South Africa

Introduction

In South Africa, there have been various calls recently for what might be termed 'status reports' on the emergence of ICTs in educational contexts. The national Department of Education (DOE), having published its White Paper on E-Education in 2004, called together a think tank in 2006, based on an overview of research and delivery needs related to the roll-out of e-learning in schools. Provincial education departments are queuing to put into the public domain their local analyses of e-learning delivery at school level (e.g. KwaZulu-Natal's 2006 'ICT in Education Indaba' and Gauteng's 2007 e-learning 'roadshow', both of which seemed to cast envious eyes at the Western Cape's perceived leadership in the area). Regulatory authorities in education, such as the South African Qualifications Authority (SAQA) and the Higher Education Quality Committee (HEQC), increasingly want to understand the national ICT landscape to inform more broadly the work they do in various institutional contexts. At a research level, there seem to be more journals interested in publishing special editions that seek to take stock of e-learning in some way; for example, *Education as Change* published a special issue on 'ICT in Education' in December 2005, *Perspectives in Education* published a special edition in December 2005 on 'Research on ICTs and Education in South Africa', the *South African Journal of Higher Education* has a special edition in press of papers presented at the National Association of Distance Education and Open Learning in South Africa (Nadeosa) conference in 2006, concerned with the 'myths' and 'miracles' of ICTs in education, and the *Journal of Education* has mooted a similar special edition. Increasingly, development-funding agencies seek understanding of the overall, actual state of 'new' technology use in education, with a view to shaping their overall interventions and funding policies.

This report is no doubt just one such piece in this contemporary context of macro-analysis of ICTs in education. Several very insightful documents have been produced in South Africa that start to answer the question of where we go now that we have enough computer systems and connectivity in place in a critical mass of institutions and know that this should be influencing teaching and learning for the better. In relation to the higher education sector, the recent Council on Higher Education (CHE) research document by Czerniewicz, Ravjee and Mlitwa (2006) provides an excellent overview of the state of ICT usage in South African universities. We draw heavily on this paper in what follows. What we add here is reflection on some more contemporary references.

The current report is primarily a literature review, largely of South African resources, although it also draws on some telephonic and e-mail interviews conducted to ascertain institutional information. It commences with an overall account of the current state of e-learning in higher education in South Africa. Then, the report draws on selected case studies and research papers to describe an overall picture of the e-learning landscape. Here, differences between university approaches to the use of ICT are highlighted,

particularly differences in research and implementation strategies across institutions, and historical discrepancies in provisioning and access related to the history of apartheid. Following this, the report seeks to make clear, succinct statements on specific aspects of the brief, regarding infrastructure and ICT usage in South Africa, the higher education e-learning policy terrain and existing South African research in the field. The final part of the report deals specifically with higher education challenges in South Africa, in general terms as well as in particular regard to software development and mobile technologies.

A note on terminology

For the purposes of this report, and notwithstanding the importance of theoretical and conceptual debate in the field, we use terminology that follows explanations in South Africa's White Paper on E-Education (DOE, 2004):

- *Information and communication technologies (ICTs)* represent the convergence of information technology and communication technology. ICTs are the combination of networks, hardware and software, as well as the means of communication, collaboration and engagement that enable the processing, management and exchange of data, information and knowledge.
- *E-learning* is flexible learning using ICT resources, tools and applications (which may involve the use of the Internet, CD-ROM, software, other media and telecommunications), focusing on:
    - accessing information;
    - interaction among teachers, learners and the online environment;
    - collaborative learning; and
    - production of materials, resources and learning experiences.
- *Online learning* refers more specifically to the use of the Internet and associated web-based applications as the delivery medium for the learning experience.

We draw on further useful distinctions regarding online learning made by the Commonwealth Department of Education and Science (see SAIDE, 2006):

- *Web-supplemented courses* retain the traditional course structure and face-to-face delivery, but add computer-mediated learning elements (e.g. the provision of online course material).
- *Web-dependent courses* involve a reduction in face-to-face encounters, which are replaced by online, interactive learning activities. This approach necessitates a redesign of content and assessment, and changes in staff skills and work patterns.
- *Fully online courses* eliminate face-to-face learning and provide a learning resource centre for online materials and on-demand assistance. They call for new skills from students and staff and a significant commitment of resources.

These terms are often used in reference to either *on-campus* or *off-campus* students.

Implementation, experiment and absence: e-learning in South African higher education

The available literature reveals that implementation of e-learning in South African higher education institutions has been varied. This reflects the variety in organisational culture and approaches as well as the varied learner communities served by the different institutions. South African case studies document a range of web-supplemented (perhaps the most common), web-dependent and some fully online courses in our universities. It has been pointed out frequently that most research on, and even straightforward documentation of, e-learning initiatives in South African higher education consists of case studies (Czerniewicz et al., 2006; Czerniewicz & Hodgkinson-Williams, 2005). These can be grouped broadly into those that are primarily *operational*, in that they commence with the implementation of established, widely researched (one may say, proven) e-learning tools and approaches (with greater or lesser degrees of success), and those that are *research-driven*, in that they involve experimentation with new or unproven technologies and approaches. The former are often top-down initiatives driven by management at a university or faculty level, while the latter are often bottom-up initiatives driven by individuals and structured as research projects. While operational projects frequently include research elements and the research-driven projects may go to scale as proven technologies and methods, this categorisation has been useful in structuring this report. Operational and research-driven projects appear to address different concerns and give rise to different challenges.

Implementation

This section addresses case studies in the literature that describe e-learning projects undertaken from a primarily

operational perspective. Such projects tend to be based on the highly centralised deployment of technologies intended to reach across a university at large. Such projects generally involve the implementation of a learning management system (LMS), or other established educational technology, and associated organisational structures and procedures to ensure the successful adoption and use of the system.

Here we examine some of these implementations, at both institutional level and course level, in order to understand how the availability of technology and the infrastructure provided by the institution is used within courses. The ways in which these implementations have played out depend on the kind of institution, the educational services it provides and the community of learners it serves.

Larger e-learning projects involving the use of well-established technology tools and approaches tend to be initiated for a mix of financial and pedagogical rationales; Le Roux (2004) suggests that this is the case with the University of Pretoria. Projects are aimed at dealing with large student numbers, where classroom size and limited staffing inhibit interaction with students. By making use of a central, shared LMS, infrastructure and support services, it is possible to achieve efficiencies of scale when delivering large numbers of courses to large student bases. Students benefit from ease of access to a wider range of learning materials, opportunities to interact with a variety of activities and other students, and greater flexibility in their learning.

Initiated at the institutional or faculty level, these projects are usually centrally supported by technology experts. The more successful amongst them also provide support services for the development of learning materials, and pedagogy experts who assist in the proper integration of technology elements into learning programmes. Academic staff either volunteer or are encouraged by policy to adopt e-learning elements in their courses. The projects examined here tend to be of a large scale and are run across a wide base of students. They tend to involve the purchase or development and implementation of large LMSs. For access students and staff rely on an existing infrastructure of computer laboratories and networks.

The University of South Africa (Unisa) presents perhaps the most prominent example of an 'operational' initiative in higher education in South Africa. Unisa is 'the dedicated distance education' university in South Africa; it serves around 250 000 students within and beyond the borders of South Africa and is responsible for about 4 500 courses, each of which is revised every three years. A challenge in implementing e-learning at Unisa has been the very diverse student base with very different ICT skills and access to very different levels of ICT infrastructure.

Unisa makes use of a 'customized delivery system' for e-learning (Kinuthia & Dagada, 2006), which comprises of two areas – a Web environment used to provide general information on programmes and courses, and a secure environment that provides access for staff and students. The latter environment consists of three areas, one each for academic staff, students and support staff. Lecturers Online is a personalised environment where lecturers can access online course resources, details of learners, student feedback, support and teaching tools. MyUnisa (previously Students Online) is a learning environment that provides access to study resources (course materials and library resources), communication facilities (e-mail and discussion forums) and administrative tools (timetables, help desk, calendar of events and queries) (Kinuthia & Dagada, 2006).

The Institute for Curriculum and Learning Development is responsible for the development of course materials, drawing on a team of instructional designers, subject specialists and layout experts, and editing and design elements to create and update materials on a regular basis. Materials are produced in English and Afrikaans, with initiatives to offer some supplemental materials in local African languages (Sonnekus, Louw & Wilson, 2006).

The move to electronic learning at Unisa has made it possible to set up collaborations with other parts of Africa and has increased the reach of Unisa's programmes. The greater diversity of the student body has created a need for academic staff to be re-skilled, not only in terms of learning to use technology, but also in terms of their approach to teaching. With the maturation of the online learning environment at Unisa and the greater involvement of staff in technology-based courses, interesting discussions have begun to emerge from Unisa about the role of academic staff in teaching (including the need for a shift from being 'experts' with knowledge to impart, to being 'collaborators' in flexible learning processes) and the challenges of addressing online learning materials to a wide range of individuals with different learning styles (Msile, 2006). The development of these debates shows that the concerns are moving beyond technology and towards effective learning in the electronic environment.

The University of the Free State has offered an online Bachelor of Commerce degree in partnership with a private-sector company, eDegree, which provides a good example of the scale on which 'operational' e-learning tends to be planned and delivered. The university is responsible for academic content and quality assurance, while eDegree provides technology support and management functions. Lecturers have reported problems regarding lack of training in online teaching and concerns about assessment. Some

tensions have arisen in the partnership, due to overlapping or ill-defined roles. If all these concerns can be addressed, the result could be a potential model for public-private partnerships (SAIDE, 2006).

Thomas and Cronjé (2006) report on the use of WebCT, an online proprietary virtual LMS, with first-year economics students at the University of the Free State. Taking a 'broadly constructivist' approach, they set out to increase the extent to which students engaged with the course materials. With classes of over 1 000 students, it proved difficult to motivate individual students to interact with the course resources and with each other, or even to ascertain the degree of such interaction. Online lecture notes, quizzes, tests and online discussions were used to supplement traditional lectures. The responses of students to the LMS were examined through focus groups and questionnaires over three years. Students reported that having access to the lecture notes lessened their workload, enabled them to prepare for lectures and improved their skills in summarising and note-taking. Students found it easier to concentrate in class, because they were not taking notes, and the regular quizzes forced them to consult their texts and keep up with the work. Thomas and Cronjé also looked at the role of lecturers, and found that lecturers at the University of the Free State had the option of personally loading materials onto WebCT or having this done for them by the e-learning division. Lecturers who were more familiar with the interface found it quicker to do so themselves, but many did make use of the support. Sometimes, materials were adaptations of existing printed materials and sometimes they were developed specifically for the LMS. Lecturers found the management of large classes difficult, but tutors were appointed to assist them (Thomas, personal communication, 13.07.07).

