. In other words, policies and plans are not necessarily indicative of, or a requirement for, effective use. Thus suggests that, if policies and plans are to add value, they should provide simple frameworks that facilitate practical action. Should they become unimplementable, unrealistic, jargon-filled documents that have no bearing on day-to-day ICT use, they might become impediments to some of the good work that is taking place.

With regard to laboratory timetables, some schools had structured times allocated for laboratory use, but many did not. Where schools did not have any timetable for laboratory use, in general there was also no significant use of the laboratory. Almost all the case study schools that have low e-readiness indices do not have a timetable (as observed in the survey data):

- School 15, Quintile 3, e-readiness index of 29%

- School 1, Quintile 1, e-readiness index of 32%;

- School 5, Quintile 3, e-readiness index of 39%;

- School 19, Quintile 4, e-readiness index of 43%; and

- School 20, Quintile 4, e-readiness index of 43%.

The exception to this is School 13 which is a Quintile 2 school with e-readiness index of 32%. It does have a timetable, but its laboratories are used almost exclusively for CAT, and there is very limited teacher use and access to ICT.

In schools where there is no timetable, laboratory access is not built into the patterns of behaviour of the school (which depend on timetables), ICT sits in the fringes of the school curriculum and occurs on an ad hoc basis as and when the possibility arises. In addition, learners do not have regular opportunities to work with technology, which affects their level of skills and engagement with ICT. This lack of organization makes it difficult for teachers to incorporate computers into their teaching plans, as they can never be sure if they will be able to take their learners to the computer room. As one teacher put it, 'it's like a hit and run – we don't plan use – we just find out if it's free'.

Some of these schools are keen on timetables, but find the task of creating a timetable daunting and are not sure where to start, as the following comment illustrates: 'There is not a clear line of this is how it will be done – but drawing up a timetable will help'. In another case, the school is overwhelmed by the thought of developing a timetable to provide access to so many learners with so few computers. The ICT

Coordinator indicated that both he and the teacher responsible for the laboratory were unable to imagine how they could devise a timetable for learners to use the laboratory because they felt that 24 workstations was too few for all of their class sizes. In schools such as these, the computer laboratory is either not used or is mostly used during breaks when learners come to surf the Internet.

Schools that have structured timetables believe that it provides regular, structured opportunities for learners to access the laboratories and allows teachers to plan lessons. This is of vital importance in ensuring that learners have structured access to labs, but requires inclusion of laboratory allocations into an already existing complex time tabling situation. This issue is discussed further below.

While the presence or absence of policies does not seem to affect ICT use in a significant way, the absence of a timetable for laboratories correlates well with its lack of use. This does not indicate whether or not the laboratory is used effectively educationally, but does generally predict more frequent use by learners and indicates that some value is attached to planning this use.

Leadership and Management: ICT Coordinator

The case studies indicate that the ICT coordinator is perceived to be of critical importance in driving ICT use in schools. There are several different perceptions of what an ICT coordinator is, while they also vary in terms of perceived roles and skills. There were variances in terms of whether coordinators were full-time or part-time, as well as in their level of expertise and perceived roles and responsibilities. Some schools do not have an ICT coordinator. In these schools, there either is no computer laboratory, the laboratory is broken, or it is not being used at all. It is interesting to note that, of the seven case study schools that have the lowest e-readiness indices (of 39% or below), only one of these schools does not have an ICT coordinator. The effectiveness of ICT coordinators in the other six schools is therefore put into question. The presence or absence of an ICT coordinator is therefore, by itself, not a sufficient predictor of effectiveness of ICT use; rather the role, status and effectiveness of the ICT coordinator within a school is more likely to be a better indicator.

In some instances, schools designate a staff member to serve as an ICT Coordinator, which means that they are part-time and also teach some or other subject. While this model can work, it poses challenges in time allocations for the ICT Coordinator between supporting ICT and teaching other subjects. This can place serious demands on these teachers, who sometimes are required to prioritize their other subjects. One ICT Coordinator indicated that she is unable to perform her role, and requested senior management to make her teaching load lighter in order that she could fulfil this ICT supportive role. However this did not happen.

In another case, work was divided between two teachers but still their priority was on their formal subjects:

> *The two ICT coordinators are responsible for the GoL laboratory. Both ICT coordinators are HoDs (one for Life Sciences and the other for English), and thus ICT is not their primary responsibility at the school.*

ICT Coordinators are selected for various reasons. For example, because they 'are more ICT literate than the rest of us', they have lesser teaching demands than other teachers in the school, or they are simply passionate about ICT. One school indicated that it uses interns who are not yet qualified teachers and therefore have been allocated those subjects that do not have high examination requirements: 'We allocated phys education and computers because these do not have complex learner's examination and assessment requirements'.

At secondary level, in some, but not all, cases, ICT Coordinators are the teachers responsible for teaching CAT or to IT. In two instances, deputy principals also served as the ICT coordinator. This is clearly positive from the perspective that he/she is in a position of power and can drive change. However it is also potentially problematic if the deputy principal is too busy to spend time on ICT. Success in this instance depends strongly on the passion and drive of the person concerned, which will affects the ways in which they promote the use of technology.

Some schools have full-time Coordinators, dedicated to supporting ICT. In some cases these are teacher interns (i.e. teachers who are studying part-time). Another scenario is for schools to have both an ICT manager and an ICT or Laboratory Coordinator. The ICT manager oversees ICT budgets and presents ICT issues at management level, while the ICT Coordinator is involved in timetabling the laboratory and providing support to teachers and learners.

There is no obvious correlation between having a full-time ICT person and high use of technology. It seems necessary to have some designated person who prioritizes ICT, whether full or part-time. Schools that did not have a designated person to deal with ICT were generally also unable to drive ICT use in schools. The notion of champions is thus an important one in promoting ICT.

Another important factor is the role and skills of the Coordinator. While it is important to have a designated person to deal with ICT in the school, this, by itself, is not sufficient. In addition, the perceived role and responsibilities of this person are important in determining how successfully ICT will be used. Some coordinators view their role as 'stock takers, making sure they know how many computers are in the school and contacting the GoL or GDE when they are broken'; while others see their role as technical (i.e. responsible for overseeing that the system is working). Yet others have a more comprehensive sense of their role as driving ICT through 'whatever means possible' This involves, planning, providing training, and troubleshooting where possible:

- *Whilst he doesn't formally train his colleagues, this teacher is constantly on call to assist with technical queries or to help teachers produce documents or resources for their lessons. As a way of coping with all of the requests he gets he sometimes sends his learners to help the teachers.*

- *I teach them how to use word and other stuff when they ask.*

Some Coordinators provide support and training in using ICT, sometimes on request and, in other instances, through provision of structured training to teachers after school:

- *I offer teacher computer training on Thursday afternoons.*

- *To ensure that teachers are computer literate so that it makes things easier for them and they do not rely on administrators. So I am trying to teach them, as well as the children, the whole Office package (ICT Coordinator).*

One ICT Coordinator provides teacher training every Tuesday and Thursday afternoon and divides teachers into basic and advanced classes. In this case, the training and support provided by the Coordinator is viewed positively as 'critical to us using computers' and the training is viewed as 'the best training we have received, much better than the GoL training'.

In addition to providing teachers with support or training, some Coordinators also provide training to learners on basic computer literacy, either using a structured, timetabled approach or one that is more ad hoc and occurs during breaks and after schools (described in more detailed in the section on Learners below).

ICT Coordinators vary in terms of their level of ICT skills and expertise. They ranged from those with 'basic ICT skills', designated to this position 'because they are better than all the other teachers in the school', to those with a high level of technical skills (for example, advanced skills and knowledge of basic applications).

It generally seemed that ICT Coordinators were trained in the technical sense but not necessarily in pedagogical and instructional design aspects of ICT. Reasons for this are unclear, but it could be that schools do not see the necessity of the pedagogical aspects, that they viewed the technical needs as much more needed, or that they take it for granted that these are teachers who therefore should have pedagogical know-how. Typically, laboratory coordinators did not see themselves taking pedagogical responsibility for a school focus on integrating ICT into classroom activities. Thus, they typically provide basic support to learners in computer use and support to teachers, including, in some cases, teacher training.

In summary, from these case studies, there appears to be no clear correlation between the designation of a person as an ICT coordinator and the use of ICT in the school. There also seems to be no correlation between making this a full-time post and higher levels of use. Most important seem to be the role, status and passion of the Coordinator, combined with the support they receive and decision-making powers that they are accorded. These champions need to be interested in ICT, believe in its power, and be proactive. Furthermore, the more skilled they are, the more likely they are to encourage ICT use.

Teachers: Beliefs and Use

It was very difficult to find a teacher from the case studies who did not indicate support for use of ICT. While the case study research included both teachers who use technology and those who do not, all teachers indicated that ICT is important and should be used. Many cited the need to:

- *Develop skills for work;*
- *Become part of the modern world; and*
- *Develop 21st century skills.*

This creates an impression that teachers feel they should be seen to support technology, possibly because it represents the beliefs of forward-looking people or because it seems politically or socially correct to say this. Given the generally low levels of ICT use by teachers in many case study schools, it seems that they have bought into a rhetoric around ICT use in education, but are not exactly sure exactly why they should use ICT and how it can improve their teaching and learning activities and outcomes. Examples of such rhetoric include:

- *Meeting the needs of technological age and that of empowering learners.*

- *We are living in the era of technology and learners need to be computer literate.' 'If they have computer literacy it will help when they get to tertiary – so they can type assignments.*

Only one teacher interviewed out of all 25 case studies indicated that perhaps there are other priorities:

Although ICTs are important there are more important needs i.e. upgrade of the ablution system (pipes are too old), security within classrooms as even desks and chairs are being stolen and only then would they look at buying laptops for teachers.

