TRANSFORMATION READY – EDUCATION COMPONENT

DRAFT COUNTRY CASE STUDY

ICT for Teaching and Learning in South Africa

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ICT for Teaching and Learning in South Africa

1 Introduction

South Africa has a population of approximately 50 million people distributed across nine provinces: Gauteng, Limpopo, Mpumalanga, Northwest, Northern Cape, Western Cape, Eastern Cape, the Free State, and KwaZulu-Natal. The high prevalence of HIV and AIDS has significantly lowered the life expectancy at birth, which varies provincially. The average national life expectancy at birth is 54.3 years; 53.3 years for males and 55.2 years for females. The Free State province has the lowest life expectancy at birth, at 46.2 years. The literacy rate for adults aged 20 and above was 80% in 2009.

South Africa has the most advanced telecommunications network in Africa, development of which was recently boosted by government investment of R300 million into broadcasting and telecommunications ahead of the 2010 Soccer World Cup. The telecommunications network is 99.9% digital and includes the latest in fixed-line, wireless and satellite communications. In 2009, South Africa had 4.3 million fixed line telephones and 46.4 million mobile telephones in use, as well as 4.4 million internet users. The South African Broadcasting Cooperation (SABC) operates four television and 18 radio stations. South Africa also has subscription based digital satellite television (DSTV), launched in 1995, with over 50 channels with South African produced content, international syndicated content, sports, and news. DSTV has several educational programmes on some of its channels.

2 South African educational context

2.1 Shape and size

South Africa has one of the highest rates of public investment in education in the world. Education expenditure constitutes 5.3% of Gross Domestic Product (GDP) and accounts for 20% of total government expenditure.

South Africa’s educational levels and qualifications are informed by the National Qualifications Framework (NQF). The NQF is organized into three bands; general education and training (GET), further education and training (FET), and higher education and training (HET). Each band includes specific NQF levels. Table 1 reflects this structure.

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5 SouthAfrica.info: http://www.southafrica.info/about/media/satv.htm
6 SouthAfrica.info, South Africa’s television channels: http://www.southafrica.info/about/education/education.htm.
### Table 1  National Qualifications Framework

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<th>Band</th>
<th>School Grades</th>
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Basic education is compulsory for children aged 7 to 15. In 2009, almost 99% of children within this age range were enrolled in an educational institution. Basic schooling runs for 13 years or grades. It starts at Grade R or ‘reception year’, through to Grade 12, the year of matriculation, which leads to higher education. Schooling is compulsory from Grade 1 – 9.

Basic education is divided into four phases:
- Foundation phase (Grades R to 3);
- Intermediate phase (Grades 4 to 6);
- Senior phase (Grades 7 to 9); and

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7 Adapted from the South African Qualifications Authority (SAQA): http://www.saqa.org.za/show.asp?include=focus/id.htm
Further education and training (Grades 10 to 12)\textsuperscript{10} in an ordinary secondary school, as well as the equivalent NQF levels 2, 3, and 4 in FET colleges.\textsuperscript{11} Higher education and training takes place in universities, leading to the attainment of undergraduate and postgraduate degrees.

In 2009, the Department of Education was split into the Department of Basic Education (DBE); and the Department of Higher Education and Training (DHET). The DBE is responsible for all schools, from Grade R to Grade 12, as well as adult literacy programmes. The DHET is responsible for FET Colleges and universities.\textsuperscript{12} Responsibility for management of schools is shared between national and provincial government. The nine provincial education departments set their own priorities and programmes in line with national policy determined by the national Department.\textsuperscript{13}

Schooling provision in South Africa takes place in public and private schools. Public schools are funded by, and receive teaching and learning materials from, the government, although parents have to pay some costs, such as uniforms and school fees. Public schools are classified according to quintiles, which denote poverty levels. Quintile 1 schools are those serving the most disadvantaged communities and quintile 5 those serving the most privileged, in terms of financial resources. Some quintile 5 schools are very well-resourced and can be at par with some private schools. Some schools within quintiles 1 and 2 have been designated no-fee paying schools.\textsuperscript{14}

In 2009, there were 24,693 public schools in South Africa, enrolling 12 million learners who were taught by 386,587 teachers. Of the 12 million learners in public schools, 5.2 million were in 14,029 no fee paying schools. There are four types of public schools:
- Primary schools only, offering education from grades R to 3,
- Middle schools, providing education from grades 4 to 9,
- Secondary schools, which offer education from grades 10 to 12, and
- Combined schools, which offer education from grades R to 12 or R to 9.

Private schools mostly cater for children of middle- to top-income parents and the elite. Historically, higher school fees have marked private from public schools, but a new category of low-fee paying private schools catering for low income learners is now emerging.\textsuperscript{15} Private schools include primary, secondary, middle, and combined schools. In 2009, there were 1,174 private schools enrolling 386,098 learners being taught by 24,557 teachers.

\textsuperscript{11} FET Colleges provide high-level skills training that integrates theoretical and practical elements aimed at meeting specific industry skills requirements to fulfil the skills needs of the country. http://www.capegateway.gov.za/eng/directories/services/11473/15016
\textsuperscript{12} DBE: http://www.education.gov.za/TheDBE/tabid/54/Default.aspx
\textsuperscript{14} ETU. Education policy: School fees. Available at: http://www.etu.org.za/toolbox/docs/government/schoolfees.html
Within the schooling system, South Africa has a rate of repetition which is higher than that for other developing countries. In 2009, 9% of enrolled learners were repeating the previous year’s grade. Repetition is higher in the advanced grades as a result of learners who have proceeded through the system without mastering basic concepts. To address this, the DBE has introduced Annual National Assessments (ANA), which are standardized language and mathematics assessments for Grades 4 to 6 and literacy and numeracy assessments for Grades 1 to 3. These assessments are aimed at measuring learner progress, and can be used for remediation to resolve apparent areas of challenge for learners. The results of the 2009 ANA indicate that literacy, numeracy, languages, and mathematics are a challenge for South African children, and need serious intervention for improvement. Only 41% of Grade 3 learners passed the numeracy assessment and only 39% passed literacy, with an average aggregate of 44% for numeracy and 39% for literacy. At Grade 6 level, only 13% of learners passed mathematics and 20% languages, with average aggregates of 30% and 31% respectively for these subjects.

The rate of completion is also low. From 2002 to 2009, an average of only 48% of people 24 years old had completed Grade 12. Learner achievement, as highlighted by the Grade 12 national school exit examination, the National Senior Certificate (NSC), has room for improvement. In 2010, about 68% of learners writing the NSC passed the examination, a 7% increase from the previous year. The class of 2010 achieved the highest percentage of learners (25%) to pass the examination well enough to be admitted to university since South Africa’s first democratic elections in 1994.

There are 50 FET Colleges in South Africa, and in 2009, they were enrolling 420,475 students, taught by 6,255 lecturers.

Currently, the country has 23 state-funded tertiary institutions, comprising 11 universities, six universities of technology, and six comprehensive institutions. In February 2011, there were also 87 registered and 27 provisionally registered private higher education institutions (HEIs). In 2009, 117,797 staff, including 43,446 academic staff were employed in public HEIs. The HEIs enrolled 837,779 students, including 684,419 undergraduate and 128,747 postgraduate students.

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18 DBE. (2011). Annual National Assessments: Notice from the Department of Basic Education to all parents of learners in grades 2 to 10 at public schools, 8 February 2011. Available at: http://www.education.gov.za/LinkClick.aspx?fileticket=FqR5CgbK1qM%3d&tabid=424&mid=1340
2.2 Curriculum

Since 1994, the schooling curriculum has undergone comprehensive changes to make it responsive to the education of a diverse body of learners and to the needs of the 21st century labour market. Curriculum 2005 was introduced into schools in 1998, and reviewed in 2000, leading to the adoption of the Revised National Curriculum Statement (RNCS) for grades R to 9, and the National Curriculum Statement (NCS) Grades 10 to 12. The current curriculum for Grade R to 12 is encapsulated in the NCS, which recently went under review. The review recommended making the NCS more accessible and easier to implement by:

- Creating a consolidated, single curriculum document;
- Clarifying the role of the subject advisors;
- Reducing administrative requirements being imposed by the curriculum to reduce teacher workload;
- Simplifying and streamlining assessment requirements and processes;
- Reducing the number of subjects in Grade 4 so that learners cope better with the transition from Grade 3 to Grade 4; and
- Targeted teacher training support for curriculum implementation.