In 1996, Potchefstroom University (now merged into the North-West University) launched a telematic learning system to provide online access to tertiary qualifications. The university saw this as a strategy for participation in the massification of tertiary education, and supported the online facilities with 53 study centres countrywide, some situated in very remote areas. Programme material was sourced from universities with similar programmes in the USA and Europe. For example, the Bachelor of Business Administration degree was developed in consultation with California State University – a type of initiative that inevitably gives rise to questions about the local applicability of the courses. There are currently 12 fully online degrees offered through the university's telematic learning system. In addition, the provision of web-supplemented and web-dependent courses is seen as important in addressing the challenges of the historically disadvantaged Mmabatho and Mankwe campuses (ADP, n.d.).

The Potchefstroom campus provides a good example, one of the few in South Africa, of a fully online course, in its honour's degree programme in pharmacology (SAIDE, 2006). The course makes use of CD-ROM, printed text and a downloadable study guide, as well as online learning materials. Assessment is conducted through a written assignment submitted by e-mail, an evaluation of a student's participation in the discussion groups, an electronic multiple-choice and short-question exam paper and an oral examination conducted via teleconferencing. North-West University believes that the move to online learning has enhanced the quality of the course, making it more flexible and accessible to those outside the Potchefstroom area. The course caters for a sophisticated student base of healthcare professionals who have access to computers; this uncommon cohort makes the fully online pharmacology honour's degree programme a success story that is difficult to replicate in most other South African contexts.

Large-scale delivery imperatives are often the spur for top-down, 'operational' e-learning programmes. One reason for the University of Johannesburg (UJ) adopting the WebCT LMS was to deal with large classes. In courses that have up to 2 500 registered students, face-to-face lectures take place for up to 600 students at a time and tutorials comprise 30 to 40 students. In order to ensure adequate attention for each student, a multi-mode approach is followed. Students are provided with study guides, a CD-ROM and access to PowerPoint lecture slides and quizzes via WebCT. Tutors are employed to assist in managing the classes via the LMS, while lecturers are supported by a central team that assists with the construction of online course materials (Kinuthia & Dagada, 2006).

There are questions about how effective these efforts have been, especially in the support of students from disadvantaged backgrounds. UJ came into existence at the beginning of 2005, as a result of the merger between the Rand Afrikaans University (RAU) and the Technikon Witwatersrand (TWR), and now has five campuses. A claimed benefit of the LMS at UJ has been the standardisation of courses that originated from the different institutions, which has ensured uniform quality across the different campuses. Students and staff make use of the same course materials and assessments, although there is some contestation about who develops the materials (SAIDE, 2006).

Stellenbosch University exhibits possibly the strongest example of a comprehensive e-learning process conceived in these 'operational' terms. Between its E-Campus Strategy, an e-learning policy and more general IT policies, it has

sought to incorporate all university business in electronic ICT systems aimed at improving the quality of the university's core functions of teaching, research and community service. The E-Campus Strategy focused on ensuring a minimum online presence for all courses by the end of 2004. This minimum presence was defined as a module outline with outcomes, made available on the Web, and some form of electronic interaction or communication (e.g. by e-mail or bulletin board) (Czerniewicz et al., 2006; see also www.sun.ac.za/ekampus/index.htm). In 2006, the university rolled out WebCT Vista, and statistics showed that 96 per cent of undergraduate students had access to at least one WebCT module (Fresen, 2005).

There has been some resistance on the part of lecturers to including technology in their teaching, and institutional debates have ensued over the appropriate means to motivate them to do so (Van der Merwe & Mouton, 2005). Staff at Stellenbosch University are supported in their use of technology by the Centre for Teaching and Learning, although this is not the only focus of the centre. There is a need to make staff more aware of the facilities available in the LMS and of ways to promote deep learning (CTL, 2006).

The University of Pretoria (UP) has a long-range institutional strategy related to e-learning, which emphasises Web-supported learning. At a policy level, it promotes a 'flexible, blended-learning' model. The main teaching method comprises traditional lectures, tutorials and practical sessions supplemented by a mix of other delivery modes including Web-supported learning, interactive television, stand-alone multimedia and video (Fresen & Boyd, 2004).

UP has a centralised Department for Education Innovation (DEI), previously the Department of Telematic Learning and Education Innovation) with a staff of 75 organised into 11 divisions. These include three educational support teams, which develop materials for specific faculties, video and graphic services, and technology divisions. Educational support teams provide skills in project management, instructional design, programming, graphic design and education consultancy (see UP, n.d.). The DEI supports the creation and integration of learning materials and has in place elaborate systems to ensure that course materials meet quality standards (Fresen & Boyd, 2004). WebCT is the LMS in use, but the DEI also supports a wider range of technologies including multimedia delivered on CD-ROM, which provides electronic materials to students who have no or low-bandwidth access to the Internet. There is a studio for analogue and digital video and sound production, recording and editing, as well as broadcasting and videoconferencing facilities.

Lecturers at UP have been supportive of e-learning and are 'very keen', but have found learning new skills challenging: 'it is not so much that they resist [it] as a tool, but just the learning curve…they've just learned the previous version… the interface has changed…and like anybody there's resistance to relearn the software' (Kinuthia & Dagada, 2006). Interestingly, the push to use ICT also comes from students. As part of the extensive quality-control procedures in place, the more than 17 000 students registered for WebCT modules at UP are surveyed twice a year. In 2003, students showed moderate levels of frustration with the system, including problems with the availability of facilities, technical difficulties and inadequate training. Students also reported feelings of annoyance or stress, and complained about the medium being impersonal and about slow responses from classmates. On the other hand students, at Stellenbosch, felt comfortable using online tools, experienced greater freedom of expression, learned from each other and had to develop skills in planning and working as a team (Van der Merwe & Mouton, 2005).

The University of the Witwatersrand (Wits) presents an interesting case study of another kind of 'operational' approach to e-learning, concerned primarily with technology and minimally with pedagogy. The following paragraphs are drawn largely from Mhlanga (2005). Wits has settled, apparently more by accident than design, for a blended-learning approach in which ICTs are used to supplement traditional face-to-face interactions. Overall, computer-mediated learning is not very widespread in the university. However, Wits does provide a rich ICT environment for students – including computer laboratories and access to the Internet, online library resources and relevant software. Some student residences have computer facilities, and online computer literacy training is available. The Oracle Student System provides all students with an e-mail address and calendar software. In the course of their studies, students across all faculties make extensive use of the Internet and online library resources.

The WebCT LMS is used to supplement learning in some courses, including those in health sciences, commerce, education and biological sciences, with varying levels of success. The Department of Statistics has been using WebCT to provide supplementary materials and quizzes for students, and has found it useful in dealing with large classes. Where e-learning is used at Wits, it is on the initiative of individual staff members who have sought to address specific teaching problems. Apart from technical support for the LMS, which is provided by Central Networking Services (CNS), there is minimal support for academic staff beyond a basic orientation to WebCT in the development of materials

and their integration into teaching. Wits appointed an ICT expert, who responsible for driving the e-learning process in the university, initially within CNS but later within the Centre for Learning and Teaching Development, which offers professional support to academic staff, but the person left and was not replaced. With such limited back-up, staff have found it time-consuming to learn how to manage WebCT, and there is no support for or recognition of this work. In spite of the absence of incentives and support, an increasing number of faculty members have opted to use WebCT in their teaching. Those who have used the LMS report that most students are enthusiastic about online learning, although they need a lot of initial training, since many have had no prior exposure to computers.

The model of e-learning delivery established by Wits is reflective of the starting point for the development of ICT infrastructures for learning in many South African institutions. For example, the University of Limpopo, the Central University of Technology, the University of Zululand, the Vaal University of Technology and the University of Fort Hare all commenced their institutional engagement with ICTs in teaching and learning by seeking to provide good technological infrastructure and support for lecturers who might wish to use an LMS in delivering their courses.

Experiment

Perhaps the more interesting developments in e-learning are those taking place outside the framework of 'proven' LMSs and more established e-learning technologies. These tend to be research-driven projects that are not highly centralised in their original conception and are run by individual lecturers seeking to address specific problems they have encountered in their teaching. In South Africa, a wide range of initiatives spread across a range of institutions falls into this category. When combined with a critical understanding by academic staff of the specific skills and learning processes needed by students in the different disciplines, such projects display the real potential of new technologies.

This section focuses on projects whose rationale appears to be uniformly pedagogic, in that they are aimed at addressing specific learning goals; these relate to specific skills required by students in a particular discipline, or address more generic skills that students need to develop. Initiated by individual academic staff or by small groups of colleagues, such projects either make use of technical experts when they are available or are initiated by academics who already possess some level of technical expertise. Significantly, because it points to the poor understanding of ICTs among many academics, two of the institutions examined in this section make use of technical experts to raise the awareness of academic staff of the potential of new technologies. Academic staff identify areas where pedagogic interventions are required and the technical experts suggest ways in which technology could assist. The projects examined here are often run on a small scale with a particular class of students. They tend to make use of general resources available in the institutions, such as Internet access, computer laboratories, existing software and technical support, but frequently use new software or learning materials specifically purchased, developed or adapted for the project.

At Rhodes University, computer science students have been involved in experiments around developing material in a variety of languages for a bridging course for students whose first language is not English. A Web interface allows students to access materials developed by volunteer students and to participate in online chat sessions in a variety of languages. The system comprises a chat room, an online glossary and a knowledge base or newsgroup. Students make use of the chat feature during lectures, and each contribution is identified by the student's number, which enables students to seek help from their peers. A shared canvas (controlled by the lecturer) adds a visual component to explanations. The glossary (of which an audio version is also available) displays explanations in technical English, simple English or one of ten South African languages. New descriptions are added using various processes, including the involvement of student volunteers. The volunteers also translate key course texts into their own languages (Terzoli et al., 2005).

Despite the University of Pretoria's commitment to WebCT, and the central support provided for the use of this LMS, extensive experimentation with other technologies does take place. De Villiers and Cronjé (2005) describe an immersive master's level course in Internet-based learning that forms part of the M.Ed. programme. The course teaches theoretical and practical skills in using the Internet to present and manage teaching. While the M.Ed. is taught face-to-face, this module is offered only online so that participants have the experience of being a student in this mode of learning. The course makes use of common software like Dreamweaver and Frontpage, as well as using e-mail and Yahoo groups for communication. Students create web pages using tools of their choice. The main web page employs the metaphor of a junior schoolroom with a blackboard, poster wall and learners' desks. Learners are able to personalise their desks. The course does not teach web-development skills explicitly, but provides links to online tutorials (De Villiers & Cronjé, 2005).