Of course, some have gone beyond the rhetoric and indicate that ICT has become integral to their lives in more intricate ways. For these teachers, computers are part of their new identity:

- *I do everything on this. My whole life is here. My life is on here. I can't function without this thing...I absolutely communicate with this thing. I send someone an email rather than phoning. I would be lost without it, absolutely lost.*

- *In this age, we can't work without it. Everything we do, we must use it.*

In addition, the case studies explored actual use of ICT. It is evident that there are a number of different types of uses amongst teachers. Of course, there are those who do not use ICT at all. Many of these teachers suggest that there are structural impediments preventing them using technology, such as heavy workloads, lack of access to the laboratory, lack of connectivity, and lack of skills. For example, one teacher said:

We would love to use the Interactive white board but it is in the computer room so we do not have access.' PS9; and another said 'give it to me in my classroom – not over there (the lab).

For those who do use ICT, there are different kinds of uses. Many use ICT to help them to become more efficient:

- *Assessment is much quicker when you use formulas on excel.*

- *Sometimes we don't even type the notes because they come out ready (from CDs).*

- *I think in the beginning, before we had computers, normally we used to ask the admin to do question papers, for example, but right now any teacher can do the stuff for herself and it saves time.*

- *It makes work easier, faster and neater.*

Some teachers who believe in the administrative capability of ICT do not actually use it themselves. Instead, for these teachers, administrators type up reports and worksheets.

Some teachers use ICT to prepare their lessons, which is more professional and efficient, and better for learning. This preparation ranges from typing up worksheets to finding information on the Internet that can support teaching and learning as well as assessment:

- *I think it improves the standard of teaching. I think you don't spend as much time compiling and searching for information for ten different books and photocopying them. Now you can just scan the picture.*

- *It makes work easier, faster and neater. The flashcards and name cards, we laminate them and use them over and over.*

- *I can find pictures and information.*

- *It simplifies teaching and learning because the Internet has more information than I do. It makes it easier.*

- *I like the worksheets and tests. I copy and paste one test to another. It makes my work easier...and scanning.*

Some teachers use ICT to support learning, harnessing the visual advantages of the technology. For these teachers, many concepts can be taught better through visual and other interactive aids:

When we were doing DNA, they don't have an idea of what it is and what it looks like, even when they look at the diagram in the text book, it is abstract to them so when I open the computer and then I explain, it becomes easier and they become interested.

A favourite in this regard is Encarta: 'Encarta is fantastic, it has pictures of things and learners can see things they never could'.

Schools that have interactive white boards in classrooms seem to make extensive use of them. However, the use is limited to teachers located in that specific classroom. For example, white boards that are located in science classes have generally only been used by the science teacher. Teachers who use the white board generally do so to bring information to learners via different media. For example, science teachers show learners PowerPoint Presentations and excerpts from Encarta to reflect visual images and sound in order to strengthen their lessons. Likewise, teachers who have e-Beams in their classrooms 'use them everyday'. According to the ICT Coordinator where e-Beams are used, teachers do this because 'they love them and because it makes their job so much easier', but also because if they have one its proposed use needs to be listed as part of quarterly planning and HODs check that it is being used as part of the IQMS visits.

Some teachers use ICT for very specific subject purposes. For example, a history teacher uses his laptop to find visual images and video clips to support his lessons. He found video clips on You-Tube to explain gas chambers and other aspects of Nazi Germany to his learners and has also made PowerPoint presentations incorporating images from the Anglo-Boer war.

Another example cited, where computers had been used, was a Geography lesson in which learners had researched how an eclipse works using 'earth and beyond' and had reported their findings. In this example, the fact that the computer could demonstrate a concept using animation was regarded as particularly useful. The

same teacher said that he had also used Google Earth to show how maps work by superimposing aerial photographs over the map. He said that the satellite images included in Google Earth 'give dimension of how maps work. We found learners' homes and the school'.

At some case study schools, educational software is the dominant ICT application. Some schools indicate that they use software to promote numeracy and literacy. Such schools rate software use as best for learning, particularly for younger learners, and attribute their high literacy and numeracy scores to its use:

- *We use CAMI maths, its brilliant.*

- *We find the educational programmes excellent.*

- *I have a reading one for grade 1 – they enjoy that and work with it well. It gives a different way of learning and adds another dimension to the way they learn.... they are used to it because they are all growing up with computers. They are coming to school already used to the movement on computers.*

Other teachers indicate that ICT makes learning more fun for their learners:

When they are here (in the GoL lab) I can see that they are enjoying themselves. In class they are passive. When they see computers, they become active.

A teacher noted that in lessons where the computer is used, learners participate much more. She viewed it as her responsibility to introduce ICT to learners:

You need to have children that are able to access the world, access life. It is not their parents that are supposed to teach them. It is up to me to open up the world for them. I need to use the most recent technology to teach kids. You cannot let them be more clever than you. You've got to be the front runner.

While there was a range of uses by teachers, none of the case studies specifically reflected teacher understanding of possible ways in which technology could change the ways in which learners work and think.

Teacher Competence

Teacher competence in the use of ICT is of paramount importance in driving its effective educational use. Teacher competence in using ICT varies considerably across case study schools, as well as within them. While it is not possible to generalize from the case studies, it does appear that teachers in better resourced schools tend to have higher levels of literacy. This does not necessarily convert into use in teaching and learning, but it is typically a prerequisite.

Teachers in case study schools typically belong to one of three groups. The first group comprises teachers who have no ICT skills and are afraid of using technology. For this group, there is sometimes fear and apprehension with the newness of the technology:

- *This is all due to ignorance…. They are afraid off expressing themselves – it is about fear. Maybe it has to do with age. They are people who don't want to be developed to get new information that is needed in this day and age.*

- *They are upfront – they are afraid of touching the computer and say that they will break it.*

Sometimes, this is because ICT has been introduced to them late in their lives and they are unwilling to learn:

- *Some say that they are BC – Before Computers.*

- *Some teachers say that they are getting old and computers are not going to help me.*

The second group of teachers has basic ICT literacy skills, which allow them to use basic applications for administration and lesson preparation purposes:

- *I use computers to type up my worksheets.*

- *I have some basic skills.*

However this group is at a very introductory level and find it difficult to use ICT without ongoing support and tend not to be as confident using it with learners: 'on my side, I won't go to the computer labs with my learners because myself I am not perfect with the computer.'

The third group of teachers has advanced ICT literacy skills and is able to use presentation software and spreadsheets comfortably. For example, 'M here, he's quite clued up. He supports whoever wants to be supported.' Included in this group are those who use Smartboards quite comfortably, moving between different forms of presentations and different information sources. It is interesting to note that, amongst these teachers, many appear to have been self taught and had not been specifically trained to develop the ICT skills that they have.

While some teachers used computers for teaching and learning, none of those engaged during the case study research reflected a high level of understanding about the relationship between education and technology and the key principles and practices that pertain to using ICT when integrating it into curriculum activities. There was no reference to understanding when, how, and why technology should be integrated into the curriculum and how such integration affects planning as well as teaching and learning. Although this may have partially been a function of time constraints during case studies, it does also imply that there are gaps in exposure and skills development in ICT integration.

Regardless of where teachers were at in terms of their skill and competence, they all called for further training. Many teachers and school managers believe that this is key to successfully leveraging technology for educational use:

- *That's the only stumbling block, because we want to implement, but teachers are not confident. Therefore the objective cannot be met. Teachers must be trained in order to be confident so that they can train learners.*

- *We need more training; we need proper training to help us.*

- *How can we use it without training.*

While all teachers indicated a need for training, they were not always able to describe in detail the nature of training that they require. However they were able to identify some important principles that should underpin a training model or strategy. First, many teachers have not received any training at all and are in dire need of some form of basic orientation or training. Second, for those who have received training, this was often viewed as inadequate, too short, and/or too basic. The consensus seemed

to be that short courses have no real effect on teachers' skills: 'We are old. We need training for a long time and not just for 2 days.'

Third, an important emerging issue was the need for different kinds of training for teachers of different levels:

- *We all need different training. Some need basic and others need advanced.*
- *They (sic) must be different training for different teachers.*

Fourth, teachers indicated that training must be accompanied by support and an opportunity for teachers to practice what they have learnt: 'we must be give time to practice and they must help us as we try to use it.' Linked to this, initial training is best done immediately after rollout of computers, otherwise the gap between installation of computers and training results in teachers losing the skills they acquired:

- *We did receive training months ago and GoL came much later, we forgot what they taught us.*
- *It can sit there year after year unless someone teaches you how to use it.... some people have seen computers but they have never actually used one. It can be very, very basic training – just to take away the fear.*

Fifth, teachers indicated that training should occur regularly and on an ongoing basis to ensure that they grow and advance. They indicated that it should also teach them how to integrate the technology into the curriculum:

The Department or district should introduce a workshop where teachers are guided on what to do with computers. Those that have a problem can contact the district. And the district can monitor the effectiveness and function of computers. There must be training workshops where we are going to be developed. There should be a programme for the whole year which is curriculum specific.