The NCS encourages use of ICT in education through specific learning areas in Information Technology (IT) and Computer Applications Technology (CAT).

The curriculum for FET colleges is the National Certificate (Vocational), offering courses and subjects at NQF Levels 2 to 4. The FET college curriculum is based on 11 organizing fields derived from different economic sectors. The organizing fields of the National Certificate (Vocational) include:

- Finance, economics, and accounting;
- Marketing;
- Management;
- Office administration;
- Information technology and computer science;
- Tourism;
- Hospitality; and
- Primary agriculture.

3 Implementation of ICTs in education in South Africa

3.1 Initiatives and successes

ICT initiatives in schooling in South Africa include content development, equipment provision, and capacity-building activities. Rollout of initiatives mainly follows governance of the education system in the country, where the national Departments primarily supplies

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direction and support of ICT, and most implementation is managed at provincial government level.

South Africa has achieved varying levels of success in its implementation of ICTs in education, driven by a degree of political will, a reasonably robust policy environment, willing corporate organizations, an active and interested non-governmental organization (NGO) sector, an enabling environment to try out new interventions to improve teaching and learning, government investment, and research informed interventions beyond the pilot phase.

3.1.1 Government support

The South African government has articulated commitment towards the development of ICT in general, and ICT in education specifically. This is evidenced by:

- The existence of ICT public entities and agencies, and a national commission to advise on ICT development in the country;
- The existence of explicit policy on e-education and other policies that create an enabling environment for ICT development and implementation, and
- Government investment in school infrastructure that enables ICT rollout and several ICT-in-education projects.

Public entities, agencies and the national commission

The Universal Service Access Agency of South Africa (USAASA), established in terms of section 58 of the Telecommunications Act (1996), is tasked with promoting universal service and access to communications technologies and services by all South Africans. USAASA manages the Universal Service and Access Fund, which is dedicated, among other aspects, to providing infrastructure for telecentres and school computer laboratories with ICT equipment which enables access to the internet and provide multimedia services.

The Independent Communications Authority of South Africa Act (ICASA), (2000), regulates the telecommunications and broadcasting industries by issuing out licences to telecommunications and broadcasting service providers, enforcing compliance with regulations, protecting consumers from unethical business practices and poor services, and controls and manages the effective use of radio frequency spectrum.

The Presidential National Commission on Information Society and Development (PNC on ISAD), constituted in 2001, has a mandate to focus on policy and development of ICT in five priority areas of e-Government: e-Health, e-Education, Small, Micro and Medium Enterprises (SMMEs), and content development, is evidence of this commitment. Recently, from 31\textsuperscript{st} March – 1\textsuperscript{st} April 2011, PNC on ISAD convened an annual multi-stakeholder forum with industry executives, government policy makers, academic experts, representatives from state owned enterprises, and non-governmental organisations, labour, and the international community to discuss the ICT Rural Development Strategic Framework and

\footnotesize{25} The DOC. Public agencies and entities. Available at: http://www.doc.gov.za/index.php?option=com_content&view=article&id=427&Itemid=509
\footnotesize{26} The DOC. Public agencies and entities. Available at: http://www.doc.gov.za/index.php?option=com_content&view=article&id=427&Itemid=509
\footnotesize{27} IST Africa. Regional impact of information society technologies in Africa: http://www.ist-africa.org/home/default.asp?page=doc-by-id&docid=3574
present tasks for stakeholders to work together to create jobs for the rural areas and map ways in which the ICT sector can support rural development.\textsuperscript{28} The strength of the PNC on ISAD is the networks rallying behind the ICT agenda it has created.

\textbf{Policy environment}

South Africa generally has an enabling policy environment, and there is a specific policy addressing ICT in Education, the e-Education White Paper, 2004. This policy and others espouse the benefits of ICT for education and national development. The e-Education White Paper stresses the benefits of ICT for teachers, learners, managers and school administrators. Similarly, the White Paper on Science and Technology, 1996 postulates benefits in terms of national innovation, and the Public Service IT Policy Framework, 2001, highlights the benefits of ICTs for government operations and access to government services by citizens.

The most significant benefit of ICT advocated in the e-Education White Paper is that it can enhance the quality of the teaching and learning process. This is also emphasized in policies like the National Education Policy Act, 27 of 1996, which promotes enhancing the quality of education and educational innovation,\textsuperscript{29} and the Further Education and Training of Colleges Act, 16 of 2006, which stipulates that FET institutions should strive to provide education that meets the skills needs of the country.\textsuperscript{30} According to these policy statements, ICT can improve efficiency for teachers. For example, through use of information systems to monitor assessment, time savings achieved from use of ICT can be channelled to other educational endeavours. Education managers can benefit from ICT through accessible information management systems that help with decision-making and planning. Education administrators can automate systems, collect, analyse and access information and save time which can be channelled to other activities within the institutions. The Norms and Standards for School Funding highlight the need for provincial departments to ‘undertake serious budgetary and financial analysis, and to use information intensely,’ tasks that require ‘several highly skilled information systems experts to improve the function of the education databases’ and ‘computer systems and databases’. Using computerized systems to manage this data will ‘improve the accuracy of budget related data’.\textsuperscript{31}

ICT also offers social development benefits, as specified by the Public Service IT Policy Framework, 2001. The benefits are to make the lives of citizens easier by enabling them to access government services anywhere, anytime, through various enabling technologies. The White Paper on Science and Technology specifies that ICT is an essential element in innovation and should be integrated in the education system. ICT, in the form of e-mail, the World Wide Web, and multimedia equipment, is essential in accessing ‘up-to-date Science and Technology information resources.’ Good IT systems for administering patents with particular search and retrieval capabilities are required for awarding, recording, and protecting intellectual property.\textsuperscript{32}

\begin{footnotesize}
\begin{itemize}
    \item[28] The DOC. Annual ISAD multi-stakeholder forum. Available at: http://www.pnc.gov.za/pnc_isad_msf/
    \item[31] The Norms and Standards for School Funding, 84 of 1996, Section 72
    \item[32] White Paper on Science and Technology, 1996, Chapter 10, section 3
\end{itemize}
\end{footnotesize}
The skills shortage in ICT has been raised as a concern by the Accelerated Shared Growth Initiative for South Africa (ASGISA). ASGISA locates this skills shortage within the whole education context, from primary to tertiary education. To alleviate skills shortages in ICT, schools and FET colleges will have to play a critical role in skilling learners and motivating them enough to pursue ICT related careers. The importance of ICT in the workplace is reflected in policies like the Public Service IT Policy Framework, 2001, where the vision of a modernized government is one that enables citizens to access government services 24 hours a day using various ICT tools. However, this vision can only be achieved if the citizenry is ICT literate. The White Paper on Science and Technology, 1996 supports a vision where the seeds of ICT for innovation can and should be planted in the education system and should be done as equitably as possible.

To support access to technology infrastructure, the e-Education White Paper specifies that the Department of Basic Education supports refurbished facilities for second-hand computers, but sets minimum specifications for refurbishments. These specifications guard against the acquisition of outdated technologies by schools. To enable facilitation of implementation of ICT in teaching and learning, the e-Education White Paper stipulates that the Department of Education will work closely with the Department of Minerals and Energy to prioritize electrification of GET and FET institutions. The State Information Technology Agency (SITA) Act, 88 of 1998 is mandated to help the DBE to access technologies in a manner that ‘leverage(s) economies of scale to provide cost effective procurement.’

The e-Education White Paper recognizes the importance of internet connectivity for e-Education. While the e-rate formalized in the Electronic Communications Act, 36 of 2005 alleviates connectivity costs for schools, the policy directive does not however specify what minimum bandwidth schools should be getting in relation to this e-rate. Consequently, schools may be getting very low bandwidth which is insufficient for meaningful connection of computers for teaching. Thus, it is unclear whether schools ever really derived any financial benefits from this policy provision.