In another case, the university has explored the use of interactive television to supplement face-to-face teacher

training at a rural community centre (De Kock, 2000). Usually, teacher training is conducted at such centres by university staff, but there is no follow-up once training is completed. Use of interactive television allows for 'an active network for collaboration, support, reflection and motivation between educators and lecturers' (De Kock, 2000: 206). Two issues proved important – instructional design of materials appropriate to interactive television, and the management of technology in inaccessible areas. The process included distributing materials to learners before the workshop, interaction with learners during the workshop, and follow-up activities. Learners were taught computer skills and were expected to complete assignments using word processors. The facilitator used a keypad that revealed a photograph and details about each responding teacher (this could be substituted with a classroom layout), and an open telephone line facilitated communication (but was confusing and needed careful management).

The Multimedia Education Group (MEG) at the University of Cape Town (UCT) was established in 1997, through a research grant from the Mellon Foundation, with the goals of researching and implementing interactive computer-based technologies and approaches to learning and teaching, particularly in support of the increasingly diverse student body. In 2005, MEG became the Centre for Educational Technology (CET), which was charged with the development of and support for e-learning across the university. CET works in partnership with educators to develop curricula and supporting materials, develops and supports online learning environments, develops staff capacity in the use of ICTs in learning and teaching, and conducts research. By 2005, CET had been involved in more than 40 e-learning projects within the university (Cross & Madiba, 2005). CET's approach has been to make use of the university's existing technology infrastructure and skills, keeping interventions simple, flexible and appropriate to the context. By being creative, it has been possible for CET to produce solutions that are less resource-intensive and that are flexible and less likely to become obsolete. For example, CET made use of the powerful features of Microsoft Office to develop a range of tutorial activities in mathematics, writing and economics courses. Staff and students are familiar with the software and it is installed and supported across the university. The Isiseko Project focused on improving academic skills among first-year history students from 'disadvantaged' backgrounds. The project provided tutorials to develop skills in constructing an argument, which made use of the metaphor of building a house, and citation and referencing practices, which drew on examples of gossip and debate.

Interaction with CET staff challenges lecturers to rethink their teaching approaches. The growth of CET provides a fine example of how a 'research-driven' programme, originally not conceived as an overall institutional initiative, can develop into a mainstream university service agent. CET is now responsible for university-wide support and development of e-learning; it operates an e-learning platform for the university built on an open-content software base, extended for local needs. The centre has become an acknowledged node of expertise at both research and higher education policy levels in South Africa.

In general, lecturers draw on technology experts to show them the potential of new technologies and to undertake the time-consuming and technically challenging task of creating multimedia materials (Burkle & Sayed, 2002).

The University of the Cape Town presents an interesting case study of teaching interventions, including a tutorial for mechanical engineering students that simulates the experiences of a ship's engineer using ultrasonic checking equipment to examine flaws in the hull of a ship, and the use of an online environment that simulates the process of editing a film by selecting from a set of clips, to facilitate student understanding of theoretical concepts in film directing.

At the University of KwaZulu-Natal, similar institutional developments have created a situation in which bottom-up, 'research-driven' online course delivery has led to the development of a home-grown, open-source LMS increasingly adapted to the needs of academic users across the university. One example of this is the use of Reason!Able software in Philosophy I courses on critical reasoning, in an attempt to address the learning needs of students across a range of different programmes. This software teaches the 'precise analytic skills of argument and critical reasoning' that are important to students in the humanities and social sciences. Spurrett (2004) is of the view that the e-learning modality is better able to sustain attention to the salient features of an argument than is a lecturer or tutor in a face-to-face learning situation. The interface provides 'cognitively helpful representations' – those that 'make the right sorts of information salient', whereas 'bad representations' are 'an impediment to learning' because they 'clutter the visual field with irrelevant distractions' (Spurrett, 2004: 165). Although evaluation research on the programme has not been concluded, initial impressions are that the level of detail and clarity in students' written assignments increased steadily throughout the course. Improvements in the abilities of the tutors were also observed.

The Durban University of Technology is a result of a merger between the Natal Technikon and the ML Sultan Technikon. The Pioneers Online project drew its staff from both of the

technikons and has benefited from the resultant combined expertise and cross-fertilisation of ideas. The project is located within the Centre for Higher Education Development (CHED), which provides it with a unique nurturing environment. While the project supports lecturers in developing online learning spaces and materials, the aim of CHED is to assist academics in the development of teaching and learning strategies. In this way, it resembles CET at UCT, but the emphasis here is on professional development. Lecturers are encouraged not just to use technology for the sake of it, but to find relevant and appropriate technologies that complement the special features of their subjects. Lecturers have been able to spot opportunities for interdisciplinary projects for their students. An example of such a project involved journalism students conducting a campus-wide opinion survey, supported by students in statistics who completed the statistical analysis.

The University of the Western Cape has experimented with the development of an open-source, home-grown LMS known as KewlNG. Under development since 2004, a new version of KewlNG was launched in 2005. An e-learning division responsible for ensuring that academics understand the importance of ICT in education and how it can be used to enhance their face-to-face teaching and learning was established in May 2005. The e-learning team offers training and support to academic staff in the use of ICTs in their learning and teaching (see Stoltenkamp & Kies, 2006; Stoltenkamp, Kies & Njenga, 2006).

The above examples provide some instances of how initiatives developed 'on the ground' can lead to innovative, larger-scale e-learning programmes in higher education teaching and learning contexts. Several other initiatives are reflected in the literature (see, for example, Henning, Van der Westhuizen & Diseko, 2005; Gutteridge, 2006; Bulman, 2006).

Absence

It is easier to report on what has been done, because it has been written about and analysed. It is more difficult to report on the absence of ICTs in higher education institutions, and yet this is an important aspect of e-learning. Cases of institutions or departments within institutions where e-learning has not been adopted provide insights into contexts where barriers to e-learning exist. This section, of necessity quite brief, accordingly highlights what is palpably absent from the literature.

While several of the historically disadvantaged universities and technikons have benefited from mergers or collaborations with better-equipped universities, many do not feature in reported case studies and research. For example, e-learning at the University of Limpopo extends to online courses in computer literacy using the MS Office suite and Groupwise, based on the development of the Batlhami Online Programme in collaboration with Massey University in New Zealand (A. Ngoepe, personal communication, 28 February 2007). However, this is not, to our knowledge, reported in any publicly available literature. Similar initiatives in the use of LMSs, notably one at the Vaal University of Technology where the VUTOnline programme has been built on a Moodle open-content software platform, are not reported in the literature. The contexts that result in an absence of ICTs in higher education are well illustrated by the distance-learning programme for teachers in the Eastern Cape run by the University of Fort Hare (Deane, 2006). In this programme, materials are paper-based and computers are used only for administration. There is little scope for introducing online materials, since most of the learners do not have access to computers; however, the possibility has been discussed of introducing audio materials (using cassette tapes) as has been done in similar programmes elsewhere in sub-Saharan Africa.

In the absence of readily available literature, it is difficult to ascertain either how substantive these initiatives might be, or indeed how, if at all, they might contribute to broader national debates on ICTs in higher education.

Overall situation in SA higher education

It is clear from the case studies presented here that e-learning in South African higher education is represented by a wide range of scenarios, from large and sophisticated implementations of LMSs to a complete absence of technology in learning. Between these extremes are exciting and active 'do-it-yourself' projects of varying sizes and complexity that are experimenting with innovative applications of technology to specific learning contexts.

In situations where large groups of students who have access to technology are being addressed, many of the established learning technologies can be usefully applied. Although students and staff may lack skills in the area, this obstacle can be overcome by providing training and support. In such scenarios, there are operational efficiency and pedagogy benefits to be had. However, the costs associated with such implementation, including the cost of the technology infrastructure, of developing or adapting learning materials and of ongoing support, should not be underestimated.

Where fewer students are involved, where there are challenges in access to technology, or where resources do not permit the implementation of large-scale solutions, e-learning can still be beneficial. By making use of technology that is available and with the support of technical experts who understand the potential of technology, it is possible to design specific interventions that address specific learning goals. In many cases, it has been shown that these interventions address pedagogical problems in ways that cannot be addressed without technology.

What emerges strongly from the case studies is that institutions invariably benefit from making available a central pool of technical skills – in both ICTs and pedagogy – that can be accessed by academic staff to provide ideas and insights into the technologies and to work on the development of e-learning materials. It is clear that academic staff are overburdened and (in most cases) lack the skills to implement e-learning effectively without support. E-learning often involves significant changes in the work patterns of academics and they need to be assisted through the process of making those changes. Where such central support is not provided, achievements in e-learning have been the result of exceptional effort by individuals (or small groups) with vision and an unusually wide range of skills. Strengthening of central support for e-learning at all institutions would be beneficial.

Finally, large tracts of the higher education landscape remain unexplored in terms of the potential for e-learning. These include institutions that lack resources and that serve student populations with no access to ICTs. Despite the challenges, the potential for making use of these institutions to provide access to technologies and to build the ICT skills of the communities they serve does exist. Greater access to computer laboratories and the Internet, with improved support for the infrastructure and basic training in ICTs for staff and students, would be an important first step in bringing these institutions to a position where they could explore e-learning further.

Broader national imperatives and limitations

In this section, we seek to provide a succinct account of the broader situation with regard to the provision, support and development of ICTs in teaching and learning in South African universities.

In the aftermath of apartheid, and with the transition to a unified educational dispensation, there are now 22 universities in South Africa, which have come into being after a long period of rationalisation of the higher education sector. Most are the product of mergers of various institutions with uneven histories and academic reputations.

National ICT infrastructure

To a large extent, the uptake of ICTs by higher education institutions is dependent on how enabling the national environment is, particularly in terms of national policies and the available ICT infrastructure. This section deals with infrastructural provision at the national level in South Africa, as a way of understanding the broad context of higher education ICT initiatives. Key forms of ICT infrastructure considered include fixed telephone lines, mobile phones, personal computers and Internet connectivity.

Compared with other countries in the sub-Saharan region, South Africa has wide access to telecommunications infrastructure. With a network index of 104.7, the country surpasses others on the continent in terms of its communication network system, with the exception of Mauritius, which has a network index of 141.6 (ITU, 2007). As reported by the International Telecommunication Union, the network index comprises the following indicators: fixed telephone lines per 100 inhabitants, mobile cellular subscribers per 100 inhabitants, and international Internet bandwidth in Kbps per inhabitant (ITU, 2007). By 2001, South Africa had an average of 112 fixed lines per 1 000 people, far above the average of 14 lines in sub-Saharan Africa, but below the average of 146 for lower-middle-income countries (ITU, 2007).