Training that had been provided seemed largely to be focused on developing computer literacy skills and not necessarily on how to integrate ICT into curriculum activities. In one school teachers received training from Intel, which did focus on integration of ICT into the curriculum. However, this training did not result in more innovative use of technology for curriculum activities, largely because use of the laboratory was dominated by the ICT Coordinator. Clearly, integrating technology into curriculum is complex, and training, by itself, is not sufficient to lead to more innovative teaching practices.

Sixth, some schools indicated that the best training and support came from their ICT Coordinators, who are able to offer training as and when need and also offer teachers training and support that suits their requirements:

- *This ICT coordinator is brilliant; he can use the computer like an expert.*
- *He is in the field. He uses what we need. It is user-friendly and we feel comfortable to ask questions.*

Seventh, some teachers indicated that they do not want training after school time, as they are too tired to concentrate: 'we need proper training. After school, we are so tired.'

In summary, teacher competence is definitely a requirement for effective ICT in schools. Of course, an ICT literate teacher will not necessarily use the technology effectively for teaching and learning purposes, as such use is informed by the pedagogical beliefs of the teachers. Teachers who are informed by didactic, rote learning practices will likely continue these practices using ICT. Changing teachers' mindsets is key to improving effective use of ICT for teaching and learning. Also of significance is that teachers who are using ICT to support a range of their educator roles do not report having developed this confidence and skills through formal training programmes focused on ICT use. Thus training, while important, is not a magic bullet.

Learners

There are two types of learners in case study schools, those who use ICT as part of their daily life and those who have not had any exposure to technology:

- *The learners are from poor families – it is rare that you find learners who know it or who have used computers.*

- *About half take it because they already know computers and use them at home, so they take it because it will be easy to get good marks. The other half doesn't have other exposure to computers – so they choose computer literacy because that will give them some exposure.*

- *Looking at the situation in which the school is located, these learner at home they do not have computers at home but they are available a school. That's the only place they can access information.*

Thus for some learners it is part of their daily life, while, for others, exposure at school is all the ICT exposure that they will have. For those who have little access to computers both at home and at school, it has been observed that:

Whilst the learners would be working on something related to the subject once in the room, the teachers we spoke to said that many of the learners have such poor computer skills that it takes them too long to accomplish anything meaningful during one period in the computer room. Added to this, 'learners forget between sessions – and we don't have enough time to develop their skills'.

As has been noted, provision of computer literacy training to learners in case study schools is either structured, unstructured and ad hoc, or non-existent. Structured use requires a timetable and ICT Coordinator and occurs during school hours, while unstructured use usually occurs after schools and requires teacher supervision.

As has been noted, schools that use laboratories in a structured way have timetables for using the laboratory. In many cases, the computer laboratory provides one lesson per week per learner for computer literacy (typically where the school provides laboratory access to all learners). In other situations, the school selects some grades for literacy training:

Of the learners in grade 8 and 9 approximately half choose computer literacy as one of their elective subjects…This system also means that instead of making all learners take computer literacy only those who are interested in computers or those who don't have access to computers at home take it – which means that instead of sharing computers and having limited access – increased access is given to a smaller, more interested group.

While it is easiest for teachers to conceive of and understand the concept of providing ICT literacy training to learners, they sometimes find it very difficult to implement, because the timetabling issues become a nightmare. Some interviewees felt unsure how to provide all learners access to the laboratory and became overwhelmed by this logistical challenge. In some schools, this has resulted in a paralysis where the laboratory is not used at all.

School 4 offers computer literacy classes to students paying an additional fee. In this school, learners are required to pay an additional R50 per month to access the computer room. This reduces learner demand and therefore improves access. However, this is contentious as it excludes poorer learners, so learners who cannot afford the fees are left in the classroom.

In addition to computer literacy classes, some schools use the computer laboratory to offer learners an opportunity to engage with specialized educational software purchased by the school. This is particularly common in better resourced primary schools, sometimes constituting the core computer activity:

- *The principal felt strongly that this was due to the teachers being very experienced and learners at the school did so well because 'We drill them hard.'*

- *The CAMI maths is absolutely fantastic I tell you.*

A common use of the computer laboratory in secondary schools is to teach CAT and IT. In these instances the computer laboratories at the school are reserved for CAT and IT use, and are fully occupied for this purpose. Schools that offer CAT and IT are very proud that this occurs at the school and indicate that this is a draw card for learners and parents. In one school, the SMT was especially proud to report that the school boasts a 93% pass rate in those subjects.

However, schools that offer CAT or IT have little extra time available for other educational uses of ICT. Often, learners in these schools are not able to gain access to the laboratories, and other teachers struggle to squeeze into ad hoc spaces that may be available within a very tight timetable:

- *We are utilizing the GoL for a CAT class which is not right because of the shortage of computers.*

- *Teachers can use the computers for doing research but during learning hours it is busy being used by learners.*

In two examples, there is more than one laboratory but the laboratories are still used for CAT and IT. The one case is School 12, which is a quintile 1 school which has three laboratories, but nevertheless indicates that it does not have enough computers for wider learner access. As a result, teachers can only access the laboratories during breaks or on the few occasions when they are free, while non-CAT learners have virtually have no access:

The school's ICT teaching programme was centred on CAT which was offered as an optional subject to grades 10, 11 and 12. In 2010, there were 160 grade 10 learners doing CAT, 90 grade 11 learners and 98 grade 12 learners. This brought a special challenge to the school because when it came to the resources they were not quite sufficient. The principal and ICT coordinator told of the story when the last group of learners writing CAT (2009) had to finish their examinations at 23H00 because of the lack of computers and challenges that they had to go

through. The school was however determined to soldier on because the results that they got from CAT, 93% pass, were one of their better results across the curriculum.

In the second case, School 23, a highly resourced, quintile 5 school has four computer laboratories, but still no access for learners and teachers beyond CAT and IT. The computer laboratories are used 'every period of every day' for either CAT or IT which means that there are no spare computers that learners can use for other subjects during the school day.

Some schools do provide ICT access to learners for project work. This typically occurs on an ad hoc basis, when teachers request use of the laboratory or alternatively during breaks and after schools when learners can get on with their project work. This type of project work generally focused on low-level information retrieval from the Internet: 'during break learners can do their projects and search for information'.

Notwithstanding the two examples highlighted above, some schools with more than one computer laboratory are able to dedicate one laboratory for computer literacy and the other for use of specialized educational software, CAT and IT, or project work.

A key issue that arises in schools that use laboratories for computer literacy, CAT, and/or IT is the reduction in teacher access to computers for preparation or teaching and learning purposes:

- *Sometimes we can't disturb him (CAT educator) when we want to get in maybe we are free.*

- *The fact that our roster or timetable is a bit full. That doesn't allow us to use the lab.*

Models of provision of ICT access to learners also vary. In one case, the subject teachers and ICT coordinator attend the class together, while, in another, the ICT coordinator provides the lesson. The latter option is easier to manage, particularly if laboratory use is timetabled. If subject teachers have to attend classes, ICT planning and timetable requirements become increasingly complex, although the nett educational result may be better.

In general, though, use of laboratories to integrate ICT into other curriculum activities does not occur, possibly partly because it generates significant planning challenges. For example, if teachers are all slotted into set timetables to use the laboratory with learners, they are forced to go to the laboratory even if a particular lesson does not demand it. This requires better planning on behalf of the teacher at the beginning of the year. Alternatively, teachers could enter into an ad hoc arrangement with the ICT Coordinator to request laboratory use, but this can also become difficult if requests are denied because another class is using the laboratory.

Models of Technology Use

Laboratory Models

A key strategy of the GDE has been to roll out computer laboratories through GoL. Thus, it is important to understand how well this model is working and what can be done to make it work better. Schools visited for the case studies can be divided into

four groups: those that have no laboratory, those that have a GoL laboratory, those that have laboratories purchased through their own or donor funds and those that have both.

Some schools that do not have GoL laboratories are eagerly, sometimes angrily waiting for them:

> To date, the school still does not have a Gauteng lab despite a site for a new building being identified and trenches being dug a few years ago 'to test the soil'. 'Recently two people from Gauteng Online arrived to inspect the GoL lab'.

Some schools expressed anger about the GoL services because they felt that GoL had promised laboratories but nothing was forthcoming for lengthy periods without 'any further communication'.

In another case, schools have the computers, but do not have the physical space to locate a computer laboratory. In one example, there are 30 computers but these are in the strong room because the school claims that it does not have space to put these computers.

For those with private, self-funded laboratories, these are generally paid for by the school and are well functioning. These are typically in wealthier schools that can afford maintenance and other costs. Donor-funded laboratories, however, do not always work as well, as they are often not sustainable. The problem with some donor-funded laboratories lies in the way in which schools and institutions can be used as a dumping ground for computers.

A key starting point for analysis of laboratories is to explore two detailed scenarios of use, drawing together aspects of the above analyses.

Laboratory Use Scenarios

In the first scenario, a laboratory is used to develop numeracy and literacy abilities in learners through educational software. In this situation, each grade 1 and grade 2 student has three periods a week, while grades 3 to 7 have two periods a week of access to the laboratory for use of educational software. One period is dedicated to CAMI and the other to general literacy and the third to general literacy (Readers for Leaders). For these periods the ICT Coordinator facilitates use of this software. Since the software provides answers to learner responses, the Coordinator merely supervises the class and does not engage with the specific content. The school is very keen on the use of this software and claims that learner performance is higher because of it. The school has a committee of ICT staff and subject specific staff members that sit on a panel to select the software that should be purchased.