The National Framework for Professional Teacher Education and Development (NFPTED) specifies how ICT can be used to widen access to teacher education, improve teacher learners’ motivation, speed up communication, and provide an enriched environment for learning. The e-Education White Paper envisions a teacher education training system where teachers are trained on using ICT in pre-service teacher training. However, this provision is not supported in the NPFTED.

Crucially, the e-Education Policy stipulates that ICT professional development has to be consistent with the National Qualifications Framework (NQF) levels. The DBE undertakes to assist teachers to access the Education, Training, and Development Practices Sector

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Education Training Authority (ETDP SETA) grants to fund ICT professional development programmes.

The e-Education White Paper, addresses the issue of change management explicitly:

> Educational leaders do not yet fully appreciate the benefits of e-learning and administration for institutions and for provincial and district offices. It is important that educational leaders at all levels of the system are provided with the necessary support to enable them to manage the introduction of ICTs and the related change processes.\(^{38}\)

Change management processes are also being managed through intergovernmental relations between the Departments of Basic Education and Communications to coordinate use of the Universal Service Fund to assist schools that cannot afford connectivity costs.

The e-Education White Paper emphasizes the importance of research to improve practices, and advocates a multi-pronged, multi-stakeholder approach to research that will improve understanding of ICT pedagogies and lead to their improvement. The white paper mandates the formulation of a research agenda on ICTs for e-learning. The SITA Act also mandates SITA to conduct research that informs planning for ICT development.

By pointing out that provincial education departments should budget for appointment of ICT specialists to provide ongoing professional development, the e-Education White Paper stresses sustainability.\(^{39}\) The South African Schools Act, 1996, also encourages school governing bodies to budget for recurrent expenditure.

The South African government has approved policy and strategy for Free and Open Source Software (FOSS). FOSS is identified as a viable way to bridge the digital divide. The Department of Education’s ‘Guidelines for the use of Open Source Software in Schools’ propose that the use of Open Source Software (OSS) is a basic requirement ‘in the development of more affordable access to ICT.”\(^{40}\) OSS bridges the digital divide because it is

> Software that is developed, tested and improved through public collaboration and distributed with the idea that it must be shared with others, ensuring open future collaboration. It is available to anyone, usually at little or no cost, it does not attract licence fees and the users have access to the source code revealing the inner workings of the software. It is software that is free of proprietary restrictions.\(^{41}\)

Moreover, OSS is proposed to enable South Africa to develop content and programmes in education using local languages. This content can easily be accessed by other users as there is no activation required with OSS. No recent information is available on the implementation of OSS. However, by September 2009, more than half of government departments had FOSS implementation plans, about 25% of the departments used FOSS servers, 40% used FOSS at

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39 Ibid: 26
41 Ibid
the back end, and 12% on desktops. SITA anticipated that budget restrictions at local
government level would make FOSS an attractive option in municipalities. 42

**Government investment in ICT in education**

The South African government has made several meaningful investments in the
development of ICT broadly, and ICT in education specifically. As already stipulated, the
government has invested large amounts of money to make South Africa’s
telecommunications system the most developed on the continent. Investments have been
made in the development and implementation of integrated management information
systems at national and provincial levels, including the Higher Education Management
Information System (HEMIS) and Further Education and Training MIS (FETMIS). Government
has also initiated and invested in the South African Schools Administration and
Management System (SA-SAMS).

The Departments of Communication, Health, and Education invest in the development of
content for the Mindset Network43 (www.mindset.co.za), which is responsible for content
dissemination to the schooling and health sectors. The Department of Basic Education has
developed and maintains the Thutong portal (http://www.thutong.doe.gov.za/) for the
schooling sector, to support provision of content, school administration and management,
and teacher professional development. All provincial education departments invest in
provincial ICT initiatives in the schooling sector. The Teacher Laptop Initiative (TLI) managed
by the Education Labour Relations Council (ELRC)44, was officially launched in May 2009
through a policy specifying the conditions for educator participation in this initiative. This
specified that the Initiative would be phased in over two years. The TLI is open to all
permanently employed teachers employed in terms of the Employment of Educators Act.
Minimum specifications for teacher laptops to be supplied by the 12 participating consortia
are given, and the minimum purchase price for such laptops, over 60 months, is R11,750.
The government provides teachers on this scheme with a monthly allowance of R130 (about
US$20), for assistance with repayment for their laptops, based on the cost of R195.83 a
month for repayments. 45

### 3.1.2 Infrastructure and connectivity

ICT rollout is dependent on power supply, and South Africa has made great strides in the
electrification of schools, with power supply emanating from three sources; the municipal
grid connection, solar systems and generators. Electricity supply is approaching universal
penetration, with 85% penetration in 2009. As a result, a greater percentage of schools is
ready to operate ICT equipment that requires electricity. In 2009, of the 24,460 public
schools in the country, 20,857 had electricity. 46

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43 Mindset. Our partners. Available at: http://www.mindset.co.za/partners/content
44 Teacher Laptop Initiative: http://www.teacher-laptop.co.za/
In 2009, there were 5,714 public schools with a computer centre, constituting 23% of all public schools. This means that these schools had computers that they could use for administration and preparation of teaching and learning resources. However, of these schools, only 2,449 (10%) had computer centres that were adequately equipped, that is, with an adequate number of computers and other technologies for classroom teaching and learning.\(^{47}\)

As explained earlier, provision of computer labs mostly takes place at provincial level and projects of note regarding deployment of computer labs are the Khanya and GautengOnline (GoL) projects. The Khanya project is based in the Western Cape, and to date, the project and its partners have funded 34,929 of the 45,012 computers being used in Khanya schools.\(^{48}\) By 2010, the GoL project had functional laboratories in 1,665 schools, benefitting 1.5 million learners in the province. Seventy five primary schools had the Foundation Phase e-Learning resource pack loaded onto computers. The resource pack focuses on numeracy, literacy, and life skills. The FET resource pack was installed on computers in 75 secondary schools.\(^{49}\)

A national project of note, with provincial input for implementation is the Dinaledi Schools project. This project was launched in schools through the 2001 Mathematics, Science, and Technology strategy, aimed at improving learner achievement in Mathematics and Science in high school. To achieve this objective, Dinaledi schools are well resourced with teaching and learning materials, including computer laboratories with computers loaded with mathematics and science software and curriculum and educational content. Currently, there are 500 Dinaledi schools nationwide.\(^{50}\)

In all, 3,161 South African Schools had internet connectivity in 2009.\(^{51}\) Many of these schools are linked to the e-Schools network comprising of 1,700 schools nationwide. The Network offers an email service, SchoolMail, which creates a mailbox for all the learners and teachers in a school for an annual fee of R1,050.\(^{52}\)

### 3.1.3 Teacher professional development

South Africa has an extensive ICT teacher professional development environment, with provision by universities, NGOs, and provincial departments.

In keeping with current thinking on ICT professional development, for example the UNESCO ICT Competency Standards for Teachers Framework, ICT professional development has been integrated into pre-service teacher education by some universities, and there are also many opportunities for in-service teacher professional development in ICT. For example, the

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\(^{48}\) WCED. Khanya website, Khanya achievements: [http://www.khanya.co.za/projectinfo/?catid=23](http://www.khanya.co.za/projectinfo/?catid=23)


\(^{51}\) ibid

\(^{52}\) e-Schools network. About the e-Schools Network: [http://www.esn.org.za/](http://www.esn.org.za/)
University of Johannesburg (UJ) and University of Pretoria (UP) are offering pre-service and postgraduate courses in ICT integration as part of their teacher training programmes. UJ has three qualifications focusing on ICT integration;53 the Bachelor of Education Honours (B Ed Hons), a postgraduate degree completed over a period of two years on a part-time basis; and the Advanced Certificate in Education (ACE) Educational Computing, delivered on selected Saturdays, and contact sessions are compulsory.54 The ACE is mainly for in-service training.