Table 6.1 shows percentages of households with fixed telephone lines and cell phones, and access to PCs and the Internet. It reflects low levels of access to fixed lines, even in Gauteng, which is the industrial powerhouse and richest province of South Africa.

Most of the fixed lines are in larger cities, which had 415 lines per 1 000 people by 2001. Telkom South Africa's Annual Report for 2003 shows that South Africa's fixed-line network stood at 4.84 million users. However, the *October Household Survey* of 1999 (SADA, 1999) indicated that while Telkom had managed to provide access to telephones within a 30-minute walk for 90 per cent of the population, the restructuring process within Telkom had resulted in a rise in tariffs, making the service unaffordable to many people. About 500 000 households were said to have been disconnected (FEI, n.d.). Figure 6.1 confirms that the penetration of fixed lines in South Africa peaked in 2000 and has decreased ever since. The commensurate growth of mobile teledensity is well illustrated.

Table 6.1 also shows striking provincial variations in terms of household access to computers, with only 4.4 per cent of households in Limpopo having access to such technology. The national average household access of 13.6 per cent is very low compared to that of middle-income countries. This low level of access is corroborated by Czerniewicz and Brown (n.d.) who report an estimated personal computer density of 7.2 per 100 people in the country. As with telephone connectivity, most of the personal computers are concentrated in the urban areas.

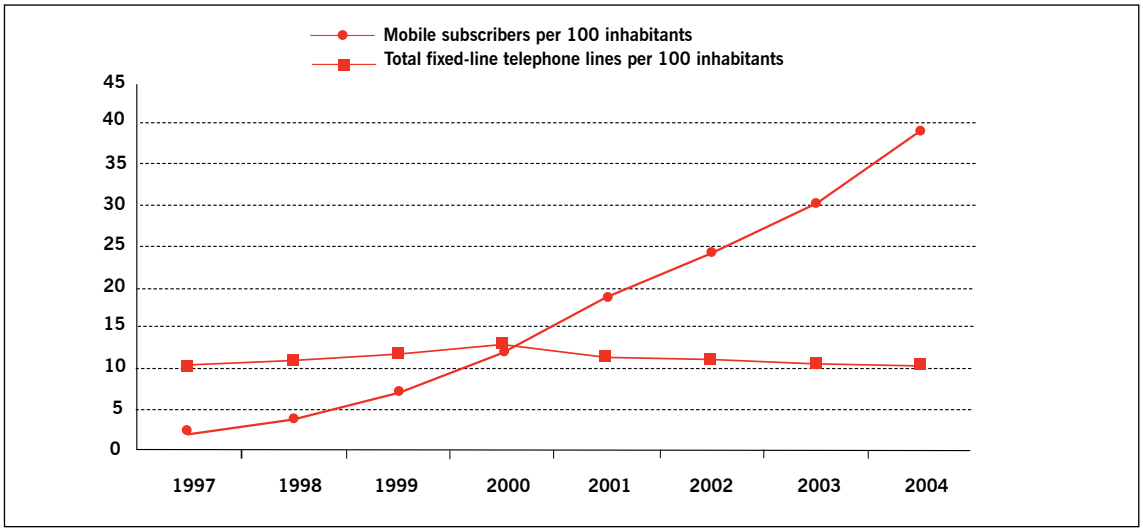
By early 2004, overall Internet penetration in Africa was around 1.5 per cent, with the highest penetration recorded in Réunion (over 20 per cent) followed by the Seychelles (around 14 per cent). South Africa and Tunisia were next in line with between 6 and 7 per cent. This compared with over 50 per cent Internet penetration in industrialised countries (Paul Budde Communications, in SAIDE, 2005). Relatively speaking, household accessibility to the Internet is still very limited in South Africa, with the Western Cape recording the highest accessibility of 23.4 per cent and Northern Cape and Limpopo provinces recording the lowest accessibility of only 3.9 per cent and 3.0 per cent, respectively (see Table 6.1). Immense disparities in Internet accessibility are discernible from province to province. These

Table 6.1: Percentage of household access to different forms of ICT by province

Province	Households with cell phone (%)	Households with landline (%)	Households with access to PCs (%)	Households with access to the Internet (%)
Western Cape	46.7	55.3	33.8	23.4
Gauteng	48.7	28.5	25.2	20.0
KwaZulu-Natal	35.2	31.7	13.3	8.2
Free State	33.9	21.8	10.3	7.3
North West	35.3	15.0	9.9	5.0
Northern Cape	20.1	20.0	9.8	3.9
Eastern Cape	25.7	15.9	7.9	5.5
Mpumalanga	26.3	17.6	7.6	5.5
Limpopo	26.1	7.1	4.4	3.0
National average	33.1	23.6	13.6	9.1

Source: Tlabela, Roodt, Paterson & Weir-Smith (2007: 13, 22, 26)

Figure 6.1: Total telephone density in South Africa, 1997–2004



Source: Gillwald & Esselaar (2004)

statistics clearly show that Internet connectivity is still a major challenge in South Africa and will continue to be so until stronger emphasis is placed on universal service in underserved areas, particularly the rural communities.

The spread of Internet connectivity is constrained by a poor communications infrastructure, inadequate and unreliable electricity and telephone networks and high telecommunication costs. The cost of dial-up services is a significant factor limiting the use of the Internet. While it is widely known that dial-up access in Africa is costly in comparison to developing countries, in general, dial-up access remains relatively expensive in South Africa. The average dial-up cost for 20 hours of connectivity per month for the continent as a whole is reported to be US$67.00; for South Africa (along with Nigeria, Namibia and the Cameroon), it is US$40.00, with Tunisia at US$30.00, Egypt at US$60.00 and Kenya at US$123.00 (see Jensen, n.d.).

The amount of bandwidth a country has determines both the quantity of and speed at which information can travel between it and other countries. By late 2000, the bulk of Internet connectivity linked the US with Europe (56 Gbps) and, to a lesser extent, the US with the Asia-Pacific region (18 Gbps). Africa had extremely little bandwidth reaching Europe (0.2 Gbps) and the USA (0.5 Gbps). Current figures indicate that the total international incoming Internet bandwidth is now well over 1 Gbps, while outgoing traffic is estimated at about 800 Mbps (See Lesame, n.d.).

At the beginning of 2004, South Africa's broadband penetration as a percentage of residential lines was 0.008 per cent, significantly behind the average of 1.96 per cent in comparable lower-middle-income countries (Gillwald & Esselaar, 2004)

Although it might seem that the whole of South Africa has access to the Internet, this remains well below the level of middle-income countries such as Singapore and Mauritius, in terms of the total bandwidth feeding the country and from an Internet penetration perspective. However, there are indications of a growing number of Internet access points in the country. Excluding schools and universities, there are about 941 access points, such as cybercafés, multipurpose community centres, post offices, digital villages and telecentres, in South Africa. These developments provide great potential for improving access to the Internet, especially among younger South Africans. In 2004, the South African minister of communications launched 35 ICT telecentres, e-schools, cyberlabs and multimedia resource centres in the rural nodal points of the country. The technology installed in these facilities normally includes a computer with Internet connectivity, a printer, a photocopier, a scanner, a fax machine, a television set and a video recorder. It is worth noting that due to such developments in Internet infrastructure, there were 3 523 000 Internet users in South Africa by August 2004, which represented 7.4 per cent of the national population.

Recent studies have shown that access is a complex and multifaceted aspect requiring more resources and effort than the provision of computers. A study conducted on 'real access' by Bridges.org showed that real-access criteria should include the following: physical access, appropriate technology, affordability, capacity, relevant content, integration into daily routines, socio-cultural factors, trust, legal and regulatory framework, local economic environment, macroeconomic environment and political will (Bridges.org, 2002). These criteria show how issues of access to communication technologies pose challenges in attempts to bridge the divide between rural and urban, rich and poor, and literate and illiterate communities in South African. Having the infrastructure available is a necessary but insufficient condition for access.

It should be noted that an important element in the use of ICTs in higher education is the need to build the 'human infrastructure' of institutions at the same pace as connectivity. The use of computers, generally, and for accessing the Internet, in particular, requires knowledge and skills that are evidently lacking on the part of most academic staff.

Institutional infrastructure

Not much substantive published research exists on ICT infrastructure in higher education institutions in South Africa. A noteworthy exception is a recent study of the five higher education institutions in the Western Cape province of South Africa (Czerniewicz & Brown, 2006). While not necessarily typical of the whole of South Africa, the study gives an indication of infrastructural issues that are likely to be found across the diverse range of higher education institutions in the country. In this section, therefore, we explore the issue of on-campus ICT infrastructure from the standpoint of student access to computers for learning purposes.

The first general point indicated by the literature is an apparent discrepancy in access to computers along the lines of the older inequalities within South African higher education institutions. It appears that historically disadvantaged institutions have less robust ICT infrastructures in place than do their more advantaged counterparts. While the now well-documented situation in

the Western Cape suggests that the discrepancies are not stark, the circumstances at the University of Limpopo, for example, point to an issue that may well be replicated more deeply across the whole of South Africa.

Table 6.2 indicates student-computer ratios at the Western Cape institutions. That the University of Cape Town and the Cape Technikon have much lower ratios than do the University of the Western Cape and the Peninsula Technikon is not unrelated to the inequalities of provisioning of the past, although it may also relate to differences in policy and teaching strategy. When considered alongside the statistics on computer access in Table 6.3, this picture deepens.

Table 6.3 provides an indication of the points on campus at which students can use computers. In the historically disadvantaged institutions, access to computers is more centralised, whereas in the others access tends to be distributed across faculties and even residences. It can be observed that while at Stellenbosch University and the University of Cape Town there is significant provision of computer facilities in student residences, the tendency at the Cape Peninsula University of Technology and University of the Western Cape seems to be for computer access to be much more centralised.

When statistics available for the University of Limpopo are brought into the picture, this trend appears even starker. In 2005, here were approximately 17 500 students at the university, three-quarters of whom were based on the Turfloop campus in Polokwane (see Table 6.7). Five computer laboratories containing a total of 220 computers for the use of students were available on that campus. Three of these laboratories were in a single building, which houses information systems and mathematics functions, and all were centralised. As the university itself puts it, reflecting on what is apparently a student-computer ratio of approximately 55:1, 'computer laboratories are heavily over-subscribed and the ICT Division is looking at ways of ensuring that students with legitimate academic work receive preference' (UL, n.d.). All of this points to a possible trend that requires further careful empirical research and commentary: with regard to basic provisioning of ICTs in higher education institutions in South Africa, there seems to be a historical backlog related to apartheid that still must be overcome.