The CAMI programmes focus on general numeracy such as multiplication tables and word problems. The content is context-free (i.e. not embedded in real-life applications) and is said to be good for practice and reinforcement of certain basic skills such as 'learning one's timetables'. The grade 1 and 2 CAMI is slightly more interesting in that it contains puzzles and requires learners to associate objects, while the upper grade CAMI is focused on improving speed and accuracy of basic addition, multiplication, and so on (i.e. it is clearly a drill-and-practice activity). This is easy to administer, and does not require a high level of engagement from teachers

or the Coordinator. However, costly software licence agreements are a down side of this approach. In addition, while there is nothing wrong with drill-and-practice activities, which are often what educational software provides, computers can be used in more sophisticated ways to enhance learning opportunities and these opportunities are lost in this approach.

In the second scenario, the laboratory is dedicated to computer literacy training for learners. Every learner has one computer lesson per week. The programme is quite structured, with a set computer literacy curriculum i.e. grades 3 and 4 learn PowerPoint and grade 5 learn Excel and then higher grades deepen their knowledge of specific applications. A classroom observation of the literacy class suggests that the focus is on teaching computer literacy through general technical use of the applications. For example, the ICT Coordinator teaches students how to draw figures and colour these figures in PowerPoint. The lessons observed were good and very structured. However, they are unrelated to the curriculum. The ICT Coordinator teaches learners literacy, without the presence of subject teachers.

In this example, the ICT Coordinator indicated that he tries to draw relationships where possible between the computer literacy classes and the broader curriculum. However, he says that it is easier to make links between what learners are doing in class and the computer literacy class for foundation phase learners because these learners work on a thematic basis for the term. Also, these learners have one teacher who needs to be liaised with, which makes curriculum integration more logistically possible. This, he says, becomes complex with the higher grades as there are many subjects, many teachers to negotiate with, and topics change all the time.

Through this activity, learners develop a sound knowledge of computer applications, with a very knowledgeable and structured computer teacher. However, this approach does not focus on curriculum integration. The ICT Coordinator suggests that linking the laboratory to curriculum activities is logistically challenging, as teachers may also have to attend. The school also says that it does 'not want to link computers too much to the curriculum because it takes the fun out of it and young children must also have some fun'.

One of the key challenges with regard to ensuring that learners have access to the laboratory is to develop an effective timetable. The deputy principal, who is also the ICT champion, admitted that timetabling of the laboratory is the most time-consuming and difficult task. The school has purchased software called Action Commercial Technology Software, which cost about R2,800, to assist with its complex timetabling requirements. The school indicates that it 'first timetables in the swimming pool, then the computer lab and then the remaining classes'. Furthermore, since there is great difficulty timetabling these laboratories within a five-day cycle, timetables are adjusted to a seven-day cycle. This provides 56-40 minute periods instead of 45-30 minute periods.

Students are allocated folders in which they can keep their work, which are categorized into grades. They are also allowed to save their work on memory sticks if they so choose. The principal indicated that antivirus software has been pretty good at keeping the system free from viruses. It is important, though, to watch that students do not bring in pictures and clips that are not age appropriate or are

problematic in terms of content. Students' work is saved on a Linux server, but they do not have passwords. This means that students can open each other's files. The ICT champion indicates that passwords create too many difficulties and hinder use.

In this case, learners can use computers for ad hoc project needs during break and after school. In these instances, teachers do not have access to the laboratories. The laboratory is accessible to learners after school until 15:00 every day and 16:40 on a Tuesday and Thursday, when learners can come to do project work. Project work includes learners looking for information on the Internet on different topics (such as the Nile or cancer and smoking). Most of the questions that teachers have asked learners to research are very straightforward and thus do not require complex information literacy skills or higher order thinking skills.

In general, staff members in this school use computers for administration, report writing, and some lesson preparation. They do not use the laboratories, preferring the dedicated teacher stations in the staff room. However, they also do not use laboratories with their learners since they are fully occupied. Teachers can use the laboratories after hours until 17:00, but do not usually do so. Teachers can also use the laboratories during their break, but tend not to do so because time is too short and they cannot achieve anything.

Problems Experienced in GoL Laboratory Deployment

In schools where GoL laboratories are located, the first issue to note is that various laboratories were recently installed or re-installed (i.e. between July and November 2009):

- *Computers were first introduced in 2006, and stopped functioning a few months after installation. The new set of computers was installed in Oct 2009.*

- *The first GoL installation took place in 2005, however in the same year the lab became defunct. The second installation then took place in 2009.*

- *The first set of GoL computers were installed in 2007 but June 2008 these were not in working order. New computers were installed in Sep 2009.*

Concern was raised in some instances that the GoL laboratories are 'always down' and/or not working. In all but three cases, however, the Internet was working at the time of the visit, and, in one of these cases, the principal had made a deliberate decision to cut off Internet connectivity (apparently, for 'the safety of the learners'). Even though connectivity was working in most schools, feedback suggests that it is erratic and fluctuates from day to day.

- *It's a schlep. I want to use the Internet and then it's down. 10 minutes to the lab and 10 minutes back.*

- *There is no Internet – it has not worked for the past two months.*

It should further be noted that, while connectivity figures for case study schools seem high in relation to the survey data, this is because cases were deliberately selected on the basis of being connected.

Schools which had experienced connectivity problems and needed help indicated that the helpdesk does not provide the support required. Some indicated that, when

they asked for assistance, it did not arrive. For instance, in one case, teachers could not use the computers as the 'motherboard was locked' and GoL had the keys. When GoL was phoned, the school was told:

We are number 230 on the list. But they never make a plan. With GoL, maybe they should call it Gauteng off line.

Other examples of complaints included:

- *With Gauteng Online, we want them to visit our school more, because we phone them and there is no response. It takes three to four months to get someone here to help us. Our neighbour school here has the same problem.*

- *'We have to wait for months. The previous year, classes were not running for a year because the computers were not working. We are able to fix it, but we were not allowed to, so we had to sit for a year without a class.*

However, another principal was more realistic about what to expect from GoL:

'If you wait for Gauteng on line, it will never happen. There are so many schools and it is not possible for them to come out and help you every day.

Some schools suggest that delays between requests for and actual provision of help destroy momentum, erode skills, and result in a culture of non-use. To resolve these issues, some teachers come to school with their personal laptops and use their own connectivity, but find that this is costly. As this option involves a personal cost, some teachers resent this. For example a deputy principal complained that 'I bought my laptop for Internet purposes – but it (the bandwidth) costs me a lot of money. I'm not going to use it for school'.

In one extreme case, the school's existing laboratory was demolished by a GoL service provider due to miscommunication between the service provider and GoL. As a result, the school's perfectly functional laboratory was torn apart:

GoL came into our school and destroyed our lab, they took out the ceilings, they took out the lighting and they left us with a shell. When they realized that they demolished a functioning lab without thinking, they tried to replace the ceiling, but most of it was left to us to fix.

Another key issue relating to GoL laboratories is the relationship between what is controlled at the central/provincial level and what the school has jurisdiction over. Many aspects of the central or provincial control over the laboratory create difficulties for schools. Many schools that use the laboratory have indicated that the model is restrictive and does not empower the school to make decisions about ICT. They indicate that the way in which the laboratory is organized means that control lies with the GDE and not the school. For example, control of the laboratory alarm systems at GDE head offices restricts the way in which schools can use laboratories. Generally, the laboratory alarm system is set at a particular time and the school cannot change this without the GDE. While the GDE can be contacted to change the alarm times, some schools are not aware of this:

We cannot even use the lab after schools because the alarm is remotely set by the GoL.

Some schools that are interested in installing their own software say that this is not possible within the GoL laboratory. A principal reported that 'The school can't put programmes on it for the needs of the school, so what's the point.' Thus, if schools

purchase licences for software, this cannot be installed centrally through the GDE as this creates complications with regard to user licences.

Whilst this is done for security reasons and to prevent harmful material from being loaded onto computers, it also prevents installation of educationally sound material onto the computers. For example, engineering students are meant to use TurboCad as part of their curriculum, but the software is not loaded on to the image of the GoL computers. The GDE has supplied some schools with the software, but teachers do not have the rights to install it on the GoL computers. As a result, teachers report that 'we just don't teach that part of the syllabus'.

Furthermore, GoL laboratories are built on a thin client model. This results in some challenges for ICT use at schools. For instance, the GoL laboratory does not allow learners or teachers to save their work on the system: 'our learners need to put their work somewhere on the system, this is not allowed in GoL'. ICT coordinators at two schools noted that the GoL laboratory model does not allow printers to be installed. Clearly there is a lack of understanding and clarity about the GoL model, as well as the roles and responsibilities of the school vis-à-vis GoL.

A One-Computer Classroom Model

In order to understand ways in which schools can maximize the use of one computer classrooms, one such case was included in the research. A one-computer classroom requires a data projector and, ideally, an interactive white board. These are all costly items. In addition the need to provide security for these classrooms can become a challenge for many schools.

One case study schools had examples of such classrooms. In this case, it was a well-resourced, historically white school with an annual fee of R8,200. The school has a total of 1,240 students and 42 teachers. The school has 110 computers spread across a number of sites, as well as three Smartboards and two laptops.

The one-computer classroom examined in this school works powerfully because it is linked to a Smartboard that is well used. Since it is located in the science class, the science teacher uses it extensively while it seems that no other teachers use it. The science teacher brings sound, and pictures to students. She also combines presentations with video clips and a range of other formats, including the use of calculators, protractors, and pairs of compasses.