UP has three teacher training qualifications that address or have a component of ICT integration. These are:
• Bachelor of Education Honours (B Ed Hons) in Computer Integrated Education, aimed at in-service and postgraduate teachers, and presented part-time over 2 years.
• Advanced Certificate in Education (ACE) in Computer Integrated Education, a two-year, part-time programme also targeted at in-service teachers interested in computer assisted learning.
• Postgraduate Certificate in Education (PGCE) with a module in Information and Communication Technology, based on Intel® Teach.55

Training by universities in ICT teacher professional development has been greatly complemented by the efforts of SchoolNet South Africa (SNSA), which has played a leading role in development and facilitation of innovative professional development programmes in ICT integration and school ICT leadership. What differentiates SNSA from university training is that SNSA trains most teachers in their sites of practice, and there is a very strong evaluative element to their training, to judge its effectiveness. SNSA manages three large teacher development programmes:56
• Intel Teach is based on face-to-face or distance delivery. The training focuses on design of projects for ICT integration, and hence requires teachers who are already ICT literate. Seven of nine provinces recognize Intel Teach as an integral and advanced component of their provincial ICT strategy for schools, and fund training for curriculum advisors, ICT coordinators and teachers. Intel Teach courses are recognized by the South African Council for Educators (SACE).
• Microsoft PiL, based on a range of selected courses designed for teachers, school management, district officials and technical support champions. PiL training is conducted in the school where possible, and some courses are available in French and Portuguese. Courses range from basic ICT skills for teachers and principals and student help desk to more complex and advanced skills in integration including WebQuests and peer coaching. By 2010, SNSA had trained over 20,000 teachers on various Microsoft PiL courses.
• Commonwealth Certificate for ICT Integration is an Advanced Certificate in Education level distance learning qualification for teachers and school leaders to successfully

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53 University of Johannesburg. Faculty of Education. B Ed Degree: http://www.uj.ac.za/LinkClick.aspx?fileticket=hKI8qrrPOxY%3d&tabid=2896
54 University of Johannesburg. Faculty of Education. Advanced Certificate in Education (ACE), Educational Computing: http://www.uj.ac.za/LinkClick.aspx?fileticket=vz02wxqkngg%3d&tabid=10532
achieve integration into school management, teaching and learning. The focus of the training is not computer skills but on how to use the computer for teaching and learning, using teacher identified curriculum needs. The course is activities driven, and teachers get an opportunity to share their classroom experiences through online communities, using email groups and other online collaboration tools. Course materials are CD based and local tutor support can be provided online.

Efforts by universities and SNSA at ICT teacher professional development are also supported by provincial ICT initiatives, which have had teacher training as a core component. The Khanya project relies on multiple methods and programmes for training Western Cape teachers for example, International Computer Driving Licence (ICDL) training, distance learning, the cascade model of training, and the facilitation model, where Khanya makes use of their trained facilitators to offer teacher training. To date, the Khanya project has trained 27,943 teachers in the province on ICT integration.

By 2010, GoL had trained 20,260 teachers on how to use the GoL laboratory. In 2010, 520 Grade 10 – 12 teachers were trained on how to use the FET Resource Pack installed on computers in GoL laboratories. The resource pack focuses on Mathematics, Physical Science and English 1st Additional Language. In total, 675 teachers were also trained to use the Foundation phase resource pack and 106 to use the mathematics software for primary schools. A further 136 teachers were trained to use the Mathematics Literacy Software installed on computers in 136 underperforming schools.  

Possibilities for informal learning and acquisition of ICT skills that could ultimately influence ICT integration are being created through the Teacher Laptop Initiative, implementation of which is now underway. Owning their own laptops is likely to lead teachers to engage in informal learning at their own pace, in their own time, using these laptops, thereby improving their ICT skills in ways that will benefit their learners. The Teacher Laptop Initiative will lessen the disadvantage that is created by lack of universal access to computers by schools. If teachers have laptops, they can use these to source materials, develop effective materials for their learners, and use them for projecting lessons.

Other informal professional development activities are available through communities of practice. The Thutong portal, for example, has a strong focus on online communities of practice through discussion forums and blogs, where teachers can share ideas on ‘best practice’ and also share resources.

### 3.1.4 Integrated management information systems

South Africa has management information systems for the various educational sectors. DBE has an Education Management Information System (EMIS) which is used for the acquisition, processing, dissemination, and reporting of quality education data. EMIS collects data from ordinary schools, adult education and training, inclusive education, early childhood development, and further education and training institutions at provincial level, which is

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analysed and consolidated at national level. EMIS data is collected for specific education sectors at different points of the school calendar. Several snap surveys and annual surveys constitute the data that is collected through EMIS. The DHET has a Higher Education Management Information System (HEMIS). HEMIS provides data on higher education enrolment, graduation, and staffing. The FET College Management Information System (FETMIS) is used by FET colleges to capture survey information electronically.

The South African Schools Administration and Management System (SA-SAMS) is a ‘robust computer application designed to meet the management, administrative and governance needs of public schools in South Africa.’ SA-SAMS has 14 modules that enable:

- Inputting of general school information; human resource information; learner and parent information; governance information;
- Generation of standard letters to groups of people through the mail merge facility, and printing of blank and completed forms;
- Exporting data for the 10th Day Survey (snap data), and the Annual School Survey from the school to provincial EMIS;
- Schools to manage their financial system, that is, maintenance of annual or monthly budgets, and payment transactions like school fees, view and print journals, accomplish bank reconciliation, and print financial and transactional statements etc.;
- Set up recording and reporting on learner progress through assessment;
- Automated timetable;
- Recording of physical resources and school infrastructure;
- Administration of a school library through creation and management of a library catalogue, management of system users, issue, return and renew library items, manage fines, manage reservations and manage history records.
- Assessment of special needs learners through the SIAS module.
- Approval and management of school data for the national tracking system through the Learner Unit Record Information and Tracking System (LURITS) Approval Module.

Information inputted into SA-SAMS by schools enables the provincial departments and national departments to access quick and up to date data for snap and annual surveys that enables appropriate educational planning.

### 3.1.5 Digital education content and open educational resources

Several initiatives provide free educational resources, only a few of which will be discussed here. Through this dissemination of free educational resources, South Africa is witnessing a growth in the open educational resources (OER) movement, where educational resources are made available under open licences. While not all materials being freely and openly made available are labelled as OER and do not have any open licence, many are effectively OER because they are available for re-use by others, free of charge.

The Thutong portal has resources on curriculum and examinations, teacher development, school administration, and management. In 2010, the Thutong Portal provided over 14,000

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59 Government IT. (2009). ICT in Education, December 2009. Available at: [http://www.it-online.co.za/content/view/1771114/76/1/4/](http://www.it-online.co.za/content/view/1771114/76/1/4/)

60 Government IT. (2009). ICT in Education, December 2009. Available at: [http://www.it-online.co.za/content/view/1771114/76/1/4/](http://www.it-online.co.za/content/view/1771114/76/1/4/)
digital content resources, had 10,000 registered users, and averaged 80,000 hits a month. There are 84 learning spaces on the portal, including a dedicated space for Matric support.61

Mindset Network, an NGO founded in 2002, has been distributing high quality materials for the schooling and health sectors openly and freely. Mindset Network has three primary projects specifically targeted for the education sector:62

- **Mindset Learn** – The target for this programme is high school learners and teachers from Grades 10 to 12. Curriculum-aligned video content for English, Mathematics, Physical Sciences, Information Technology, Mathematical Literacy, and Financial Literacy is broadcast via satellite television. In 2008, this content was reaching 1,200 high schools and over 2 million homes in Southern Africa. The content is also available on the Mindset website: [www.mindset.co.za](http://www.mindset.co.za).

- **Mindset Cabanga** – Officially launched in 2006, this programme is for primary school learners and teachers, and is currently broadcast on Saturday mornings, with an initial focus on Grade 4 Natural Science, Mathematics, and Technology. The material is available in video, computer multimedia, and print format. The programme is currently running in more than 50 primary schools. The long-term strategy for the programme is the development and distribution of content for Grade R – 7 in multiple languages.