Institutional higher education e-learning centres

Given the pronounced importance of e-learning in higher education, at least at the level of provision of ICT

Table 6.2: Student-computer ratios at higher education institutions in the Western Cape, 2005

Institution	Student enrolment	Number of student computers	Student-computer ratio
Cape Technikon*	18 523	1 588	11:1
Peninsula Technikon*	10 040	1 654	6:1
University of Cape Town	21 716	3 042	7:1
University of the Western Cape	14 873	1 455	10:1
Stellenbosch University	22 082	1 631	12:1

**Note: The Cape and Peninsula Technikons have since merged to become the Cape Peninsula University of Technology*

Source: Brown, Arendse & Mlitwa (2005), cited in Czerniewicz & Brown (2006)

Table 6.3: Student access to computers on campus by location

Location	Cape Technikon*	Peninsula Technikon*	University of Cape Town	University of the Western Cape	Stellenbosch University	Total
Faculty	53%	16%	63%	36%	52%	49%
Central	27%	80%	7%	39%	16%	28%
Residence	1%	n.a.	10%	2%	24%	7%
Library	11%	n.a.	11%	11%	6%	10%
Other	5%	1%	6%	9%	n.a.	6%
(N)	1 451	751	213	1128	638	6 105

**Note: The Cape and Peninsula Technikons have since merged to become the Cape Peninsula University of Technology*

Source: Brown, Arendse & Mlitwa (2005), cited in Czerniewicz & Brown (2006)

infrastructure, all South African universities seem to have some form of dedicated information technology department. Most also appear to have a centre concerned with the support of e-learning in some way, although there are relatively few dedicated individuals doing this work. Such centres range from those that work merely with basic ICT training for lecturers (e.g. at the Walter Sisulu University and the University of Venda) to those that have relatively sophisticated research operations integrated with systematic support programmes for lecturers in the development of e-learning (e.g. at the University of Cape Town and the University of Pretoria). The form and location of these organisational structures reveals something about how the institution in question views the nature and role of educational technologies in relation to teaching and learning (Czerniewicz et al., 2006).

Table 6.4 lists the centres that are dedicated to the function of e-learning at South African universities. The predominant tendency in the emergence of these centres is for expertise to be located in teaching and learning support structures, rather than ICTs being conceived of only in technological terms. In some cases, there is a more specific focus on teaching and learning in higher education *per se*.

There appears to be a general recognition across the board that teaching and learning issues should be placed at the

Table 6.4: University centres responsible for supporting ICTs in teaching and learning

Traditional universities	
University of Cape Town	Centre for Educational Technology, Centre for Higher Education Development
University of Fort Hare	E-learning Section, Teaching and Learning Centre
University of the Free State	Centre for Higher Education Studies and Development
University of KwaZulu-Natal	Centre for Information Technology in Higher Education
University of Limpopo	Academic Computing Support Section
North-West University	Academic Support Services
University of Pretoria	Department of Telematic Learning and Education Innovation
Rhodes University	Academic Development Centre
University of Stellenbosch	Centre for Teaching and Learning
University of the Western Cape	Teaching and Learning Technologies Unit E-Learning Division
University of the Witwatersrand	Centre for Learning and Teaching Development
Comprehensive universities	
University of Johannesburg	Centre for Teaching, Learning and Assessment
Nelson Mandela Metropolitan University	Centre for Teaching, Learning and Media
University of South Africa	Institute for Curriculum and Learning Development
University of Venda	Department of Information Technology Services
Walter Sisulu University for Technology and Science	Situation unclear in current merger context, but an academic development unit at Border Technikon (one of the merging institutions) seems to facilitate web-supplemented courses
University of Zululand	ICT Department (includes an 'electronic classroom' for training lecturers in online applications)
Universities of Technology	
Cape Peninsula University of Technology	Fundani Centre (teaching, learning and academic support) Centre for e-learning
Central University of Technology	Centre for e-learning and Educational Technology
Durban University of Technology	Centre for Higher Educational Development
Tshwane University of Technology	Department of Telematic Education
Vaal University of Technology	Department of Teaching and Learning, Centre for Institutional Development

forefront of the establishment and support of e-learning at South African universities. However, as Czerniewicz et al. (2006: 27) note, this does not mean that concern with ICTs in teaching and learning is necessarily at the top of university agendas, either in research terms or in terms of institutional governance:

The location of such centres in learning and teaching structures represents a significant shift from the past, and signals an emphasis on the educational part of educational technology. However despite this, a supportive champion is an important element in the power play of legitimacy and growth…[D]ifferent arrangements may be due to a lack of senior level overview of the kind of integrated work required of ICTs in higher education, itself a new area crossing over several disciplinary domains. They may also reflect long-standing tensions within universities between the craft knowledge of practitioners in what are generally regarded as support posts, and the specifically discipline based knowledge of traditional researchers.

National e-learning policies

This section comprises a literature review of national ICT policy discussions and debates in the South African context. The review raises two key concerns:

- there seems to be a lack of discussion and debate to inform ICT policy issues with respect to the higher education sector; and
- policy documents on higher education, such as they are, offer a very loose framework for implementing ICTs in the sector, suggesting that ICTs are not viewed as fundamental to the transformation of the sector.

International literature suggests that higher education, across the globe, has been influenced significantly by the advent of ICT, which is regarded as the main driver of the knowledge economy and a key ingredient for achieving global competitiveness (Castells, 2001; see also Gibbons et al., 1994). Thus, ICTs have given rise to an economy in which knowledge is the driving force of innovation and business growth. This economy is dependent on 'innovation through the production of knowledge (mainly through scientific research), its transmission through education and training, its dissemination through ICT technologies and its use in technological innovation', making higher education a critical player in the process (CEC, 2003: 4). A dominant claim is that ICT impacts on higher education curricula in two significant ways. The first is to serve as a catalyst of new knowledge conception and production processes, resulting in demands for particular forms of 'high' knowledge and skills. The second is to offer fundamentally new ways of organising and delivering knowledge (e-learning). Thus, the 'potential to offer flexible, custom based education available to anybody, anywhere and anytime paves the way for a different kind of learning environment i.e. e-learning', which changes the higher education landscape in important ways (Tiffin & Rajasingham, 1995: 118):

- it changes the nature of the student body to include working students, as well as students from across the globe;
- it has the potential to scale up education provision substantially (i.e. massification);
- it provides opportunities for a variety of institutions and organisations to offer education programmes through the Internet, thereby increasing competition among a wider group of providers; and
- it offers new ways for students and teachers to interact and communicate, which impacts on pedagogical strategies and teaching and learning outcomes.

At one level, the predominant policy impetus in South Africa seems to accept these notions. E-learning is viewed as offering flexible and inexpensive delivery that has the potential to respond to skills' shortages by increasing access to education and serving as an equaliser in economic development and transformation (DOE & DOC, 2001).

The South African government views e-education as a crucial strategy in becoming globally competitive and locally responsive (GCIS, 2001, 2002; MOC, 2003). It is seen as providing the foundation upon which an e-society can be built. This approach is reflected in the setting up of the Presidential National Commission on ICT and the Presidential Information Advisory Committee on IT, both of which prioritise the relationship between education and ICT. It is further supported by the White Paper on e-Education (DOE, 2004), which sets out a comprehensive framework for implementing ICT in schools. Accordingly, e-education is necessary for effective participation in the information society, and has the potential to enhance teaching and learning, to promote access, to create new opportunities for learners and teachers and, therefore, to transform education. For the minister of education, it is not 'whether we…introduce ICT in teaching and learning' but 'how we can successfully introduce ICT in schools' (DOE & DOC, 2001: 3).

However, while it is evident that ICT is viewed by the government as an important factor in the economic growth and development of South Africa, the higher education policy framework suggests that it is not viewed as critical to

transforming the sector. The 1997 White Paper on Higher Education (DOE, 1997) represents a comprehensive strategy and programme for transforming the sector. This includes ensuring high-quality relevant education, high skills output, efficiency, access and redress. Yet it makes reference to ICT only in very broad and unspecific terms. There are statements about ICT being critical in the global economy and in changing the nature of knowledge and skills required to function effectively in this era, but few references are made directly with respect to e-learning, which is generally linked to distance-education provision. For instance the White Paper states:

It will promote the development of a flexible learning system, progressively encompassing the entire higher education sector, with a diversity of institutional missions and programme mixes, a range of distance and face-to-face delivery mechanisms and support systems, using appropriate, cost-effective combinations of resource-based learning and teaching technologies…expanding the range of programmes and increasing enrolments based on open learning and distance education, especially for young and older adults, with particular emphasis on women. (DOE, 1997: 18)

The White Paper makes no specific statements about possible strategies for using ICTs to support teaching and learning; nor does it speak to the implications for new cognitive research and pedagogical practices concerning the use of technology as a tool in teaching and learning. Instead, the focus is on supplementing distance education.

The White Paper supports the provision of higher education through the use of technology to assist working students, as these students generally have access to the required technologies. Regarding the issue of massification, the policy stance on increasing access to higher education through the use of technology is not clear. However, the White Paper cautions against the proliferation of poor-quality higher education:

The risk the Ministry wishes to avoid is a laissez-faire *proliferation of higher education programmes by an increasing range of providers, without benefit of a planning framework and without adequate safeguards to ensure the quality of provision. This would almost certainly result in the unplanned blurring of institutional roles and functions, and, given resource constraints, a strong tendency to over-provide low-cost programmes in low-priority curriculum areas.* (DOE, 1997: 22)

All of this has led some commentators to suggest that the policy on ICT in higher education is not wide enough. Cross and Adam (2007), for example, suggest that while South Africa has gone a long way in adopting an exemplary approach to the integration of ICTs in schools, it lacks a national framework and vision concerning the role of ICTs in higher education. This means that in order to develop institutional frameworks and strategies, institutions have to rely on a series of fragmented statements scattered through policy documents that provide little direction (e.g. the Report of the National Commission on Higher Education, the White Paper on Higher Education and the National Plan for Higher Education). This, in turn, results in the proliferation of different approaches to integrating ICTs in curriculum design and delivery, with attendant difficulties in extracting 'common denominators that could be applied across the system' (DOE, 1997: 74).

The subject of much debate in South Africa has been whether or not a national ICT policy or regulatory framework for higher education is desirable. In a recent engagement with key academic players in e-learning in higher education, conducted on behalf of the Higher Education Quality Council, the South African Institute for Distance Education reached the conclusion that it would not be desirable to develop a specific regulatory framework focused on this area in South Africa (SAIDE, 2006), and that the matter of e-learning in higher education would be dealt with more appropriately in the context of existing regulatory principles and frameworks. Yet there are several voices in South Africa arguing for serious consideration of a national policy framework, not least in relation to the uneven implementation of e-learning across the sector. A national policy framework might establish positive, open-ended principles to be strived for in the long term, rather than minimum standards or criteria, which is what a regulatory framework tends to reflect.