While this is certainly powerful in combining a variety of different learning opportunities and is a good use of a single computer, it does not specifically reflect an educational approach that is highly innovative or that promotes critical thinking and problem solving. The use of computers does not necessarily change a teacher's pedagogical practice and principles. For example, much of her observed teaching was didactic and did not require a high level of cognitive engagement by learners. The lesson was interesting, combining sound, pictures, and text to convey knowledge. The teacher could move between different applications seamlessly and easily. This definitely creates a resource-enriched learning environment. However, this case illustrates well that the pedagogical beliefs of the teacher informs their use of technologies in the classroom.

Using Technology for Special Needs

An examination of the use of technology in an ELSN school, School 24, suggests that computers have become essential to integrating learners with disabilities into the learning environment.

> *For these children computers are essential to connect them to the world. Otherwise they will have no way of connecting and communicating with the world.*

However, the case study school examined also reveals that the cost of securing the relevant technologies and software to support such learners is high.

This ELSN school historically focused on learners with cerebral-palsy. The school has two thrusts, one being the usual academic thrust up to grade 7 and the other a skills focus referred to as a modified curriculum, which focuses on providing young adults with basic skills. The school has two computer rooms, with approximately 17 computers in each room. These computers were funded by DELL, and there is no GoL laboratory. The one computer room is a general one, accessible to all students in the school, while the other one is focused particularly on developing work-based skills in learners between the ages of 16 and 19. The general laboratory is used to provide learners with very basic computer skills, such as moving the mouse. Learners have about one hour of computer access per week. The computer teachers provide basic computer orientation for these learners.

The laboratory shuts down at 13:40 when school closes, since the school does not have after-school activities and many learners take the bus home immediately after school. For the work-based programmes, students use the laboratory to develop skills linked to employment. For example, the school's website reports that:

> *The coffee shop has been equipped with ovens, fridges and all the necessary appliances needed to run a quality establishment. Children have been on a course in waitering, and every Friday they serve between 30 and 50 school staff members, friends and family. With the help of our staff, children prepare the designated meals with great dedication and enthusiasm.*

There are also some computers in classrooms, some in the Occupational Therapy and Speech Therapy Departments, and a few in the resource room. The computers in classrooms are for those learners who are unable to read, write, or communicate in typical ways and require computers to assist their learning. For example, a student who is not able to use his hands or to speak uses his feet to type information in order to communicate, and, for this, the school has purchased specialized technologies.

> *For those learners that are non verbal, we give them an alternative means of communication, and the computer is an alternative way for them to communicate.*

In addition, the school has purchased specialized software which is used by Occupational and Speech Therapists. For example, speech therapy uses software referred to as Alternative Augmented Communication.

There is no doubt that teachers and therapists in this school were highly committed to using ICT to support teaching and learning. A teacher indicated that, 'while ICT is a nice-to-have for many other schools, it is essential to learning in this school'. Most teachers have basic literacy. Teachers use computers for lesson preparation such as worksheets. They view this as important since textbooks have to be adopted for their

learners and a worksheet provides them the opportunity to do so. Teachers also use it for report writing and other administration. However while teachers use computers for learners who are unable to read or write or speak, ICT is not integrated into curriculum for all learners. Thus technology is used to integrate individual learners into the learning environment.

It would be possible to argue that, for some learners, the technology is essential to their effective integration into society and that ELSN schools should receive additional dedicated computer budgets. However it will be important to consider how sustainable such an approach actually is. In addition, the technology use is very often linked to certain therapies required by the learners. If the schools have the technologies but not the therapists, it will be difficult to use these technologies effectively to maximize benefits for these learners.

Conclusion and Recommendations

Summary of Findings

Infrastructure and Access

Gauteng schools have relatively good access to computers: 97% have computers (with similar levels of penetration in both primary and secondary schools); and there is an average of 33 computers, approximately 2 laptops, and 3 administrative computers per school. The computers are most commonly available through computer laboratories, with 81.2% of Gauteng schools having at least one computer laboratory. However, these laboratories are under pressure and the average learner is theoretically only able to access computers for about one lesson per week (based on optimal usage patterns). Analysis of the case studies reveals that there are frustrations with the centralized management of software and security of the GoL computer laboratories. This removes management responsibility from School Management Team and severely limits types of ICT use by schools.

The majority of schools report having Internet connectivity in principle, with 83% reporting having connectivity. However, in practice, just under half of the schools (41%) have reliable Internet connectivity that would allow for systemic changes in ways of communicating or use of networked environments to shift teacher and learner behaviours. To gauge how reliable Internet connectivity is at schools, respondents were asked to estimate what proportion of time the Internet was available. Only 41% of the schools (both primary and secondary) with Internet connectivity report having it available for more than 75% of the time. This level of availability is considered to be a very low benchmark for reliable connectivity.

Most schools have access to Microsoft Office (95%) and school administration packages (87%). They seem to have less access to specialist software packages, and do not appear, in general, to be making purchases of software to support financial management or curriculum delivery.

There is also relatively good access to computers amongst administrative staff (an average of 3.57 computers for administration per school). However, teachers participating in the survey generally have limited access to computers – be this through laptops, dedicated teacher computers, computers in classrooms, or access to a computer at home.

Organizational Culture

It is encouraging that most schools (about three out of four) have an ICT Coordinator and that only a small minority (6%) have no ICT budget. However, only 41% of schools report having an ICT policy or plan, or an ICT committee (41%), while a similar percentage (44%) involve their SMT in ICT planning. From this, one may infer that approximately 60% of schools have a need to establish management structures for ICT planning processes. As one would expect, a similar percentage of

schools lack plans and ICT budgets. These schools, one may assume, require support in ICT management issues (including appointing an ICT coordinator, establishing an ICT committee, involving the SGB and SMT in planning, developing ICT plans, and financing).

It is, however, important to add that requiring all schools to develop ICT plans will not be sufficient to ensure effective ICT use. The case studies clearly demonstrate that some schools manage ICT effectively with well-established practices and procedures, but have no formal policy documentation. Others have policy frameworks which are no more than codes of conduct for learner use of the laboratories. The nature and levels of ownership of ICT policies (as evident in a document or simply in organizational practice) to improve the core functioning of the school seems to be more important than whether or not a policy document exists.

From the case study analysis, it appears that the presence of a timetable for the computer laboratory may be a better predictor of ICT use (or at least of computer laboratory use) than the presence of an ICT policy. In the case studies, schools that did not have any timetable for laboratory use did not report significant use of the laboratory. In these schools, ICT sits on the fringes of the school curriculum and ICT use occurs on an ad hoc basis as and when opportunities arise or when teachers make specific effort to use the computer laboratories. This limits learner exposure to computers, and teachers' ability to plan for ICT use in their lessons. The timetable also provides information on educational choices with regard to ICT use. Timetables reveal which grades and subjects/learning areas have access to the laboratory, and may indicate whether computer literacy skills, drill-and-practice software use, ad hoc project work, ICT integration led by subject teachers, or other uses of ICT are prioritized. In the survey, it was shown that the presence of a timetable is linked to higher scores of e-readiness in the school, as well as higher scores for administration, and to a lesser extent, preparation and teaching and learning.

The presence of an ICT coordinator is confirmed to be pivotal to ICT use in schools, as case study schools without an ICT coordinator showed minimal ICT use. However, there appears to be no correlation in case study schools between this being a full-time post and levels of use increasing. The skills and roles of the ICT coordinator varied considerably (although support and training for teachers was a consistent role). There was little evidence that ICT coordinators viewed their role as including support for pedagogical use of ICT, with them more commonly focusing on technical elements. Most important seems to be the passion and drive of the coordinator, combined with the support they receive and decision-making powers that they are accorded by their schools. These champions need to be interested in ICT, believe in its power, and be proactive. Furthermore, the more skilled they are, the more likely they are to encourage ICT use.

As the case studies illustrate, organizational practices vary considerably across and within schools, and there are very few common strategies or practices across all schools. The survey analysis reveals that, where schools have ICT management structures and budgets in place, they report requiring further support on:

- ICT software, insurance, and technical support (as these are least frequently included in ICT budgets);

- ICT-related staff training provision (cited as a major challenge facing schools), with a particular emphasis on training in use of ICT to support teaching and learning;

- ICT hardware options and ways to prioritize learner ICT access (as lack of learner access to computers is cited as another major challenge facing schools);

- ICT budgeting (as few schools include all the main budget items one might expect in a school ICT budget);

- Timetabling and booking systems for ICT use (as this is a key indicator of laboratory use, and was cited as a difficult task);

- Monitoring and evaluation of the effectiveness of ICT use (as less than half of schools conduct any M&E); and

- Funding sources for resourcing ICT plans (as schools are inevitably going to require annual ICT plans, which will require ongoing funding from sources other than dedicated ICT budgets and initiatives such as GoL and SASAMS).

Statistical averages show that there are inequalities in the Gauteng school system, which largely mirror the school quintiles (low quintile schools tend to have achieved and be doing less than those in higher quintiles). Although this pattern is evident in the survey data, the case studies reveal that there are exceptions to this pattern. There are schools in the study that are making significant efforts to integrate technology into various aspects of the school's functionality for both administrative and teaching and learning purposes, and these schools are not necessarily only those with the greater resources. Some highly resourced schools are not using technology especially innovatively, while there is evidence of some poorer schools engaging effectively with ICT.

