

INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTS) AND SOUTH AFRICAN HIGHER EDUCATION: UNDERSTANDING/S (OF) THE LANDSCAPE

Laura Czerniewicz, Neetha Ravjee, Nhlanhla Mlitwa

1. INTRODUCTION

This chapter provides some insight into the ways in which Information and Communication Technologies (ICTs) are understood by practitioners and researchers working in higher education institutions in South Africa, in general, and how ICTs are understood in relation to change, in particular. These interpretations are located within policies, practices and structures that nationally and institutionally frame the work, both explicitly and implicitly. The chapter also briefly highlights some key issues that are at present dominant in the field.¹ Running through the chapter are observations of unevenness, emergence and growth.

1.1. FRAMING AND METHODOLOGY

This study draws from the literature on higher education, and the sociology and philosophy of science. Interview transcripts, national and institutional policies and regulations, as well as published journal articles by South African researchers, and to some extent, Master's dissertations and doctoral theses are drawn upon extensively. Methodologically, an iterative approach is used, working firstly, up from the data and secondly, down from the theory to locate the data in the larger theoretical frame.

The main sources of direct data for the report are institutional policies, structures, new teaching practices and interviews with 16 people, generally holding middle management positions, at the intersection of the technological and the educational, within university structures in South Africa. The interviewees are interpreters at the interface between policy makers, on the one hand, and academics and students, on the other. A different picture would have emerged had the respondents been senior level decision-makers or discipline-based academics or students. The respondents were keen not to be personally identified, given that they often raised institutionally based problems.

The respondents by no means comprise a comprehensive list of everyone working in the field. They do, however, provide a sample of a range of employees at South African institutions (as they existed in 2004), including historically advantaged and disadvantaged; primarily English speaking or primarily Afrikaans speaking; technikon and university. No one from the dedicated distance education providers was interviewed, as the focus was on ICTs in the institutions that are chiefly regarded as contact institutions.

¹ This chapter is drawn from a lengthy research report, which maps ICTs in higher education in South Africa. The report provides details from primary sources, fleshes out theoretical perspectives and provides additional sections. The report is available from the Council on Higher Education (2005).

Recent work in technology studies, particularly those of Feenberg (1999) and Brey (2004), are drawn on in order to provide starting points to understand the relationship between ICTs, social context (educational context) and change. Feenberg's four approaches to the relation between technology and society – determinist, instrumental, substantive and critical – proved useful. Brey's (2003:50-54) work helps to explain the ways in which technology and society are co-constructed, or "deeply interwoven". Brey argues that technology is socially shaped and that society is simultaneously shaped by technology. Social-shaping approaches assert that social factors and social processes shape technology, and oppose determinist claims of technological change as a linear process resulting from an internal technological logic. Strong versions of this approach would include social constructivist approaches. Technological-shaping approaches, in contrast, claim that technologies shape their social contexts in various ways – by opening novel possibilities for change, and in their side effects and multiple uses.

Finally, it was deemed necessary to problematize technology – its language, assumptions, strategies, practices and effects – in its different contexts, as a way of exploring both explicit and implicit power relations. This means accepting that technology can at times function to enhance teaching and learning, but it can also disadvantage, stigmatize and exclude people in various ways (Ravjee, 2004a:3-4).

1.2. GROWTH OF ICTS IN HIGHER EDUCATION

A review of the landscape reveals that there has been an increase in interest in technology in many higher education institutions in South Africa since 2000. While in other countries the interest in technology is related to national policy frameworks and impetus provided by funding bodies, this is not the case in South Africa, where there are as yet no specified policies for technology in higher education. Despite this, higher education institutions are spending more of their budgets on ICT infrastructure than in previous years in the face of a poor ICT infrastructure, nationally and in higher education.