Cross and Adam (2007) suggest that the South African case reflects the fact that ICT use is ad hoc, fragmented and uncoordinated and that, in most instances, this is repeated in the formal policy positions. The e-learning strategies in the White Papers are framed within existing paradigms and do not look at ICT as radically changing the nature of higher education. This echoes a widely held view in South African higher education institutions that the less restrictive national strategies on ICT are, the better are the possibilities for the institutions to be innovative in seeking models for implementing ICT (see Broere, Geyser & Kruger, 2002). While the literature indicates that policy and implementation trends throughout the world tend to respond to global drivers (the knowledge economy and ICT growth) at the expense of national and institutional interests, the South African experience shows how local imperatives do indeed shape policy contexts.

Czerniewicz et al. (2006) suggest that there is neither a framework nor monitoring and evaluation of ICT implementation in higher education, and that policy documents reflect the ad hoc, limited focus on ICT. They argue that the focus of current policy is on ensuring that students develop the skills required for participation in the knowledge economy and not on the use of ICT to support teaching and learning.

Thus, the dominant approach of the government and regulatory authorities seems to be focused on using ICT to support existing education programmes and paradigms. Using ICT to fundamentally change education practices is not the stated aim. Policy appears to be informed primarily by the access challenges that underpin demands for greater ICT implementation and use. The result is that there is substantial room for institutionally informed choices. While these choices can be creative, they can also raise serious issues about the access and equity imperatives that so starkly divide the South African terrain. In this context, a search for what is possible within the macroeconomic context is critical.

Institutional e-learning policies

Some higher education institutions have developed comprehensive strategies. Others have only broad position statements, with implementation being left up to individual departments or lecturers. The continuum represented here, of policy statements on ICTs in higher education, can be employed to describe some of the positions adopted by institutions.

By the late 1990s, a number of universities had already put in place extensive policy frameworks governing the use of ICTs in education and in institutional governance and administration, which they continued to develop into the 2000s. The Universities of Stellenbosch (an integrated strategy incorporating 'e-learning, e-information, e-student administration, e-research and e-services') and Pretoria (a telematic learning and education innovation strategic plan) are notable in this regard. More recently, Tshwane University of Technology and the Universities of the Free State, Limpopo, Cape Town and the Western Cape have developed similarly comprehensive policy statements.

However, there is still a specific range of emphases in these documents: the 2004 ICT Policy Document of the University of Limpopo (UL, 2004) makes no mention of teaching and learning issues except insofar as they are part of the mission statement of the institution. The University of Cape Town's 2003 Education Technology Policy, on the other hand, prioritises the articulation of technology in pedagogy, treating ICTs as a 'knowledge domain' linking education, information and ICTs. This reflects our earlier observation that the policies adopted by universities in this regard are closely aligned to the institution's predominant ideas about the nature of teaching and learning. Where there is a belief that ICTs are merely a neutral medium for conveying any kind of pedagogic principles, the tendency is not to write ICT policies related to teaching and learning. Where, however, there is a fundamental recognition that the manner in which ICTs are deployed carries with it implications for pedagogy, the polices tend to integrate the two concerns.

At the other end of the spectrum, there are institutions that appear to have no policy framework related to ICTs in education. For example, the University of the Witwatersrand is practically silent on the issue, apart from a statement in the strategic plan that the university will implement e-learning where applicable (see Mhlanga, 2005). Then there are institutions that have formulated principles about teaching and learning that refer to the importance of ICT usage, but which do not have core institutional polices on ICT usage in place; these range from systematic teaching and learning strategy documents (Durban University of Technology) to looser collections of documents to guide university processes (Rhodes University) (see Czerniewicz et al., 2006).

In a survey of universities conducted early in 2006, in which official university responses to a questionnaire were obtained, SAIDE produced the descriptions contained in Table 6.5 of ICT policies in place in South African higher education institutions. The categories used were guided by those sent out earlier by Czerniewicz et al. (2006), and the purpose of the survey was to verify and possibly extend the work done by these authors. Only four universities did not respond to the questionnaire.

South African research on ICTs in education

Czerniewicz et al. (2006) pose the question as to whether or not ICTs and learning can be considered an emerging domain of research inquiry in South Africa. While not tackling the philosophical issues at stake – which, from a 'realist' perspective, have to do with ontological questions concerning different strata of reality and the sciences associated with them, and, from a 'post-modernist' perspective, are concerned with definitions of discursive communities of practice – the answer that they suggest is that 'this field of research is in the process of defining itself and clarifying its boundaries' (Czerniewicz et al., 2006: 33).

This is as true, they suggest, of international research trends as it is of debates and developments in the South African literature.

What then can be said of this process of definition in the South African literature? A recent analysis of South African higher degree research output on the pedagogical integration of ICTs suggests that only a tiny proportion of dissertations and research reports in the area are concerned with actual teaching and learning processes in ICT-borne learning environments (Moll & Matshana, 2006). Between 1990 and 2005, well over 200 funded higher degrees awarded by South African universities related to the study of ICTs in education: approximately 50 per cent of these were on management of ICTs in education, and 50 per cent related to pedagogical use of ICTs. This sounds promising as an indication of a serious research trend related to the latter category, but a more detailed analysis, as depicted in Table 6.6, reveals otherwise.

Table 6.6 depicts the dearth of dissertations focused on the process of teaching and learning using ICTs or on the integration of ICT into pedagogy – and the relative proliferation of degrees that are more concerned with the use of ICTs for monitoring and evaluation of education.

Only one in ten dissertations over a period of 15 years seem to have been focused on actual processes of teaching and

Table 6.5: Survey of ICT policies at South African universities, June 2006

Policy status	University
Institutions with formal polices, complete with strategic plans and regulatory frameworks, as well as statements of policy principles	University of Pretoria University of Stellenbosch University of the Western Cape
Institutions with formal policies or strategic documents with clear principles and intentions but no implementation documents as yet	University of Cape Town Tshwane University of Technology
Institutions with draft polices	University of Fort Hare University of the Free State
Institutions where ICT policy is incorporated into related policy documents	Durban University of Technology
Merged institutions where it is not clear if policy from one institution applies across the new institution	University of Johannesburg University of KwaZulu-Natal
Institutions with no frameworks, although they may have relevant institutional structures	Cape Peninsula University of Technology Nelson Mandela Metropolitan University Rhodes University North-West University University of Venda University of the Witwatersrand Vaal University of Technology Walter Sisulu University

Source: SAIDE (2006)

Table 6.6: Funded higher degrees on ICTs in education, 1990–2005

Studies related to pedagogical use of ICTs (80%)		Studies related to pedagogical use of ICTs (20%)		
Evaluation	**Monitoring**	**Research on teaching and learning processes**		
Impact studies	Policy research	Virtual communities of practice	Peer-group learning around computers	Individual learning processes
e.g. quasi-experimental studies; case studies; illuminative evaluation	e.g. review of best practice; comparative research	e.g. ethnography	e.g. discourse analysis	e.g. modelling 'mind-machine' relations

Source: Moll & Matshana (2006: 14)

learning using ICTs. While these studies were not confined to higher education, the trend there is unlikely to be very different.

Another interesting trend that emerged from this study is that of the more than 200 higher degrees awarded in this period, approximately 80 per cent were from five universities, three in Gauteng (Pretoria, Johannesburg, previously RAU, and Witwatersrand) and two in the Western Cape (Cape Town and Stellenbosch). This seems to indicate that if there is a field of research still defining itself in South Africa, it is concentrated in the traditional, previously white universities.

Are these patterns equally evident in published research by academics in the field? In an analysis of recent articles on ICTs in higher education in the *South African Journal of Higher Education*, Czerniewicz et al. (2006: 31) note:

in 2001 there was one article…However, there were three in 2002 and six in 2003. In 2004 there were three. The articles that have been published in SAJHE come from several different institutions. Two were from University of Cape Town, two from Rand Afrikaans University, two from University of Pretoria, and one each from the University of Witwatersrand, Cape Technikon, University of South Africa, University of Natal and the University of Stellenbosch.

Certainly, the impression of an emergent research tradition still concentrated in a handful of universities is borne out, but there is evidence perhaps of more direct concern with teaching and learning issues. The authors' categorisation of the types of research represented in these articles – 'five were "big picture" articles on challenges, imperatives, change and critique…seven were located in specific sites (for example information literacy and early childhood interventions) or focused on specific issues (including learning design online and online games)' – is not quite the same as that adduced above in relation to postgraduate outputs. The articles in the latter reference are concerned with pedagogies in ICT environments. These patterns are borne out by the contents of the more recent special editions of *Education as Change,* 2005, 9(2) and *Perspectives in Education*, 2005, 23(4). In the former publication, there is a healthy balance between articles concerned with aspects of pedagogy (assessment, narrative strategies, mediation, training) and articles related to access and technological infrastructure. In the latter publication, all nine articles are focused on pedagogical issues. Even if an outcome of editorial design, this is a good indication of increasingly focused research on such matters in South Africa. However, not unexpectedly, most of the articles are by authors from the same universities mentioned above.

The patterns that emerge here are indicative of a number of issues of particular importance in the South African context. Only relatively recently has the issue of the primacy of pedagogy in the use of ICTs been put on the national higher education agenda. Until recently, the bulk of research on ICTs in education could be said to have been trapped in the old mistake of allowing 'the technological tail to wag the pedagogical dog'. A principled national research agenda focused on the pedagogic integration of ICTs seems to be required. Part of this agenda must tackle the question of the continuing marginalisation of institutions and individuals previously disadvantaged by apartheid. Questions of pedagogical access to ICTs, and the epistemological access that this might entail, seem to suggest certain kinds of priorities in research direction and development that may be distinctive of South Africa. On the basis of the preliminary analyses of the published literature offered above, there is clearly a need to analyse more carefully the theoretical and research developments in South Africa, and about South Africa, of the past two decades or so.

Higher education challenges in South Africa

Demography of higher education

The major transformational issue in South African higher education of the past decade has been the normalisation of student intake relative to the demographic composition of South Africa at large. Although the process is far from complete, it is widely acknowledged that dramatic progress has been made in this regard at the previously white universities of the apartheid era. The same cannot be said for previously black universities, whose student demographics remain largely unchanged. Table 6.7 sets out the most recent statistics for all South African universities.