It is hard to imagine a scenario where those exceptional schools that have managed to rise above historical and resource constraints to perform better than expected within their particular quintile did not do so as a direct result of the quality of management and leadership in the particular school. Uniformly, case study schools where ICT leadership was weak demonstrated poor use of ICT. In this regard, the case study analysis shows that, while there is almost ubiquitous rhetoric about the importance of ICT in the school environment, there is frequently little evidence of leaders being able to articulate and demonstrate how this is being attained.

In some of the case study schools, managers are quite supportive of ICT use in practice, while in others they demonstrate no practical interest in its use. As an example of the former, in some cases the school SGB has made a policy decision to set an example by having all documentation typed. In cases of the latter, where management practices show no support for ICT use, this is reflected in the ways in which ICT is sidelined. Some managers felt that there were many other priorities, rather than seeing ICT as part of a strategy to deal with these priorities.

The case studies suggest that there are widely varying different focuses, but some common themes. Consistently across the case study schools and echoed in the survey data, the most common practices were use of ICT for administration (school and teacher), ICT literacy, teaching of IT and CAT, and – to a lesser extent – lesson

preparation. The case studies indicated that, while the nature and extent of use varies, ICT use to create new knowledge and develop critical thinking and problem-solving skills is largely absent, while there is only very limited evidence of use of ICT to teach subjects other than IT and CAT.

Management beliefs about the importance of ICT are, in themselves, insufficient to indicate whether or not ICT will be used in a school. In order to lead effective ICT use, the leadership must view ICT as integral to its overall vision and direction (including its core function of supporting teaching and learning). If this does not occur, then ICT can become a sideshow or add-on and may not be effectively integrated into the work of the school. At least some of the case study schools felt that ICT leadership should be by example, from the district level, where ICT use should be a fundamental component of relationships between schools and the district.

The case study analysis confirms that schools have individual needs, and require some flexibility in choosing what combinations of ICT suit their educational needs. Some schools manage a computer laboratory almost solely for delivery of computer literacy or to teach CAT and/or IT. Some choose to install drill-and-practice software in their computer laboratories to support specific subjects or learning areas, while others cater for learners with special needs and therefore have specific requirements. Some schools manage computers in staff rooms and resource centres, others make use of a laptop and data projector which can be moved around the school, and, in at least one case study school, a model of one computer and a data projector or an interactive whiteboard in a class is adopted. These choices depend on the particular educational purposes of the school itself, while also reflecting the vision of the School Management team as to how ICT can best support their educational vision.

Teachers

One of the most striking findings from this audit is the low level of teacher use of ICT. A very high proportion of teachers (42%) are not using computers at all: they do not have an e-mail address and report never using a computer at school or using it only monthly. Likewise, the benefits of cheap and efficient communication cannot be realized when more than half (60%) of teachers do not have an e-mail address.

Teachers are using ICT for administration to some extent (24% in primary schools and 38% in secondary schools) and for preparation (19% in primary schools and 25% in secondary school), but minimal use of ICT for teaching and learning was reported.

It is remarkable that, in a profession which focuses on knowledge, information and communication, so many teachers are not using ICT at all. The reasons for this are likely to be many and varied, yet several barriers to teacher use may be extrapolated from the survey and case study data.

First, the lack of teacher access to ICT at school and at home is an obvious barrier to its uptake and use. The survey finding that 60% of teachers have access to ICT at home appears to indicate good access, but, when this was probed in case study interviews, it was revealed that this situation tended to be one where children or spouses had access but that the teachers themselves were not sufficiently confident to

take advantage of this home access. Without having a computer to use on a daily basis in support of their educator roles, teachers are clearly unlikely to use one. This failure to provide computers for teachers was also evident in the case study schools. Computers in schools were typically there for development of learner ICT literacy, teaching CAT or IT, use of educational software by learners, or administrative use. Schools typically did not have adequate computer access for teachers, and there are at least some examples of case study schools where teachers are actively discouraged from using computer laboratories.

Second, teachers report low levels of confidence in use of ICT, which clearly inhibits use. There are very low proportions (fewer than half) of teachers who feel confident to use computers on their own, with only 40% feeling confident to use ICT if someone supports them. Eighty percent of teachers are not confident enough to use ICT with their learners in support of the learning mediator role.

Third, teachers report that they lack the skills to use ICT. High proportions of teachers report being unable to perform any ICT-related task, and these proportions increase as the quintile value of the schools declines. Significantly, more than half of teachers in quintile 1 schools report being unable to perform any ICT-related tasks.

Lack of teacher confidence and skills is generally (although not necessarily) linked to the availability and nature of ICT training for teachers. This connection is confirmed by SMT members, who identify lack of staff training as the major challenge facing schools, with the lack of staff training in using ICT to support teaching and learning singled out as a particular challenge. This raises questions about the extent and nature of ICT-related training that has been available to teachers. Just under half of schools have benefited from some form of staff training in ICT, and most training for teachers has been of an introductory nature. The dominance of basic ICT skills or computer literacy is consistent with the ICT training offered by GoL. Amongst the 65% of schools that have GoL computers, 82% have received some sort of ICT training. The emphasis in these training opportunities was on a 'basic introduction', 'computer skills', and 'Internet and e-mail'. The training offered has, however, been short, with most teachers (76%) reporting that they have received fewer than four hours of ICT training during the last 12 months.

In this context, there is clearly a need for more professional development for teachers. At the same time, it is clear that there is no 'one-size-fits-all' solution to professional development for teachers, and a menu of different kinds of professional development models and options is required. Professional development which is of a longer duration than the dominant training models deployed to date and goes beyond basic introductions towards exploring use of ICT for all of the educators' roles (including a particular focus on using ICT for teaching and learning) is necessary.

Teachers in the case study schools requested more training that:

- Has different levels and focus areas to suit individual teachers' needs and curriculum specializations;

- Is accompanied by support and an opportunity for teachers to practise what they have learnt;

- Occurs regularly and on an ongoing basis;

- Is provided, at least in part, by their ICT Coordinators; and

- Is available during school time.

Notwithstanding this clear appetite for more teacher training and support, lack of skills does not necessarily signify a lack of training, nor will training by itself solve the problem of low teacher use of ICT. In work environments where ICT is an integral part of professional roles, many professionals who are not competent in ICT either learn 'on the job', or actively seek to improve themselves professionally by soliciting support from colleagues, family, and their community. This is done without any formal ICT skills training courses. Of course, for this to work, people require adequate access to ICT so that they are able to acquire skills through continued use. It may be that, in these work environments, the implications of professionals not being able to use ICT are dire: they cannot perform their job, and so may not stay employed. It may, therefore, equally be argued that a lack of teacher confidence and skills in using ICT is not only a result of lack of training or lack of access to ICT, but may also reveal a lack of extrinsic motivation or any professional requirement to acquire ICT skills.

Support for the hypothesis that teachers do not feel a professional requirement to use ICT is evident in the finding that those teachers who do use computers most commonly report using them for personal (non-professional) purposes. There seems to be more personal than professional incentive to use ICT amongst teachers. For those teachers who use ICT in support of their professional functions, they are least likely to be using ICT to support teaching and learning. Teachers who use computers reported using ICT most often to support administration, then for lesson preparation, then for teaching and then least often for learning.

Further support for the hypothesis that there is a lack of motivation from teachers to acquire ICT skills is evident in the case study analysis, where SMT members and school leaders cited lack of teacher effort to transform their old ways (in addition to lack of teacher skills) as a key challenge. Those teachers in the case studies who did not use ICT noted anxiety, fear, and resistance to changing long-established practices as key factors inhibiting their use of ICT.

Learners

As indicated above, very low proportions of teachers report using ICT while teaching their learners. This is the case in both primary and secondary schools. Levels of learner use of ICT with teachers increases with the quintile value for the school.

This is not to suggest that learners are not using ICT at school at all, as they may be using ICT in specific lessons dedicated to this, such as Computer Literacy classes or in the FET subject areas of CAT and IT.

Another indication of learner use of ICT is provided by examining whether or not schools offer Computer Literacy classes to their learners. In all, 45% of secondary and 55% of primary schools report to be offering Computer Literacy. The percentage of schools offering Computer Literacy classes differs markedly by quintile, with the

likelihood of Computer Literacy classes being offered decreasing with quintile value. Some prioritization in relation to grade levels targeted for computer literacy classes is evident. Primary schools (36%) are more likely than secondary schools (16%) to offer Computer Literacy classes to all grade levels. In secondary schools, there is slightly more emphasis on Computer Literacy classes for grades 10 to 12. For primary schools, where priority is given to certain grade levels, the emphasis is far more likely to be on Grades 4 to 7 than on Grades 1 to 3.

The prevalence of offering Computer Literacy classes as the main use of computers is perhaps understandable in a context where learner access to the computer laboratory is limited to one lesson per week. It would, however, seem important that links with the curriculum are made within these Computer Literacy classes, and that subject or phase teachers are involved in the planning and use of this time. From the case study examples, one may infer that Computer Literacy classes tend to be offered by a dedicated staff member. This limits the extent to which what is done in these classes links to subjects or learning areas, and further limits the exposure of all teachers to making use of ICT in support of their curriculum specialization. This is confirmed in the survey data when considering the high percentages of teachers reporting that their learners are not using ICT when they reported on software packages that they use, or their purposes for ICT use with learners.