The increased interest appears to have occurred for several reasons, the most prevalent being a dominant view, an agreed kind of "common sense", that people are moving towards a new kind of society for which ICTs are considered a basic requirement. Such a society requires a support infrastructure in the form of people with knowledge, skills, and the ability to deliver ICT services. It also involves a reformulation of the nature of learning and the requirements of a graduate. For some, technology is a fact of life and has to be engaged with as a competitive necessity or as a result of current circumstances. Two other common views are, first, that ICTs can play the role of on educational change agency and, second, that technological innovation and educational innovation are intertwined.

Although a few universities had put ICT strategies in place as long ago as the late 1990s, in most cases, this has happened much more recently and, in a few, it has been impossible to find any evidence of action in this arena at all.

With regard to where the interest is coming from, the prime movers are individual academic staff (in the form of champions), senior leadership (either informally or formally) and the students themselves.

In all institutional contexts, individual champions are cited as drivers: staff (academic and non-academic) already using computers, located either in pockets of group activity or largely isolated. These individuals are found in different places in the structures and hierarchies, and come from a variety of disciplines. These individuals became involved, because they had experienced technology on an individual course, or because they were “playing with technology”. Many began as educators using technology for administrative support, and then moved on to experimenting with teaching and learning possibilities from there.

Sometimes, the drivers are individuals at a senior level who recognize and support activity on the ground; and, in this way, succeed in “getting e-learning started on campus”. In at least eight institutional cases, senior level strategic decisions have been taken to support the adoption of ICTs in higher education, with the concomitant significant resources being systemically provided. In some of these cases, particularly historically black institutions, senior level administrators have supported ICT uptake without the institutional resources to partner this commitment, with “money, money, money” being cited as the major constraint, and donors being drawn on for some support. It was observed in one case that larger forces might be needed to drive internal processes, as “we need to be pushed from the outside,” as one respondent confessed.

The third significant group driving the increased use of ICTs is students. They already use computers more than academics do,² and arrive with expectations that ICTs will form part of their higher education experience. They are thus key drivers for change.

2. POLICIES AND STRUCTURES

While ICTs for education at schools and in institutions of further education and training (FET) are prioritized at national policy level in South Africa (Department of Education, 2003), there is a lack of a coherent national policy framework on ICTs in relation to higher education in South Africa. References to educational ICTs in a number of related policies do, however, exist in *ad hoc*, limited and indirect ways.

The importance of ICTs for education, specifically for teaching and learning, is noted in the Higher Education White Paper 3 (1997), the National Plan, the National Research and Development Strategy (2002) and the Foresight ICT report (1999), all of which pair economic change in an information economy with educational change, and relate this to the need for ICT-related graduate competencies.

² See Czerniewicz and Brown’s paper on use of ICTs, 2005, for details.

However, there is no coordination regarding ICTs in higher education across pertinent policy documents and this opens up the possibility of key issues being overlooked while other relevant matters are foregrounded in those documents. The need for a single critical eye on these issues is a matter to be noted and addressed at a national supervisory level or, as the Americans say, at “oversight” level.

At the institutional level, there is a continuum of policy examples of ICTs in higher education. On the one hand, there are formal policies complete with strategic plans and regulatory procedures, as well as statements of policy principles. There are a number of cases of draft policies or of individuals currently engaged in producing them. On the other hand, there is a significant group of institutions where there is no evidence of such policies at all.

A handful of institutions have detailed and comprehensive policies and associated documents in place. Stellenbosch University, for example, has an E-Campus Strategy, an e-learning policy, and a general Information Technology (IT) policy and requires a “minimum electronic presence” (Van der Merwe & Pool, 2002). The University of Pretoria provides another case of a detailed institutional policy framework, with its Telematic Learning and Education Innovation Strategic Plan 2002-2005 (September, 2002). Other institutions, including University of Cape Town (UCT), Tshwane University of Technology and the University of the Western Cape, have formal policy or strategic documents that make their key principles and intentions clear, although there do not appear, as yet, to be accompanying operational or implementation documents.

In other cases, such as University of Fort Hare and the University of Free State (UFS), draft policies exist, and in several cases, policies are being written from the ground up with newly appointed individuals being required as their first task to produce “some sort of policy document” to frame their work.