- **Mindset Health** – Although specifically focused on healthcare workers, patients and the general public, the valuable information provided on this programme is also good educational material for school learners and university students. Mindset Health’s main and initial content focus is HIV & AIDS, tuberculosis (TB), and child survival, and other intended content focuses are malaria, injection safety, and healthy lifestyles. The Health content is also distributed in video, computer-based multimedia and print formats and is available in English, Afrikaans, isiXhosa, isiZulu, and seSotho. The programme is currently broadcast in South Africa, including in clinics and hospitals, and is available at 455 health facilities in the country. Mindset Health was launched in 2003.63

The Siyavula project ([http://siyavula.org.za/](http://siyavula.org.za/)), founded in 2008, is a Shuttleworth Foundation project focused on working with teachers to develop teaching and learning materials collaboratively and share them through an open licence agreement. Siyavula has partnered with Connexions ([http://cnx.org/](http://cnx.org/)), a pioneer in OER, to extend its education portal to serve as the foundation for the Siyavula community of teachers. Siyavula has over 4,500 Grade R to 12 OER in English and Afrikaans, with some materials translated into Xhosa, aligned to the South African curriculum, accessible from the Connexions portal ([http://cnx.org/lenses/siyavula](http://cnx.org/lenses/siyavula)).

Another content dissemination initiative, the History Classroom, is based on a partnership between the South African History Online, Thutong, and the DBE. The project provides online learning resources designed specifically for teachers and students. The resources available on The History Classroom are carefully selected and aligned with the school history curriculum from Grade 4 to Grade 12.64

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62 Mindset Network – programmes. Available at: [http://www.mindset.co.za/about](http://www.mindset.co.za/about)
63 Mindset Network – programmes. Available at: [http://www.mindset.co.za/about](http://www.mindset.co.za/about)
3.1.6  Multiple modalities of dissemination of content

There are multiple forms of dissemination of free content to accommodate variations in ICT provisioning in schools. This improves the reach of the materials, and ensures equal access by all that bridges the digital divide. Some materials are distributed through satellite, podcasting, printed format and video streaming.

Mindset uses a wide range of distribution channels to increase reach and improve accessibility. These include:

- **Broadcast**, through DStv Channel 319 for Mindset Learn and on free to air digital broadcast for Mindset Health.
- **Datacasting**, where large volumes of content are sent via satellite to computers in South Africa. Mindset has installed the equipment for this to take place at 800 schools and 360 clinics.
- **Website** – Mindset operates four websites from which their digital content can be accessed by the public free of charge: [http://www.mindset.co.za](http://www.mindset.co.za); [http://www.mindset.co.za/learn](http://www.mindset.co.za/learn); [http://www.mindset.co.za/cabanga](http://www.mindset.co.za/cabanga); and [http://www.mindset.co.za/health](http://www.mindset.co.za/health).
- **Offline applications** – Mindset has also developed DVDs of all its video content, which can be used on a DVD player or a computer.
- **Mobile** – Because of the ubiquity of mobile phones in the South African society, Mindset is developing ways to make content downloadable and viewable on mobile phones. 65

Materials from the Thutong initiative, Siyavula, and the History Classroom are all available online and can be printed by teachers for dissemination to learners.

The Learning Channel, South Africa’s leading television learning resource, offers about 500 hours of educational content and, with over 8 million viewers, has the highest viewer following in the age group above 16 years for education-related programmes. Learning Channel’s broadcast activities are supported by other delivery platforms, including the internet ([www.learn.co.za](http://www.learn.co.za)), newspapers, hi-tech audio-visual aids, workbooks and short message service (SMS). The Learning Channel collaborates with SABC, Liberty Foundation and Standard Bank to deliver curriculum-based lessons in the core subjects to FET learners and their facilitators through its live weekday broadcast programme on SABC 1. 66

The SABC provides accessible, curriculum-relevant educational television and radio programmes to learners from foundation to senior phase. 67 The current SABC School TV programmes for foundation phase level are:

- **Adventures at the Water Hole**, which is a series focusing on nature and the environment using animals as characters;
- **Letter TV**, which focuses on developing literacy through learning about letters and words;
- **Fourways Farm**, a programme that introduces scientific concepts to children; and
- **The Number Crew**, aimed at developing mathematical literacy. 68

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65 Mindset. Technology platforms. Available at: [http://www.mindset.co.za/technology](http://www.mindset.co.za/technology)
SchoolTV currently has three intermediate phase programmes: *Let’s Meet 1*, a programme that profiles South African heroes and acknowledges and profiles their work; *Imvelo Yethu*, a Natural Sciences programme; and *X Marks the Spot*. SchoolTV also provides worksheets for teachers to work with in their teaching of the SchoolTV content.69

### 3.1.7 Mobile learning

Because of the high penetration of mobile technology in South Africa, especially among the youth, South Africa is piloting projects that make use of mobile technology for learning. The projects that have been piloted so far capitalize on the popularity of the social networking platform MXit, to motivate learners to direct the use of this platform to educational purposes.

The m4Lit (mobile phones for literacy) pilot project was initiated in 2010 to explore teen leisure reading and writing around fictional texts in South Africa (SA), using mobile media. This project was initiated in response to evidence that ‘teens do not read, teens do not write enough, and teens love their phones,’ and that there are no leisure books in 51% of South African Households.70 The story, *Kontax*, is targeted at teens between 14 and 17 years and was published in English and isiXhosa. Readers could interact with the story as it unfolded, discussing the plot, voting in polls, commenting on the story, and writing a piece as part of a competition for story sequel ideas. The project aimed to contribute to the understanding of mobile literacies, and teen reading and writing using their mobile phones. The MXit platform was used for this project because of its popularity among youth, and because it has a low cost for mobile data.71

In 2008, the South African Department of Education partnered with Nokia and Nokia Siemens Network to pilot a mobile mathematics project for Grade 10. This project made use of MXit to disseminate mathematics quizzes, exercises, and theory and content for Grade 10 learners. To participate in this project, learners needed a mobile phone that could access the internet, and they had to register on the social networking programme MXit. Most of the learners were already registered on MXit, but needed to accept MoMaths, as one of their contacts. Teachers had to have access to a computer to use Moodle to track learner usage, monitor performance, and diagnose areas for remediation.

The project was piloted in six public schools in Gauteng, Mpumalanga, Northwest, and the Western Cape in 2008, and then scaled up 30 schools, representing various school contexts. Learners could choose exercises from a database of approximately 10,000 questions, in multiple choice format, and also choose to engage with the theory which offered explanations on mathematical concepts. While completing the exercises, learners could chat to their friends and collaborate to solve mathematics problems. Learners received

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70 Vosloo, S. (2010). M4Lit (mobiles for literacy) project findings. Research developed and conducted in collaboration with Ana Deumer and Marion Walton (both University of Cape Town). Available at: http://m4lit.files.wordpress.com/2010/03/m4lit_project_findings_svosloo_2010.pdf
71 Shuttleworth Foundation. M4Lit. Available at: http://www.shuttleworthfoundation.org/projects/m4lit/
immediate feedback on the exercises, and teachers can monitor learner progress and see where learners are struggling and initiate proper intervention. Aware of the digital divide, the project made provision to mobi-kits comprising ten mobile phones that the school could manage for use by learners.\footnote{Vanska, R., & Roberts, N. (2010). Count on cell phones: Mathematics education in South Africa via cell phones and the web. Available at: \url{http://ictupdate.cta.int/en/Feature-Articles/Count-on-cell-phones}}

3.1.8 Private sector investment in ICT in education

There is significant involvement of companies investing in ICT in education, mainly through their corporate social investment (CSI) programmes. The financial assistance from the various CSI sources ensures quicker expansion of ICT projects, and in some cases, ensures their sustainability if the funding is provided on a long term basis.