Besides the organization of Computer Literacy classes distancing ICT from curriculum specializations and most teachers, another concern is the apparent lost opportunity to teach learners about appropriate use of ICT. Introducing ICT to learners has risks and ethical considerations. This is not a reason to limit ICT access or prohibit its use, but rather an opportunity to teach learners about appropriate uses of ICT. Despite this, 60% of schools do not teach about copyright, plagiarism, acknowledging sources, and safety and security on the Internet. The numbers of schools that do teach about one or more of these issues are very small (fewer than 20% in primary schools and fewer than 40% in secondary schools). The likelihood of these issues being taught increases with the quintile value of the school. Across the board, security and safety on the Internet is the topic that is least taught.

Besides Computer Literacy classes, at the FET band in secondary school, learners would also be expected to use ICT if they were enrolled for CAT or IT. In total, 38% of secondary schools offer CAT and 18% offer IT. Learners are more likely to have these subjects offered in their school if they are in a quintile 5 and/or a high fee level school.

A final indication of learner use of ICT is evident when considering the numbers of schools that provide learners with access to computers outside of formal school hours. This is referred to as informal learner use. Half of secondary schools and nearly a third (32%) of primary schools make provision for learners to use computers after school hours. The likelihood of providing access to computers for informal use by learners increases by quintile value.

The ICT infrastructure and learner access data reveals that there is relatively high availability of computers. However, theoretical calculations on learner access reveal that computer laboratories should be under pressure (assuming all learners potentially have access and that they are in use for six hour per day). However, the

above learner use data reveals that this pressure on computer laboratories may only be theoretical in some schools. There are two possible explanations for this: either computer laboratories in these schools are idle rather than being optimally used or computer laboratories are only being used by a small minority of learners.

One may therefore conclude that learner use of ICT is limited and learner use of ICT in support of the curriculum within learning areas and subject choices is minimal. Where learners are exposed to ICT, it tends to be through Computer Literacy classes. The case studies reveal that, in some schools, access to computer literacy classes is limited to certain grade levels and, in others, Computer Literacy classes may only be accessed by more affluent learners who pay a technology levy. At secondary schools, about a third of schools offer CAT and fewer than one in five offer IT, subjects which require that learners make substantial use of ICT.

E-Readiness

An e-readiness index was computed for each school, incorporating responses to questions about the availability of computers and printers; teacher, learner, and administrator access to computers; existence of an ICT coordinator and plan or policy; internet connectivity; actual SMT use of ICT; and availability of ICT support. Across Gauteng schools, the average e-readiness index is 45%, with primary schools scoring slightly lower (44%) on average than secondary schools (47%). This indicates that there is still much work to be done in encouraging effective use of ICT in schools. There is thus still much to be done by the province, district, and schools themselves to attain this in the approximately two thirds of schools that do not yet meet this minimum benchmark.

Equally clear and consistently evident when considering the survey, case study, and example schools in the e-readiness index analysis is that there is no clear step-by-step pathway which can be mapped onto all schools. Each school has a specific context and particular requirements. While all schools may need support to establish and then strive towards their own clear educational vision that has ICT as integral to attaining that vision, the specific means through which the vision will be attained cannot be pre-determined. In fact, it may be argued, that simply centralizing the design of a single model solution or even a predefined pathway to ICT use, would further disempower SGBs and school management teams, which must be central to defining and pursuing, their vision for ICT use, as well as being accountable for their schools' performance. SGBs and SMTs may use ICT to contribute towards becoming a functional and then an effective school, but imposing ICT onto a school that lacks both vision and accountability for school management is likely to create new problems, rather than provide instant solutions.

Another clear issue emerging from this audit is that, in relation to all indicators of ICT (access and use, organizational culture, teacher and learner use) in schools, there is substantial variation in the indicators by quintile. This is apparent in all of the survey data, and is most starkly summarized in the distribution of the average e-readiness indices for each quintile. The pro-poor policies of the government are highly appropriate in this regard in redressing imbalances and targeting government expenditure into schools in quintiles 1 and 2. However, the data reveals that quintile

3 and 4 schools also have relatively low e-readiness indices and require additional support. The fee levels in these quintiles cannot support the kinds of investments required to see ubiquitous access of ICT for Gauteng learners and teachers. While there are some schools not making effective use of ICT in quintile 5, as reflected in some schools having low e-readiness indices, this is not likely to be as a result of lack of resources. Fee levels in quintile 5 schools generally seem able to meet ICT resource requirements without further government support.

Recommendations

Clearly, significant progress has been made in Gauteng schools with regard to e-readiness, particularly through the GoL investments in connectivity and computer laboratories for learners. This study has revealed that the major challenges now are to ensure that schools use the ICT infrastructure that they have effectively and that they plan for, and manage, ICT use in the school on an ongoing basis. The main challenges facing many (although certainly not all) Gauteng schools are listed again for ease of reference:

1) Schools lack reliable connectivity to the Internet.

2) Schools do not take ownership of the ICT that they have, and lack leadership and a vision of how ICT can support their core business, at times viewing ICT as an add-on rather than integral to their functioning. Factors contributing to this state include:

   a) Not all School Governing Bodies and School Management Teams use ICT to support their roles and/or take responsibility for leading and managing ICT use in the school as an ongoing function. This is not necessarily evident in a school ICT policy document, but may be evident in the organizational culture and practices around ICT use.

   b) Not all schools have appointed an ICT coordinator. While the roles of ICT coordinators differ markedly from school to school, few play a role in supporting teachers to use ICT for teaching and learning purposes.

   c) Not all schools have timetables for their learner computer laboratory, and those that do express difficulty in drawing up timetables.

   d) Districts do not expect schools to use ICT as part of their core function (for example, in communication with other schools, the district, and provincial structures).

   e) SMTs are not able to choose and manage the software and functioning of their GoL computer laboratory, as this is decided and managed at the provincial level.

3) Teachers do not use ICT to support any of their educator roles. Factors contributing to this state include the following:

   a) Teachers do not have adequate access to ICT at school and at home. They do not have e-mail addresses.

b) Teachers lack the confidence and skills to use ICT in support of their seven roles as an educator.

c) It is currently acceptable for teachers not to use ICT to fulfil their defined roles as educators. There is a lack of professional motivation, and an accompanying reticence, amongst teachers to incorporate ICT in their daily lives.

d) There is an appetite for more, better differentiated, and longer teacher professional development activities that include school-based support. In particular, there are clear requests for training that focuses on using ICT to support teaching and learning.

4) Learners have limited access to ICT for teaching and learning. Factors contributing to this state include the following:

a) Computer laboratories are only (theoretically) available for use by each learner for one lesson a week.

b) Not all schools have timetables for their learner computer laboratory, and those that do express difficulty in drawing up timetables (see above).

c) Where schools manage to timetable computer laboratory use, some prioritize computer literacy classes for specific grades, others prioritize CAT and IT subject areas, and others prioritize use of drill-and-practice software in support of specific subjects or learning areas.

d) Not all schools provide informal learner access to the computer laboratory outside of school time (for example before school, at breaks and in afternoons).

In our view, the GDE can best contribute to overcoming these challenges, by shifting its role from being the core driver orchestrating delivery and use of ICT to schools to becoming an enabler of school-driven ICT use. This requires the GDE to shift its focus to helping schools to create the enabling conditions to use ICT more effectively to support teaching and learning, and then being able to respond quickly to, and support, schools that articulate their own ICT needs on an ongoing basis.

This would mean that the GDE role would shift from being one of the 'architect', which is then responsible for ICT 'roll out' or 'implementation' to schools to becoming a support service that facilitates actions as identified and requested by schools. This would not mean that all ICT-related purchases and contracts would be made at school level, as this would reduce the economies of scale that can be negotiated in bulk agreements (be these for infrastructure, SGB or SMT management support, teacher training or Internet Service Provision). However, it would require that the GDE negotiate and manage a menu of options in relation to different components of ICT use in schools, which schools would then access as and when they identify their specific needs.

This implies a shift in responsibility from the GDE to the school, which carries with it risks – particularly in schools where governance and management structures are ineffective. However, it is not possible to fix ineffective governance and management

structures by removing the responsibility for conceptualizing and using ICT, but rather by providing intensive and proactive support to help such schools learn how to manage themselves effectively. In acknowledgement of this risk in schools that are not running optimally, it will be important to work in collaboration with the structures and support systems within the GDE that are specifically addressing this challenge. Once again, the GDE's role should be to respond to the requests for ICT support and options, as identified by the SGB and/or SMT (albeit in collaboration with specialist teams working with them), to make them functional.

This does not imply that the GDE should simply wait for requests from schools. The GDE can be proactive in its responsiveness, and this audit provides rich information that can be used to anticipate the needs that particular schools have. What the audit also makes clear, is that there is no single 'one-size-fits-all' in relation to school needs, and that a menu of options is therefore essential.

Given this context, the following recommendations are proposed for consideration by the GDE.