In some instances, ICTs and teaching and learning are incorporated into related policy documents, such as the Learning, Teaching, and Assessment Strategy at the Durban University of Technology (DUT). However, there do not seem to be any frameworks at all regarding the use of ICTs in higher education in a significant number of institutions.

Policy intentions are first being formally marked and are only articulated later in many institutions. Even without formal policies or regulations in place, there are relevant structures in existence at most institutions, located in several settings, including teaching and learning structures, higher educational development structures, IT structures and faculty departments.

The largest concentration of expertise is located in teaching and learning structures with the more recent trend being to locate online learning in newly created structures, specifically

framed to support higher education development, as at the University of Cape Town, the Durban University of Technology and the University of the Free State.

The location of such centres in learning and teaching structures represents a significant shift from the past, and signals an emphasis on the educational aspect of educational technology. However, despite this, a supportive champion is an important element in the power play of interests, legitimacy and growth. Hence, one e-learning coordinator noted that their director (of a teaching and learning structure) had no interest in e-learning as a tool and had not included that element in the current strategic plan. In another case, the head of the teaching and learning structure indicated that the e-learning structures focused on the “e” part while ignoring the “learning” dimensions. In cases where structures continue to be located in the ICTs services, it was because of a champion supporting the work located there.

Many institutions have two structures, which divide the roles of support, development, research and teaching along traditional academic/non-academic lines. Thus, teaching and researching ICTs is likely to be located in academic departments, such as education or information systems, while non-academic structures play support, service and/or development roles. This division of labour differs from institution to institution, as does the extent of collaboration as well as associated tensions. These structural divides are significant and may be due to a lack of senior level monitoring of the kind of integrated work required of ICTs in higher education, itself a new area spanning 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.

The fragmentation and dispersed location suggest how important individual champions remain at this early stage, especially given the absence of dedicated, coherent policy frameworks. The relationships, at institutional level, between individuals, emerging organizational forms, roles and practices and current uncoordinated policy frameworks need to be explored more fully given the crucial role being played by educational technologists – implicitly and explicitly – as agents of change. Through decisions and choices on the ground, important decisions are being made framing an emerging policy framework, which makes explicit the subconscious allocation of values. While this daily work is exciting and often innovative, it would benefit from conscious policy principles that exemplify the clear objectives of South African higher education.

Attention clearly needs to be paid to the issue of a potential single national policy. There are arguments both for and against an overarching policy, especially in the light of the currently policy intense, higher education environment. A national policy would provide a clear statement of principles, and express values in relation to overall intentions and goals. Such a policy could play a role in ensuring that the required human resource development could take place in a coordinated fashion in a manner that is appropriate and responsive to local conditions. It could also play a role in an accreditation system for the emerging career paths of people working in

his field. However, a new policy would require additional resources in a national department that is already financially stretched. It might also spawn additional regulations which change-weary academics and managers could be resistant to even if the intentions were sound.

3. PRACTITIONER-BASED NOTIONS OF ICTS IN SOUTH AFRICAN HIGHER EDUCATION

The terminology of ICTs in education varies a great deal, although the most commonly used terms are e-learning and online learning. Given the emphasis on the social aspects that were observed throughout this study, it is not surprising that for many it is the “learning” part of the word that is important. E-learning may be associated with a specific pedagogical approach – for example, either instructivism or constructivism – an indication of how diverse the connotations of the concept can be.

There is also lack of consensus about the extent to which e-learning is associated with distance learning, with polarized positions being represented (both that it is associated and that it isn't!) as well as arguments for other terms, including “blended learning” and “open learning”, regardless of the platform on which it occurs. There is occasional use of terms, such as “distributed learning” and “multimodal learning”, but the terms “virtual learning” and “networked learning”, both used regularly beyond South Africa, are not evident in the data collected for this survey.

There is agreement that technology in higher education refers to information and communication technologies, that is, the amalgam of computing and telecommunications technologies, including computers, the Internet, CD-ROMS, software and digitalware. Generally, ICTs refer to networked computers.