Notably, the table indicates that South African student enrolments are sound as far as gender equity is concerned. However, in the academic staffing of higher education institutions, progress with regard to racial and gender equity has not been as dramatic. Debates rage as to whether or not institutions, particularly previously white institutions, have put sufficient effort into changing the inherited imbalances of the past. Whatever one's views are on these debates, statistics indicate steady changes towards equity on a year-by-year basis.

Table 6.7: Overview of South African universities in 2005

Institution	Headcount student enrolments			Black students as a proportion of headcount totals (%)		Female students as a proportion of headcount totals (%)		Proportion of contact & distance headcount enrolments in major fields of study (%)		
	Contact	Distance	Total	Contact	Distance	Contact	Distance	SET	Business	Humanities
Cape Peninsula University of Technology	28 889	72	28 961	78	86	52	63	47	33	20
University of Cape Town	21 764	0	21 764	49	n.a.	51	n.a.	41	25	34
Central University of Technology, Free State	10 114	206	10 320	82	82	49	63	43	35	22
Durban University of Technology	22 779	0	22 779	93	n.a.	50	n.a.	49	35	16
University of Fort Hare	7 175	1 615	8 790	92	99	56	81	16	15	69
University of the Free State	22 337	2 322	24 659	65	35	58	34	29	13	58
University of Johannesburg	43 182	2 362	45 544	70	96	53	66	30	33	37
University of KwaZulu-Natal	35 208	5 496	40 704	83	89	54	59	30	26	44
University of Limpopo	17 579	0	17 579	99	n.a.	51	n.a.	43	14	43
Nelson Mandela Metropolitan University	19 928	4 229	24 157	69	97	51	72	30	24	47
North West University	27 092	11 504	38 596	52	94	59	68	21	17	61
University of Pretoria	38 531	7 820	46 351	40	99	53	72	37	14	48
Rhodes University	6 045	277	6 322	52	100	57	74	21	15	64
University of South Africa	638	207 293	207 931	63	72	84	55	12	41	46
University of Stellenbosch	21 465	237	21 702	27	94	52	83	40	14	46
Tshwane University of Technology	49 705	10 702	60 407	86	99	51	59	36	29	35
University of Venda	10 497	0	10 497	100	n.a.	50	n.a.	28	22	49
Vaal University of Technology	17 408	0	17 408	94	n.a.	49	n.a.	44	50	6
Walter Sisulu University for Technology & Science, Eastern Cape	23 871	625	24 496	100	100	62	83	27	33	40
University of Western Cape	14 463	117	14 580	94	38	59	35	31	15	55
University of Witwatersrand	23 626	0	23 626	64	n.a.	50	n.a.	50	17	33
University of Zululand	10 398	0	10 398	99	n.a.	65	n.a.	17	12	71
Mangosuthu Technikon	9 901	0	9 901	100	n.a.	49	n.a.	57	31	12
Totals/Averages	482 595	254 877	737 472	74	76	53	57	29	29	42

Source: 2005 HEMIS (Higher Education Management Information System) database, September, 2006

Note: In a headcount enrolment, both full-time and part-time students are counted as units (i.e. no account is taken of the course loads carried by students). Contact students are those who are registered mainly for courses offered in a contact mode. Distance students are those who are registered mainly for courses offered in distance mode. Black students include black African, coloured and Indian students. SET majors = majors in science, engineering and technology, and include majors in engineering, health sciences, life sciences, physical sciences, computer sciences and mathematical sciences. Business majors include majors in accounting, management and other business-related areas such as marketing. Humanities majors include majors in education, language and literary studies, fine arts, music and the social sciences. Home economics is now reported under SET and not humanities as was done previously. Numbers and percentages may not necessarily add up due to rounding off. n.a. = not applicable.

Changes and challenges in the higher education sector

Currently, higher education in South Africa is experiencing significant changes as a result of a number of contending forces and competing interests. These include:

- *Global pressure* to ensure that education supports the global economy. Often, this is translated into market-driven programmes underpinned by a utility model of higher education, with an emphasis on skills- and applications-based research and demands to increase higher education throughput (Scott, 1998).
- *National pressure* to support the emergence of a new democracy (Kraak, 2000). This manifests in efforts towards reconciling the efficiency and fiscal discipline concerns that underpin the macroeconomic policy framework with the principles of equity, access, redress and nation-building (DOE, 1997).
- *Institutional pressure* underpinned by the mission, values and historical context of institutions. Organisational factors, such as how the institution defines knowledge production, what is viewed as the purpose of education and how the historical contexts of institutions impact on the curriculum reform process (Jansen et al., 2001).

Thus, the process of change in institutions is mediated by a multiplicity of factors within a highly differentiated higher education sector. Depending on their histories, cultures, missions and resources, institutions display a variety of responses.

The impact of these changes is telling in regard to teaching and learning, as market driven models of education assume precedence. One of three things seems to have happened to subjects or disciplines that have no direct bearing on the needs of the economy: they have been adapted, removed from the curriculum structure or shifted to the periphery. This has particular implications for the humanities, which tend to be positioned as subordinate to all-important science and technology. Accompanying these trends is the overall tendency to privilege particular conceptions and modes of knowledge production driven by immediate economic concerns. This type of knowledge is referred to sometimes as Mode 2 knowledge and is characterised by an emphasis on skills, practical knowledge and applications-based research (see Kraak, 2000).

South Africa recently underwent a significant policy and legislative transformation process in higher education, which was aimed at increasing access, efficiency, accountability and quality. This comprised a lengthy and highly participatory policy process, followed by the setting up of structures to support implementation (Badat, 2004). Critical milestones included the setting up of the National Commission on Higher Education in 1995, which was aimed at exploring possible models for South African higher education, the Green Paper of 1996 and the White Paper of 1997, which set out the framework for higher education. The government played a significant role in the process, and this is reflective of a highly active 'state supervision' model (Kraak, 2000). The Ministries of Education and Labour were involved and, through them, structures were established to deal with quality, monitoring and accreditation. Key issues dealt with included:

- institutional restructuring, institutional mergers and the creation of a single and no longer fragmented higher education system;
- new funding strategies based on efficiency and redress;
- articulation between qualifications through the National Qualifications Framework;
- co-operative governance and partnership strategies;
- access targets; and
- curriculum restructuring towards relevance and flexibility (Badat, 2004).

Thus, the South African policy environment reflects a dynamic tension between global and national priorities. While most agree that this is the case, many disagree over the extent of focus and emphasis on global versus national imperatives. According to Kraak (2000), South African policy provides a reasonable combination of imperatives for both globalisation and democratisation. The White Paper refers to several roles for higher education, including: support for the labour market; development of individual aspirations; creation, transmission and evaluation of knowledge; and socialisation of citizens. However, for Jansen (2000) and Kishun (1998), South African policy is more strongly influenced by global pressures than by national pressures.

Clearly, there are tensions between the democratic agenda of redress, equity and access and the global economic agenda of skills, efficiency and effectiveness. These tensions are reflected in the debates on both policy and implementation. For instance, the National Qualifications Framework is at the nexus of the debates and tensions surrounding education and training and the world of work. The National Qualifications Framework is aimed at ensuring articulation between different qualifications, creating a relationship between education and the world of work. It is viewed by some as a means to improve the skills and output of education and to steer higher education towards a relevant curriculum that supports the needs of society. Other commentators, however, view it as an attempt by the

state to impose curriculum change in higher education (Van der Vyver, 1999) and capitulation to market forces (Luckett, 2001).

Global trends and national reforms

Four issues seem to present challenges to the implementation of global trends in national curriculum reform:

1. ideology and culture;
2. the historical context of higher education in South Africa;
3. massification and access; and
4. the critical role of ICT.

Here we shall discuss the first three briefly, and then concentrate more on the fourth issue by way of refocusing our attention on ICTs and learning in higher education institutions.

The first issue concerns the extent to which curriculum reform may undermine local culture, values and the nurturing of a young democracy. Many programmes are underpinned by perceived notions of neutral technical education (Ekong & Cloete, 1997). Some authors suggest that a universal curriculum could destroy local culture and local patterns of life, impacting on democracy and human rights. Such voices advise that South Africa should develop its own responses by conducting an analysis of the needs and priorities of South African society (Jansen, 2000).

The second challenge for curriculum reform is the historical context of institutions, and associated lack of capacity and resources to transform. Commentators have suggested that the historical inequalities that underpin cultural and organisational arrangements in institutions should not be underestimated, as this impacts on the ability of institutions to respond to global pressures (see Jansen, 2000; Bunting, 1994).

The third, perhaps most significant, challenge in the higher education system is to ensure increased access and throughput. While access is a significant driver of curriculum reform in the South African context, at both policy and implementation levels, strategies for creating access are undermined by the financial challenges faced by the higher education sector and the associated drive for efficiency. Access is reflected at two levels in the literature – physical and epistemological. As mentioned above, there has been significant progress in physical access for previously denied communities, but the issue of epistemological access and success in higher education remains a challenge. More intensive teaching and learning strategies are required to address these issues of success and throughput

The literature suggests that attempts to support student success have manifested in a range of strategies and responses. Firstly, pedagogical strategies dominate curriculum reform in relation to access. There are many examples in the literature of developing and testing new pedagogical approaches to support student access (see Griesel, 2004). Secondly, bridging programmes have been developed to offer scaffolded learning and skills development to under-prepared students (Maharasoa, 2003). This includes offering students more face-to-face contact and more tutorials with smaller teacher-student ratios. It is clear that addressing access requires extensive resources, which are not necessarily available. There is a discrepancy in the ratio between the increase in student numbers and the government funding subsidy – 20 per cent versus 7 per cent (Cloete & Moja, 2005; see also Sehoole & Moja, 2004).

It is here where the fourth challenge mentioned above comes into the picture with regard to teaching and learning. Frequently, claims are made that the deployment of ICTs in higher education contexts will provide a platform for the proper delivery of and access to additional learning and teaching support required by students to redress the historical legacies of poor schooling (see, for example, Cloete, 2006; Mafange & Pretorius, 2003; Draft Consensus Statement, 2006). However, the challenges related to perceiving ICTs as enabling global higher education are significant. Most South African institutions do not have the required infrastructure, skills or access to operate at this level (Gillwald, 2001). This constraint must be considered in proposed solutions for the country. There are strong suggestions in the literature that access in the South African context cannot be provided through ICTs, as is the case in some developed countries (Maharasoa, 2003). Gillwald (2001) argues that most South African institutions do not have the required infrastructure, skills or access to operate at this level. On the other hand, there is considerable evidence that available computer technology and infrastructure in many South African universities, from the point of view of teaching and learning, are not being used by students to their fullest potential. The imperative here seems to be much more considered academic support programmes (in the classical sense of the term), centred on the development of properly scaffolded learning programmes in online environments. The task entails both research and teaching of fundamental importance for South African education.