In addition to government funding, the Dinaledi project is sustained partly through the Adopt-a-Dinaldedi School model, which is a partnership between DBE, provincial education departments, and private donors. Donors are required to contribute a R50,000 cash injection to each adopted school in each agreed year of project implementation, to support the school in acquiring resources needed to boost science and mathematics performance in the school, as well as assist with purchase of technologies needed for this improvement, for example calculators, mathematical instruments, and essential science equipment.\footnote{Van Wyk, T. (2008). Framework for Adoption of Dinaledi Schools by Private Donors. Available at: \url{http://www.thutong.doe.gov.za/Default.aspx?alias=www.thutong.doe.gov.za/dinaledischools}}

The Mindset Network is sustained not only through private donors or corporate organizations but also government partnerships and other various stakeholders who provide funding for the project. These stakeholders include:


Telkom South Africa is also investing in ICT in education. Through the Molteno Institute of Language and Literacy, Telkom drives projects aimed at developing mobile libraries, science laboratories and ICT projects. Telkom’s objective is to help the education sector in its implementation of the e-Education policy. In 2010, Telkom funded 150 ICT schools in the Western Cape. In addition to this support, it has also supplied 1,000 schools with one computer each, supported 100 Supercentre schools, 102 Dinaledi schools, 157 Thintana

\footnote{\url{http://ictupdate.cta.int/en/Feature-Articles/Count-on-cell-phones}}
schools, 30 special schools, 30 ad-hoc schools, and 31 ICT Saturday schools.\textsuperscript{75} The Thintana project is intended to set up computer centres in 200 disadvantaged secondary schools across the country.\textsuperscript{76}

IBM has set up computer laboratories in under-privileged schools to encourage a love for technology and related careers. Additionally, IBM has made financial and technology investments to enhance learning in selected tertiary education institutions and universities across the country. More than a thousand computers and accessories like servers and printers, as well as Internet connections have been deployed in various needy schools and institutions, including ‘Vryheid’s Inkamana, Bekkersdal’s Zamokuhle, Lebowakgomo in Limpopo, Athholang in Kagiso, Gauteng, Wits University’s Library and Centre for Students with disabilities and the SOS Villages’. With the Wits Centre for Students with disabilities, among their many projects, IBM is trialling web adaptation technology, which is aimed at making web pages more accessible and usable for by older adults and people with visual, motor or cognitive disabilities.\textsuperscript{77}

MTN is also piloting a tele-teaching project, which was launched in May 2010 at Kgaphamadi High School. In this project learners from multiple classes can connect at the same time and can interact with the instructor in one classroom, with all classrooms linked through technology.\textsuperscript{78} MTN, together with other sponsors; Ericsson, Murray & Roberts, Canon, Mustek, Anglo American Chairman’s Fund and the French Embassy, has also funded the establishment of Science Centres in selected shopping malls in South Africa. The idea behind the science centres in a shopping mall is that the public, particularly children, will access and engage with technology to demystify science and technology and generate a passion towards learning science and technology in fun ways.\textsuperscript{79}

3.1.9 Nurturing ‘digital natives’\textsuperscript{80}

Despite the digital divide in South Africa, mostly defined by social class, several initiatives are focused on nurturing ‘digital natives’ by introducing technology to children at a very young age. Exposed to technology early in their lives, children are most likely to embrace technology and exploit its educational potential for their social and economic upliftment as they progress through schooling.

The Meraka Institute (\texttt{http://www.meraka.org.za/ICTeducation.htm}) has several projects intended to reach children from a very young age and include:

- MobiLed, which harnesses a mobile platform to create informal and formal learning opportunities;


\textsuperscript{76} Eastern Cape Department of Education. Thintana i-Learn Project: \texttt{http://www.ecdoeresearch.gov.za/index.php?option=com_content&view=article&id=56%3Athintananinternetlearnproject&catid=2%3Ainterventions&Itemid=20}

\textsuperscript{77} ibid

\textsuperscript{78} MTN. MTN alleviates shortage of skills through tele-teaching. Available at: \texttt{http://www.mtn.co.za/AboutMTN/Press%20Room/Current%20Press%20Releases/May2010/Pages/MTNalleviatesshortageskillsforskilsthroughtele-teaching.aspx}

\textsuperscript{79} Cape Town Science Centre: \texttt{http://www.ctsc.org.za/index.php?id=622}

• The Young Engineers Programme, which makes use of various strategies like technology clubs, holiday programmes, extra classes, competitions, and workshops to nurture a passion for ICT and engineering among young people;
• Tekkie Tots, a programme that exposes pre-school children to technology;
• Physical Learning Objects, based on experimental research and design of tangible, intelligent learning objects, which has culminated in designs that have been exhibited at Scifests;
• Sun2Ice/Kids’ Club for experiential technology learning for children aged 9-12; and
• Motivate, a project that uses multimodal computer gaming environments to provide occupational therapy to young children with developmental delays that could lead to learning difficulties.  

IBM has two early learning ICT initiatives. IBM’s Reading Companion (http://www.readingcompanion.org/index.html) is an online interactive literacy programme that helps children between the ages of 5 and 7, and adults who cannot read, to use e-books of their choice from a virtual library to help them with reading and pronunciation. Reading Companion provides evaluation reports on the progress of each user that can be used by teachers to track their progress and assist them with further development. Several schools in South Africa are involved in the pilot project for this programme. 

The IBM KidSmart Early Learning programme targets pre-school children and teachers to encourage children in that age group to get comfortable with using computers. Children are exposed to a colorful play station loaded with educational software. More than 700 smart units have been installed in early childhood development centres across the nine provinces of South Africa and hundreds more will be rolled out on this project as part of a R12 million flagship programme. The KidSmart programme is also being boosted by the early learning website (http://www.kidsmartearlylearning.org/EN/) which provides information for parents and teachers on how to encourage use of a computer to encourage learning and playing using a computer.

3.1.10 Research and evaluation

There is a strong culture of research and evaluation in the ICT interventions being implemented, be they at national or provincial level, or institutional university level. Evaluation of projects is useful for providing useful feedback for change and improvement.

SNSA commissions external evaluators to evaluate their teacher training and the Khanya and GoL projects have also been evaluated at various points of implementation, to inform subsequent planning for the projects.

The Nokia Mobile Learning for Maths project was evaluated in its second year of implementation in 2010, and the evaluation findings showed that two thirds of the teachers in the 30 schools used the service, with a quarter using it regularly. Learners whose teachers

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83 Ibid
did not use the service also used the service, showing that the service motivated learners to practice their mathematics.\textsuperscript{84}

Evaluation of the m4Lit pilot project in 2010 reports that there is potential for distributing stories through mobile technology and that this strategy enables studies to generate in depth understanding of how the distance between mobile and school literacies can be exploited to improve school achievement.\textsuperscript{85}

The Meraka Institute has an ICT in Education Research Group that directly supports the South African e-Education policy through the application of innovative ICT to support teaching and learning in schools and creation of hands-on exposure to science and technology careers among the 3 to 18 age groups. Their research includes:

• The application of mobile technologies in collaborative formal and informal learning environments;
• The application of gaming and blended media environments to support formal and informal learning activities;
• Designing innovative, graphical learning environments for children;
• Assessment and evaluation techniques for measuring learning outcomes resulting from ICT interventions in the educational domain;
• The use of multi-modal technologies in child-computer interaction environments;
• Designing and developing physical/tangible learning objects (‘intelligent e-toys’); and
• Alternative learning devices and technologies to support education in a developing world context.\textsuperscript{86}

3.1.11 Demand and supply of ICT in the higher education sector

The higher education sector has responded positively to a demand for technology by students, and all universities are at various stages of piloting and implementing ICT initiatives. Although there is no updated data on the level of ICT access in higher education institutions, there is strong evidence of implementation of ICT initiatives, which suggests adequate access of ICTs.

Across the board, universities in South Africa have embraced the potential of ICT to enhance teaching and learning. Almost all public universities have a centre that supports ICTs in teaching and learning. Some of these centres focus on ICT training for lecturers and students, while others work on innovative projects through research. While all of the centres are involved to varying degrees in supporting integration of ICT for teaching and learning, only a few examples of initiatives will be discussed here, focusing on deployment of learning management systems (LMSs), initiatives to tackle teaching and learning challenges, mobile learning initiatives; open educational resources, and a research network.