For many people in higher education, using ICTs means the web. Thus, the term “web-based” is used as an equivalent to ICTs even when, technically speaking, the two terms are not interchangeable. The shift from stand-alone multimedia machines to inter-connected web-based technologies is noted, with many observing that it is only since the advent of the web that ICTs have been mainstreamed into education.

While there is some consensus about what ICTs are, there is less about what they mean. Such meanings can be evoked by the metaphors used to describe them, as they all reflect serious thought into these issues and clearly place competing ideas about teaching and learning at the centre of the e-learning debate. In addition, while these metaphors refer to ICTs in higher education, they can be seen to reflect larger discourses on the relationship between technology and change, and its role or function in higher education. They can therefore be usefully interpreted through the technological shaping of society and the social shaping of technology, or the co-construction approach that combines elements of both, as described earlier.

The dominant conception of ICTs in education is that of the tool, the nature of which varies. This exemplifies a social shaping perspective, with ICTs generally perceived as neutral. Thus, the comment that “ICT is just a tool, some people see technology as being able to teach people and I don’t believe it can” (I.K.) is typical. This point may extend to the related vehicle metaphor, which leads to a discussion of issues of appropriateness, and the fitness of ICTs for purpose and use, with questions being asked as to what kind of vehicle or tool is needed for specific kinds of tasks.

We have found it necessary to problematize technology further and we argue that it can, under certain conditions, be beneficial or not under other conditions, and is highly dependent on other things such as specific context or the history of the institution. A less commonly articulated approach specifically imbues tools with human values, indeed ‘tools have politics.’ (I.M.)

There is also some indication of approaches whereby ICTs and education are co-constructed. These tended to be expressed in two other metaphors, which are less dependent on images and suggest stand-alone or linear components. These metaphors suggest more systemic approaches: the ecology metaphor and the bloodstream metaphor. Both begin by explaining or defining ICTs in higher education as some kind of network. Interestingly enough, they both move towards describing ICTs in relation to change processes. The bloodstream metaphor is used to indicate networks, but also to suggest a diffusion mechanism by which ICTs are appropriately and selectively utilized, and are mainstreamed into the core business of the university.

The diffusion metaphor is indicative of a theme not covered in this project, that of the processes and mechanisms of organizational change, especially in relation to ICTs. The “how” of such unfolding and elaborate change in institutions is the subject of much international literature and is certainly an area of investigation that would be valuable locally.

4. INTERPRETATIONS OF ICT AND HIGHER EDUCATION CHANGE

Given that ICTs are being taken up in a higher education context characterized by the changes with which ICTs are almost inevitably associated, it is necessary to explore the ways that the intersections of ICTs and higher education change are understood and constructed.

These notions of change are perceived of as “clusters of meaning” which are represented in formal texts, reported practices and meanings in practice. In attempting to understand how meanings emerge, and how meanings are learned, it is important to examine dominant meanings in specific local contexts, in networks of institutional actors. The ways in which contested meanings of ICT within and among groups both shape how institutions use (or do not use) particular ICTs, and give rise to new practices and issues (e.g. prioritization of institutional funds; choice of software) are also considered.

Three clusters of meanings of the relation of technology to higher education change emerge in this empirical research: first, ICT and higher education change as improvement, second, ICT and higher

education change as innovation, while the third locates ICT change in, and as, transformation (in different ways). The first two meanings seem to be located firmly in the overarching globalization discourse on higher education change – evident in the language of improvement and innovation in associated policies, structures and practices – and generally tend to present an unproblematic view of the relationship between ICTs and higher education change. The third meaning seems to oscillate between an optimistic view of technology in transforming higher education, and a critical perspective that problematizes certain aspects of the higher education space.

These three meanings coexist and overlap, contradict and compete, at different times. They jostle with one another and are foregrounded at different times, at different levels within institutions and at meso-levels and at macro-levels, often operating within the dominant meanings of the globalization discourse, but also intersecting with other subaltern discourses to form various clusters of associated meaning and practices.