In the light of post-apartheid imperatives for universities to be responsive to the learning needs of students, this challenge has particularly significant implications for current understandings regarding access; for example, according to Czerniewicz and Hawkridge (2004), the experience at

the University of Cape Town seems to be that considered implementation of computer-supported learning in context helps to deepen the disciplinary understanding of students, which is sometimes termed 'epistemological access' (Morrow, 1993). However, at the same time:

because the digital domain has become so dominant and is changing how the world works, it is creating new realms of exclusion for students without access to computers, and lecturers who are grounded in pre-digital print culture. In a context of increasing inequality, it adds another layer of complexity to the challenge of social inclusion. (Czerniewicz, 2004: 149)

Open-source software

There is a mix of proprietary and home-grown LMSs in use in South Africa, some based on an open-source philosophy, with institutions aligning with particular products according to pragmatic, institutional or ideological reasons. Czerniewicz et al. (2006: 7) argue that the broader issues of open source and open content must be understood against the political imperatives of change in higher education:

the choice of a specific online learning environment in terms of proprietary versus open source options [expresses concepts of change in practice]…Such decisions may challenge or support dominant intellectual property relations.

Their report proceeds to show how debates about open-source technology are deeply embedded in both political and pedagogical issues and, as such, are pivotal to questions about higher education institutional transformation as a whole. While advocates of whatever position in the debate might argue only the advantages and disadvantages of using open-source or proprietary software options in relation to cost, software development and other technical issues, it seems that broader questions, such as whether or not public funds can legitimately be spent on proprietary software for use in public institutions, are germane to this terrain. The choices made certainly give a sense of these debates, even at face value.

Table 6.8 indicates current usage of LMSs in South African universities, insofar as this could be established. As published literature is sketchy on the subject, university web sites and telephonic interviews were utilised. The latter included an interview with Eiffel Corporation, the official suppliers of WebCT products in South Africa.

The table indicates an increasing use of LMSs in South African higher education institutions. There appears to be universal acceptance that some form of online learning is necessary for the future of all universities, although the degree to which this should be Web-supported learning or fully online is still a matter of considerable debate and future development. Broadly speaking, institutions can make one (or more) of three choices:

- use licensed, proprietary (commercially sourced) software;
- develop a system on an open-source software platform; and/or
- develop their own home-grown software (which may then be put into either a commercial or an open-source trajectory).

When one examines different levels of institutions, it seems that there may be many in which a range of LMSs is being utilised, with ownership resting at department or faculty level rather than at the institutional level (Czerniewicz et al., 2006). However, as the use of ICTs for multiple functions becomes more institutionalised, the number of available choices will no doubt tend to be impacted on by management decisions. Thus, the debate is likely to deepen regarding the choice between proprietary software and open-source software. Many institutions that have relied on proprietary software in the past have found the experience restrictive; these have begun exploring open-source alternatives. Several institutions having developed home-grown solutions, have then found them to be a relatively expensive option and are either exploring alternatives (whether proprietary or open source) or positioning their products as open-source projects that can gain wider use and attract external resources, thereby reducing overall development costs for the institution (Czerniewicz et al., 2006).

Mobile technologies

The phenomenon of 'mLearning' – learning enhanced by the use of mobile, wireless technologies – is receiving increased attention. Engagement with this phenomenon ranges from the administrative use of cell phones at the Universities of Pretoria and South Africa, through examining the optimal utilisation of wireless computer connectivity at the University of Cape Town (Ng'ambi, 2005a), to complex utilisation of such technologies in supporting content in teacher development programmes at the University of Fort Hare (Leach et al., 2005). Work is incorporated into a range of mobile ICTs, such as pod-casting using MP3 players at the Central University of Technology (Baird & De Beer, 2006), and the development of pervasive computing systems across a range of mobile devices in support of learning at Rhodes University (Barker et al., 2005).

Table 6.8: Use of learning management systems by South African universities

Traditional universities	LMS	Source	Comment
University of Cape Town	Sakai	Open	Originally used WebCT, but migrated from it progressively for principled reasons; built its 'Vula' platform on Sakai; member of SA Sakai association.
University of Fort Hare	WebCT[a]	Commercial	Has indicated an interest in moving to open source, possibly KEWL or Moodle.
University of the Free State	WebCT	Commercial	Has expressed intention and is preparing to move to open source; member of SA Sakai association.
University of KwaZulu-Natal	OLS	Home-grown Open	Open source product, developed in-house.
University of Limpopo	WebCT	Commercial	Developed the 'Batlhami Online' programme on WebCT base.
North-West University	Varsity	Home-grown Commercial	Has expressed intention to move to Sakai platforms in future; member of SA Sakai association.
University of Pretoria	WebCT	Commercial	Strong public commitment to WebCT.
Rhodes University	Moodle	Open	Used WebCT briefly, now migrated onto Moodle-based platform, largely for reasons of affordability.
University of Stellenbosch	WebCT	Commercial	Strong public commitment to partnership with WebCT
University of the Western Cape	KEWL NG	Home-grown (with partners) Open	Core development institution for KEWL; strong advocate of open-source software.
University of the Witwatersrand	WebCT	Commercial	n.a.
Comprehensive Universities			
University of Johannesburg	WebCT	Commercial	Strong public commitment to partnership with WebCT
Nelson Mandela Metropolitan University	None		Limited in-house LMS used at old PE Technikon (merged into NMMU), now discontinued; currently using videoconferencing across 7 sites to deliver limited number of courses (e.g. MBA) – no further use of ICTs at this stage; extensive planning taking place.[b]
University of South Africa	Sakai	Open	Previously used home-grown software and WebCT; migrated entire institution to Sakai platform from 2006; member of SA Sakai association.
University of Venda	WebCT	Commercial	n.a.
Walter Sisulu University for Technology and Science	WebCT	Commercial	Verbal reports of LMS use; no other evidence from institution; Eiffel SA indicates the institution uses WebCT.
University of Zululand	n/a	n/a	Information not available.
Universities of Technology			
Cape Peninsula University of Technology	WebCT	Commercial	n.a.
Central University of Technology	WebCT	Commercial	n.a.
Durban University of Technology	WebCT	Commercial	n.a.
Tshwane University of Technology	WebCT	Commercial	n.a.
Vaal University of Technology	Moodle	Open	Has developed 'VUTOnline' on Moodle base; minimal use in teaching and learning at this stage.

Notes: *a) Following the merger of WebCT and Blackboard in February 2006, both LMSs are classified above as WebCT; b) Personal communications, Paul Harper, Centre for Teaching, Learning and Media, and Marinda Taljaard, Computer Science & Information Systems, both of NMM University, 7 May 2007.*

The potential for much of this work lies in the apparently high incidence of cell phone communication amongst South African higher education students. Although, as previously seen, teledensity rates for the country appear to be low – only 11 in 100 people have fixed lines, while 36 in 100 people have mobile phones (Czerniewicz et al., 2006) – there is much higher usage amongst university students. At the University of Pretoria, for example, in 2003, it seemed that less than 10 per cent of students had off-campus access to the Internet, but more than 90 per cent had cell phones (UP, 2004). Thus, there is widespread advocacy of the potential of this latter technology for teaching, learning and administrative purposes at universities.

Available evidence suggests that cell phone communication, particularly the short message service (SMS), is used at two universities in the administration of courses, rather than for teaching and learning. At the University of South Africa, some use has been made of cell phones to deliver exam results and reminders via SMS, but there have been problems with networks being unable to support the high volumes of messages (see Nonyongo et al., 2005; Madiope et al., 2005). The University of Pretoria has also experimented with using text messaging on cell phones to communicate results and deadlines to students (Hendrikz & Raseale, 2006).

Viljoen et al. (2005) describe the use of SMSs in learning support for rural distance learners. Students were sent instructions about the SMS project, which included abbreviations to be used. SMSs were used for sending hints about readings and assignments, an interactive quiz, an invitation to submit questions on a specific part of the course, advice in response to student questions, and an invitation to call and listen to a pre-recorded mini-lecture. Students found the hints helpful, and 63 per cent called in to hear the mini-lectures.

There are also several examples of innovative research work on using mobile technologies to enhance teaching and learning in higher education. Ng'ambi, at the University of Cape Town, describes a project in which the 'seamless integration of the SMS and the web interface', brought about by encouraging the use of SMS texting by students, has had at least four positive implications for student learning:

1. *exposure to other students' questions mirrored their own understandings and misunderstandings;*
2. *anonymity created a feeling of a safe environment which empowered students to ask and respond to questions;*
3. *students were able to monitor their own growth and development through observing their own changes in the way they asked questions; and*
4. *the educator received feedback on where the students learning difficulties lay and was able to quickly respond.* (Ng'ambi, 2005b)

Related work at the Tshwane University of Technology has sought to examine the relationship between emergent SMS languages and formal academic languages in higher education learning spaces, with a view to better understanding how the former may support or undermine the latter (Mphalele & Mashamite, 2005).

Conclusions

A proliferation of models and approaches to the deployment of ICTs for teaching and learning purposes exists in South Africa's institutions of higher education. Underpinning this proliferation is a relatively loose policy context, with little determination and regulation of ICT practices in higher education from the centre. This situation is encouraging in that it promotes widespread experimentation with e-learning. In a number of institutions, this has resulted in innovative and contextually appropriate projects. However, some of the literature suggests that, because the ICT infrastructure that exists in the country and within its higher education institutions varies considerably between haves and have-nots, there is a need to consider the enforcement of robust ICT-in-education imperatives. Many commentators advocate stringent policy and regulatory frameworks related to access and equity. Nonetheless, despite the broad policy framework, there is evidence of increasing efforts to secure infrastructure and increasing use and implementation of ICT in the sector.

The use of ICTs is a serious component of the higher education agenda in South Africa. At the administrative and technological infrastructure levels, all universities in the country have committed substantial resources to the provision of appropriate hardware and software in order to get information systems up and running. Increasing attention is being paid to the pedagogic integration of ICTs into university courses, sometimes with too much sense of the 'technological tail wagging the pedagogic dog', but often with an appropriate caution about the potential of ICTs to provide solutions in regard to the improvement of South African higher education. Most importantly, there is an emerging research community that is increasingly seeking to make a critical and contextualised contribution to central academic debates in the international arena. While it is clear that ICTs are now very much part of the higher education landscape in the country, it is equally incumbent on all players within the higher education sector to ensure that they work in ways that are educationally sound, and not simply for their own sake.

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