\textsuperscript{84} Vanska, R., & Roberts, N. (2010). Count on cell phones: Mathematics education in South Africa via cell phones and the web. Available at: \url{http://ictupdate.icta.int/en/Feature-Articles/Count-on-cell-phones}

\textsuperscript{85} Vosloo, S. (2010). M4Lit (mobiles for literacy) project findings. Research developed and conducted in collaboration with Ana Deumert and Marion Walton (both University of Cape Town). Available at: \url{http://m4lit.files.wordpress.com/2010/03/m4lit_project_findings_svosloo_2010.pdf}

\textsuperscript{86} Meraka Institute. Advanced Institute for Information and Communications Technology. ICT in Education Research and Innovation Group: \url{http://www.meraka.org.za/ICTeducation.htm}
**Deployment of learning management systems**

Universities in South Africa have implemented varied ICT initiatives, which have been described as operational, that is, implementation of established technologies and methodologies; and research driven, based on experimentation with new technologies and approaches. The most prevalent operational deployment of ICT in higher education in South Africa is based on the deployment of LMSs for administration and teaching and learning. The deployment of most LMSs by South African universities is aimed at addressing teaching and learning challenges like large classes, multilingual classes, and students who are under-prepared to cope with university education. Projects are implemented at institutional or at course level. Students can have increased interaction from an LMS through discussions with their peers, and they can access a wider repertoire of resources.

The University of South Africa (Unisa), with a student population of over 250,000, and administering over 4,500 courses, provides a good example of an operational initiative in higher education in South Africa. Unisa uses a Web environment to provide general information on programmes and courses, and a secure environment that provides access for staff and students. Through Lecturers Online, lecturers can access online course resources, student information and feedback, and support and teaching tools. MyUnisa is the space for students, that provides access to course materials and library resources, e-mail and discussion forums, timetables, help desk, calendar of events and queries. Through e-learning, Unisa has established collaborations with other African and international higher education institutions and expanded the reach of Unisa’s programmes.

The University of the Western Cape has developed an open-source LMS, Knowledge Environment for Web-based Learning (Kewl). UWC has an e-learning division that supports staff capacity to develop and use e-learning, and students to maximize the learning potential of ICTs. UWC has an open courseware project that engages in open courseware publishing, research on open education practices, projects supporting student production of open educational resources, and policy formulation for open innovation and education.

**Initiatives to address teaching and learning challenges**

Universities in South Africa have turned to technology to solve teaching and learning challenges like large classes and student diversity. The University of Johannesburg adopted WebCT to address the challenge of large classes of up to 2,500 students registered in one course. Face-to-face lecture capacity at the university is 600 at a time and tutorials can only accommodate 30 to 40 students. To enhance learning for students under these circumstances, the university provided study guides, a CD-ROM and access to PowerPoint lecture slides and quizzes. Tutors helped to manage classes via WebCT.

In response to large classes, the Centre for Educational Technology (CET) at the University of Cape Town (UCT) ([http://www.cet.uct.ac.za/projects](http://www.cet.uct.ac.za/projects)) has developed a learning environment, MOVES, around Excel and Word, to support tutorials. MOVES has been used

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88 ibid

89 UWC. eLearning development and support unit: [http://www.uwc.ac.za/index.php?module=cms&action=showsection&id=gen11Sr7Nm5e54_5074_1242827577](http://www.uwc.ac.za/index.php?module=cms&action=showsection&id=gen11Sr7Nm5e54_5074_1242827577)

90 ibid
to develop tutorial activities for introductory mathematics, statistics and writing courses. It was integrated with other UCT subsystems, a necessary aspect to avoid duplicating functionality available elsewhere. The programme provides feedback to lecturers and students, and provided significant time saving for lecturers as tutorials were marked and results captured electronically for lecturers to evaluate performance patterns and intervene appropriately.91

The University of Pretoria has a centralized Department for Education Innovation (DEI) which has educational support teams that develop materials for specific faculties, while also providing video and graphic services. The DEI identified 31 high impact modules in 2009. These modules are mostly taken by first year students, they are serving programmes associated with scarce skills, there is a high failure rate in these programmes and there are large enrolments. Consultants worked with lecturers to design interventions to enhance learning in these modules. UP has developed an e-resource to support the teaching of large classes using clickUP. Lecturers log in as students on the system, to engage in discussions; support decision-making to improve teaching in these classes; and expose lecturers to resources, including literature on how to handle large classes.

UP makes use of the Umfundi system, clickUP Quiz Tool and CompAssess (for computer literacy testing) for computer-based testing (CBT). A range of departments especially those with very large classes use CBT to assess their students regularly. This form of assessment informs student learning as students get timeous feedback on their work and are made aware of areas that need improvement quickly. Lecturers use analysis of test results to improve the questions. The demand for CBT is increasing at UP, and in 2009, there were 345,634 tests taken by students in the Faculty of Health Sciences within the Umfundi and clickUP systems. CBT was being used by 128 departments in 2009. DEI also offers orientation courses to students on what is available for them for learning on the online platform.92

**Mobile learning**

South African universities are also making use of mobile technologies to support academic administration and community work. At UCT, in a project run by CET, mobile phones are used to enable students to text questions that they would otherwise not ask in a face-to-face session. These questions serve as feedback on learning to the practitioner. This project is designed with a web and mobile interface, where practitioners post announcements on a virtual notice board and students use SMS to access these. Academics also use SMS broadcast to send notifications about online resources and lecture scheduling (http://www.cet.uct.ac.za/projects).

UP has used mobile technology to support university community work. Students in the Faculty of Engineering, Built Environment and Information Technology volunteer 40 hours for tutoring maths as an option to a compulsory course on volunteer services to the community. These students are available as tutors ‘Dr Maths’, and assist learners in primary

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Open educational resources

Some universities are actively producing open educational resources. CET is running the OER UCT project with support from the Shuttleworth Foundation, to showcase the teaching of UCT academics through encouraging them to publish their teaching resources as open educational resources. UCT’s Faculty of Health Sciences and UWC’s School of Public Health, as well as the Faculty of Dentistry have in the past two years been actively involved in the production of Health OER in a project driven by the OER Africa initiative of the South African Institute for Distance Education (Saide) and the University of Michigan. Saide has also spearheaded the production of open source teacher education materials through the AceMaths project, which was a collaboration between Saide and several universities to develop materials that could be openly used and adapted for reuse in universities. Uptake of the AceMaths materials has been very good. There were 266 users of the materials in 2003, and, in 2009, uptake had risen to 2,233.

In addition to the institutionally driven ICT initiatives, there are also donor-funded and NGO-driven ICT initiatives in higher education. A notable, one based on open source principles is the Peer to peer University (P2PU) (http://p2pu.org/). P2PU, funded by the Shuttleworth Foundation, is an online community initiated in 2009 for university students wishing to learn collaboratively using the internet and open source materials. The initiative complements formal university education programmes. In P2PU, individuals submit a course idea and volunteer to run a course, based on input from experts and community members. Members of the P2PU community evaluate the course facilitators through a peer review process. Over two years, P2PU has grown from five members when it was launched to a community of 1,000. P2PU has formed ‘schools’ that constitute a focused learning focus for a particular community. To date the ‘schools’ are:

- School of Webcraft (http://p2pu.org/webcraft), which focuses on teaching skills on web development. The courses are free and internationally accessible.
- School of social innovation (http://p2pu.org/sosi/), which helps groups who want to create courses on projects that can make a difference in their community and teach their ideas to others.
- School of mathematical future (http://p2pu.org/math-future/) is an open learning environment for mathematics teachers working in diverse contexts.