Policy and Planning

1) *Ensure that all future ICT rollout activities are driven by a clearly defined set of policy imperatives designed to stimulate greater use of ICT for the core functions of schooling.*

   Extensive progress has been made in providing ICT infrastructure to Gauteng schools, and raising levels of e-readiness. However, levels of ICT use do not yet reflect sufficient leveraging of this extensive investment. Consequently, it is now appropriate to drive greater use of ICT across the province by establishing firm policy commitments that require more sustained and ongoing use of ICT in the daily operations of schools. These might include:

   a) Requiring that all communication and documentation from SGBs be produced in typed formats, and available electronically.

   b) Requiring that all communication between school SMTs and the district and province should be done electronically. All schools should be expected to communicate electronically with the SGB, with other schools, with the district, and provincial structures, with other forms of written communication being systematically dismantled in order to create a clear imperative to use ICT and to ensure that ICT infrastructure at schools remains operational.

   c) Requiring that all schools submit Management Information electronically to the province in agreed formats as and when this data is required for planning and management purposes.

   d) Expecting all schools with a computer laboratory to include a timetable for use of their computer laboratory as part of their annual school plans.

   e) Publishing guidelines to SGBs and SMTs on which elements of their functioning should be making use of ICT and require them to make use of ICT for all documentation (i.e. all school documents such as SMT minutes, annual plans, communication with parents, learners' reports, budgets, school information brochures are expected to be typed, and stored electronically).

The above are simply illustrative examples of policy imperatives that might be considered to drive more sustained and systematic use of ICT in schools.

2) *Ensure that schools are required to take over responsibility for planning current and future use of ICT, as part of broader school planning processes.*

It was clear from this survey that the existence of an ICT plan is not, by itself, an indicator of more extensive or better use of ICT within a school. However, the survey and case studies also revealed that many schools demonstrate no meaningful sense of ownership of the ICT infrastructure that they have received. This can only be changed by decentralizing ongoing responsibility for planning and use of this ICT infrastructure, particularly for teaching and learning purposes. From this perspective, it is not recommended that schools be forced to produce ICT plans, as there is no evidence that this will lead to great use. However, it should be possible to introduce some strategies to facilitate greater levels of school ownership and use of available ICT infrastructure. This might, for example, include:

a) Indicating clearly and repeatedly that responsibility for effective use of ICT will be a school responsibility.

b) Requiring schools to submit formal requests, with a clearly defined rationale, to procure additional ICT infrastructure. With the level of basic ICT infrastructure in place, it should now be possible to begin to decentralize responsibility for procurement of ICT (see also recommendation 6 below).

c) Publishing guidelines for schools on identifying and appointing an ICT coordinator and providing an indication of intended roles for this position. This should include, but not be limited to, providing school-based support to teachers in ICT use, taking overall responsibility for encouraging ICT use to support teaching and learning, and managing informal use of the computer laboratories by learners outside of school time.

d) Creating incentives for schools to appoint ICT Coordinators, as well as incentives for teachers to volunteer to become ICT Coordinators. These incentives might take the form of additional budget to procure specialized software, access to additional professional development opportunities, a reduced teaching load to free up time for tasks associated with the ICT Coordinator role, and token salary increments.

e) Allowing greater control and flexibility of use of GoL laboratories over software choices and overall management and maintenance of the computer laboratory (including the ability to install software on laboratory servers), but only in instances where schools specifically request this and can demonstrate that they are capable of handling this responsibility.

f) Providing schools support in ICT planning and development of management competence through district structures, in collaboration with broader provincial processes aimed at improving management systems, processes, and capacity at schools (see also recommendation 7 below). This would include development of management competence in both SGBs and SMTs.

ICT Infrastructure and Connectivity

3) *Ensure that all schools have reliable connectivity to the Internet, building on the connectivity infrastructure already supplied by GoL where this is cost-effective.*

Possibly the most notable gap in ICT infrastructure is the relatively low level of reliable Internet connectivity, which should be a high priority to resolve (particularly as prices for bandwidth are now declining significantly as a result of greater availability of international bandwidth and increased competition). Without reliable connectivity, it will be difficult to establish requirements of the kind mapped out in the previous recommendations. The benchmark for reliability should be that the Internet is available – at least for SMT and teacher use –at least 95% of the time and that all schools are connected to some form of broadband Internet connection.

4) *Ensure that all school staff members (SMT, administrators and teachers) have an e-mail address and can send and receive e-mails.*

If the GDE can ensure that all school staff members have an email address, it will then become possible to drive greater levels of ICT use by shifting decisively to electronic communication.

5) *Systematically improve the performance of the GoL call centre, to ensure greater responsiveness to calls requesting technical support and resolution of such problems within an agreed timeframe.*

As part of this process, the Call Centre should define annual performance targets, against which its performance should be measured.

6) *Ensure that provincial budget is set aside for further procurement of ICT and then develop a list of ICT infrastructure and specialized software options for purchase by schools.*

The purpose of this list would be to enable schools to make requests to procure additional ICT infrastructure and software through provincial procurement processes. Such purchases could be partially funded by a centrally administered fund, to which schools apply to acquire additional ICT resources and services (thus creating an incentive for schools to plan more effective use of ICT). However, it should also be possible for the province to secure preferential pricing deals with suppliers, so it should also be possible for schools to use this facility to procure software using their own funds (but benefiting from bulk procurement procedures). Of course, such a system would be required to go through normal tendering process and be governed by the Public Finance Management Act.

Such a menu of infrastructure and access options may include consideration of:

a) SMT and administrator requirements such as computers, laptops, management and administration networks and security, mobile telephones, data projectors, production equipment such as high volume printers and photocopies.

b) Teacher requirements, such as computers dedicated for teachers, mobile telephones, home ownership of computers for teachers, teacher laptops,

teacher networks and security, data projectors, interactive white boards, digital cameras; televisions, and so on.

c) Learner requirements such as computer laboratories, learner computer clusters in classrooms or resource centres, learner laptops, and so on.

d) A list of available education related software for use in schools. Such a list may be developed through a provincial approval process (as an extension of the list of printed learning and teaching materials) or simply provide a list of currently available offerings or frequently made requests from Gauteng schools in relation to software licensing.

Professional Development

7) *Develop a menu of ICT professional development options for the SGB, SMT, and teachers, and administer bursaries for participation in these professional development activities.*

The survey and case studies have highlighted that a key requirement is greater investment in a more diverse range of professional development activities for school staff members. The current short courses introducing ICT have had no noticeable impact in building confidence in use of ICT or in driving more sustained and better use of ICT. Consequently, it is proposed that a more comprehensive suite of professional development activities be identified and made available to schools through an appropriate bursary administration fund (which sets limits on annual school expenditure on professional development, suitably weighted to provide increasing levels of professional support to schools at lower quintile levels). As with the previous recommendation, however, schools and teachers should be required to provide a rationale for provision of funds when they make requests for professional development (highlighting how the professional development will drive school-defined objectives for use of ICT).

Such a menu should include, but not be limited to:

a) ICT management and leadership training and mentoring which includes developing a vision for ICT use within the school that supports its core functions as a school, as well as developing and managing rolling ICT plans;

b) Using ICT to support SGB and SMT functions;

c) Using ICT to develop an overall school timetable, including developing a timetable for a computer laboratory;

d) Basic introduction to using ICT to support the roles of an educator;

e) Integrating ICT across the curriculum;

f) Specialized professional development on using ICT to support particular phases and curriculum specializations;

g) Professional development focusing on pedagogical approaches in which ICT supports rich contexts of learning.

8) *Initiate a proactive programme of support to schools that have scored lowest on the e-readiness index to develop their capacity to harness ICT effectively.*

The key challenge with the previous recommendations is that they assume growing levels of responsibility at school level for owning and driving effective ICT use. Clearly, where schools lack capacity to develop effective plans, appoint ICT Coordinators, create timetables, and so on, there may be problems creating this sense of ownership. However, this problem cannot be solved by removing these responsibilities from them, as this will simply disempower them further. Consequently, it is proposed that a systematic programme of leadership and management support be introduced through district office structures, coordinated with other provincial processes to build school management capacity within both the SGB and SMT. This programme of support should focus on developing schools' capacity to harness ICT effectively and thrive within the provincial systems generated through implementation of the other recommendations in this report.

Driving Teacher and Learner Use

9) *Require that teachers be expected to use ICT to support their educator roles.*

While professional development is an important requirement for ICT use, it is equally clear that greater teacher and learner use of ICT also needs to be driven by need and demand. Consequently, in addition to the policy imperatives defined earlier, a key requirement for growth is to make it increasingly an expectation of how schooling functions. This should become evident through the following illustrative benchmarks, which schools should systematically be expected to achieve over the next three to five years:

a) Teachers have daily access to a computer with Internet connectivity.

b) Each teacher has an e-mail address and uses e-mail regularly in communicating with other teachers, the SMT, district, province, professional membership associations, and unions.

c) Teachers maintain an electronic repository of their work within the school LAN. In this regard, all documentation produced by teachers is typed and stored electronically. This should include, for example, assessments such as tests and examinations, learner attendance records, learner mark schedules, worksheets and other learning materials, and communication with parents.

d) Teachers seek out and participate in professional development activities relating to their profession in general and their curriculum specialization in particular. This should include ICT-related professional development opportunities.

10) *Recommend that learners have meaningful access to ICT at particular points in their school career by making explicit the GDE curriculum priorities in this regard.*

This may be done, for example, by:

a) Identifying particular subjects or learning areas in secondary and primary school level and, where appropriate, specific grade levels, where learner use of ICT is expected in Gauteng. This should reflect the provincial priorities in relation to the existing Revised National Curriculum Statement. It should be

detailed enough to provide guidance to SMTs on what should be prioritized in terms of timetabling for computer laboratories.

b) Defining basic levels of ICT competence that are required of learners at particular points in their schooling, for example at Grade 6, and Grade 12. This would be intended to support schools to determine what is being taught in computer literacy lessons, or the level to which ICT is being integrated into teaching and learning of particular subject areas. Minimum requirements of what is expected from a learner in terms of their ICT use at the end of primary school can then be built upon at secondary school level.