The SABC recently introduced the Open Varsity programme on 21 March 2011, broadcast on SABC2 from Monday to Thursday. Open Varsity offers lessons in arts, law, commerce, engineering and natural science, provided by expert professors in the various areas. Open Varsity also helps students with life skills. In addition to the live broadcasts, students can

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94 CET. OER UCT: http://www.cet.uct.ac.za/oer
also download useful information and tips on academic and non-academic issues at www.openvarsity.mobi.97

South African students also have access to the VUMA! portal (http://www.vuma.ac.za/), an online site aimed at supporting university students. The portal provides learning resources through a library and links space, and provides handy advice on skills to cope with university life. There is also social networking through blogs and discussion forums.98

Research network
To support research efforts, the South African National Research Network (SANReN), was launched in 2007. SANReN ‘is a high-speed network dedicated to research traffic and research into research networking and broadband infrastructures.’ In the first two phases of implementation, SANReN aims to connect up to 204 sites across the country with research networks hosting over 3,000 research and education organizations from across the globe. The Meraka Institute is responsible for the implementation of SANReN, and the SANReN network is currently being actively rolled out in Durban, Cape Town and Pretoria.99

4 Challenges to implementation of ICT in education

Even though South Africa has achieved relative success in its implementation of educational technology initiatives, there are still challenges that need to be surmounted. These range from infrastructure and connectivity to management of initiatives, and processes associated with achieving sustainability of initiatives, for example teacher training.

4.1 Differentiated provision of infrastructure and connectivity

Although relatively significant progress has been made in deployment of computer laboratories and access to connectivity, provision is highly differentiated by province. This is reflected in Tables 2 and 3.

Table 2 Availability of computer centres in public schools, 2009100

<table>
<thead>
<tr>
<th>Province</th>
<th>Number of Schools</th>
<th>With Computer Centre</th>
<th>Computer Centre Stocked</th>
<th>Without Computer Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Cape</td>
<td>5,715</td>
<td>596</td>
<td>211</td>
<td>5,119</td>
</tr>
<tr>
<td>Free State</td>
<td>1,643</td>
<td>353</td>
<td>109</td>
<td>1,290</td>
</tr>
<tr>
<td>Gauteng</td>
<td>1,994</td>
<td>1,510</td>
<td>828</td>
<td>484</td>
</tr>
<tr>
<td>KwaZulu-Natal</td>
<td>5,835</td>
<td>982</td>
<td>305</td>
<td>4,853</td>
</tr>
<tr>
<td>Limpopo</td>
<td>3,918</td>
<td>428</td>
<td>165</td>
<td>3,490</td>
</tr>
</tbody>
</table>

99 SANReN: http://www.sanren.ac.za/
## Province Table

<table>
<thead>
<tr>
<th>Province</th>
<th>Number of Schools</th>
<th>With Computer Centre</th>
<th>Computer Centre Stocked</th>
<th>Without Computer Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mpumalanga</td>
<td>1,540</td>
<td>254</td>
<td>81</td>
<td>1,286</td>
</tr>
<tr>
<td>North West</td>
<td>1,740</td>
<td>391</td>
<td>172</td>
<td>1,349</td>
</tr>
<tr>
<td>Northern Cape</td>
<td>609</td>
<td>314</td>
<td>85</td>
<td>295</td>
</tr>
<tr>
<td>Western Cape</td>
<td>1,466</td>
<td>886</td>
<td>493</td>
<td>580</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24,460</strong></td>
<td><strong>5,714</strong></td>
<td><strong>2,449</strong></td>
<td><strong>18,746</strong></td>
</tr>
</tbody>
</table>

As Table 2 shows, Gauteng, the Western Cape and the Northern Cape have the highest number of schools with computer centres that were equipped. The number of well equipped computer centres in the Western Cape and Gauteng are reflective of the success of computer lab deployment in the provinces, from the Khanya and GoL projects.

Similarly, access to internet connectivity was also differentiated by province as reflected in Table 3.

**Table 3 Access to telecommunications and internet**

<table>
<thead>
<tr>
<th>Province</th>
<th>No of Schools</th>
<th>Communication System Available</th>
<th>No System</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cell Phone</td>
<td>Land Line</td>
</tr>
<tr>
<td>Eastern Cape</td>
<td>5,715</td>
<td>5,430</td>
<td>1,234</td>
</tr>
<tr>
<td>Free State</td>
<td>1,643</td>
<td>1,541</td>
<td>918</td>
</tr>
<tr>
<td>Gauteng</td>
<td>1,994</td>
<td>1,545</td>
<td>1,794</td>
</tr>
<tr>
<td>KwaZulu-Natal</td>
<td>5,835</td>
<td>5,420</td>
<td>2,599</td>
</tr>
<tr>
<td>Limpopo</td>
<td>3,918</td>
<td>3,846</td>
<td>994</td>
</tr>
<tr>
<td>Mpumalanga</td>
<td>1,540</td>
<td>1,455</td>
<td>821</td>
</tr>
<tr>
<td>North West</td>
<td>1,740</td>
<td>1,666</td>
<td>783</td>
</tr>
<tr>
<td>Northern Cape</td>
<td>609</td>
<td>554</td>
<td>452</td>
</tr>
<tr>
<td>Western Cape</td>
<td>1,466</td>
<td>1,022</td>
<td>1,421</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24,460</strong></td>
<td><strong>22,479</strong></td>
<td><strong>11,016</strong></td>
</tr>
</tbody>
</table>

Nationally, the availability of a cellular telephone in public schools is almost ubiquitous, but fewer than half of schools have a fixed line connection. Even fewer schools have access to a fax facility. Only about 13% of public schools had access to the internet in 2009. As with

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provision of well-equipped computer centres, the Western Cape and Gauteng had the most number of schools with internet connectivity.

4.2 Lack of central coordination of initiatives

Although there are multiple ICT initiatives being implemented across the country, there is no central coordination of these projects. As such, there is no comprehensive source of up to date information that is centrally available on status of the various initiatives. The lack of central coordination could also be the reason why there is differentiated implementation in the provinces. A further pitfall of this lack of central coordination is that more investment may be made in the provinces where deployment is considered as successful, that is Gauteng and Western Cape, at the expense of other provinces who also need to improve their ICT infrastructure and connectivity.

4.3 Limitations of modalities of teacher professional development

Teacher training on ICT integration is usually of fixed duration which has been reported in evaluations as too short by teachers with no prior ICT skills at the beginning of the training. Sustainability of training could be threatened because of reliance on donor funding to make the training affordable to a majority of teachers but the training of trainers within localities addresses the issue of financial sustainability as SNSA is investing in people rather than keeping a limited pool of trainers who travel to offer training. ICT professional development in universities is removed from the context of the teachers’ work.

4.4 Lack of universal access to technologies by learners

The lack of computers in schools in the seven provinces could be reflective of lack of computers at home. If students cannot access computers at schools, this puts them at a disadvantage as they will not be able to use technologies elsewhere, at home, to access information. In the Nokia mobile maths project, it emerged that even though it appeared a great percentage of students had access to a mobile phone, these phones were not suitable for accessing the maths content as they did not support internet connectivity. As such, the ubiquity of mobile telephones should not be construed as access to mobile phones that enable teaching and learning.

5 Conclusions: Lessons from SA ICT implementation

In summary, several lessons can be drawn from SA’s implementation of ICTs for teaching and learning:
1) Government commitment to ICT encourages deployment from other avenues, and will lead to government investments in ICTs in education.
2) A robust policy environment that supports the e-Education policy is an enabling, but not sufficient, condition for ICT rollout.
3) MISs are very important for recording school level data, for example the infrastructure, connectivity and enrolment data in schools. This helps for proper planning.

4) Open educational resources offer the potential to bridge the digital divide, especially if there is limited access to computers. Materials can be printed and disseminated for learner use.

5) It is useful to have several initiatives being implemented as this increases the reach of ICT implementation.

6) Public sector corporate social investment can be enabling in ICT roll out.

7) Demand for ICTs leads to active supply of ICT initiatives, as has been the case in higher education.

8) Making ICT an integral part of pre-service teacher education is in line with international thinking on how ICT professional development should be approached, and will induct teachers to ICT integration before they start teaching. This is likely to increase their confidence levels with ICT integration.

9) The direction into mobile technology for teaching and learning has potential as the mobile penetration in South Africa is very high, although programmes that are developed have to take cognisance of the compatibility of the programmes with available mobile phones for the target learners.

10) National portals like Thutong can help to send a positive message and government commitment to ICTs in education, but these require ongoing support and investment.