4.1. CHANGE AS IMPROVEMENT

The idea that the recent ICT inspired changes lead to various kinds of improvements in higher education – from increasing access to higher education, reconfiguring libraries and institutional management and administration, to improving the quality of teaching and learning – is evident in all data forms informing this study. Key terms in this discourse include “enhance”, “improve” and “added-value”. This perspective is expressed in the progress-linked metaphors used to describe e-learning – door, horizons, staircase – which suggest an improvement in the form of a movement to a better place. Thus, one respondent surmised that “... if anything it [e-learning] is a staircase I suppose, because it is a difficult uphill struggle but you get there in the end. Hard work but rewarding, a staircase with a great shining light at the end.” (I.B.)

In this meaning of change, existing relationships, activities and pedagogical practices within the institution remain fundamentally the same. There is neither a threat, nor a fundamental challenge to a sense of identity or an existing notion of what higher education or pedagogy comprises. However, prevalent institutional and pedagogical activities can be accomplished more speedily, or more efficiently, or to a greater extent, thanks to technology. Rather than a fundamental shift in pedagogy or in the higher education space itself, there is rather some kind of added value. The meaning of “change as improvement” is evident in ways that include increased access to content and better communication, and forms part of an efficiency paradigm.

Networked computers are often promoted, because they increase access to content, especially for those in disadvantaged circumstances, and the point is often extended to emphasize how increased access is provided to a larger system, an endless library for all. The quantity of information is stressed, as are the value of immediacy, the ease of updating material, and the speed of research. On the other hand, a repeated criticism of online learning is that it is used too often to “dump” content, and that the real opportunities lie in the communication possibilities of the technologies.

Hence the remark that “a computer is a machine, it has no life to it, it has no personality to it, it’s a creation of man, ok. All that a computer has done, it has made communication a lot more effective”.

The possibilities of extended communication are described in two ways: by collapsing distance and by compressing time. Not only do ICTs offer a larger classroom, but they can also take students beyond the classroom. This leads to an “anywhere anytime” hype, which may mask other factors that determine whether there is a real shift in practice. Therefore, the opening up of distance is described as being experienced in both a positive and a negative light, with explicit links being made to costs and pedagogical approaches. It is observed that extended delivery across distance may be meaningless in isolation, but at the same time, there is a sense that opening up relationships across distance provides opportunities for new models that provide increased control and power.

The questions arise as to the conditions under which these extended possibilities can enhance pedagogical communication and how online communication is being used. These are the subjects of a growing research area, given that the advantages of the medium do not automatically lead to optimum educational use.

Improvement approaches are often associated with an efficiency paradigm where the fundamental nature of the system is not seen as problematic, but rather that the system is not working as well as it should. This paradigm does not seek to transform existing practices, but to make them more efficient. The efficiency paradigm is also viewed in both a positive and a negative light. For some, efficiency means lightening teaching and administrative burdens by automating repetitive tasks, so that the real pedagogical issues can receive attention. However, some argue that common practices are simply add-on approaches, which include using technology for the delivery of course content without adding value in the form of follow-up interactive learning activities, or without addressing issues of curriculum transformation. This is in line with comments from elsewhere that e-learning is currently ‘merely an enhancement of existing practices’ (Garrison & Anderson, 2004).

This perspective is not dominant in the interview data, and indeed references to this approach usually appear in the form of a critique of constant improvement that does not necessarily question the nature of that change.

There is an increasingly common acknowledgement that ICTs, or any other technology, cannot improve teaching and learning or effect change independently of the context of its application. Thus, the degree to which web-based teaching enhances learning depends on the context, and the argument is also made that the context rather than the medium determines the effectiveness and the extent of added value.

In summary, on the positive side, ICTs are seen as providing the tools to make higher education more efficient in various ways – by reducing administrative work and assisting with monotonous teaching activities. On the negative side, efficiency can become a good in itself at the expense of other educational values.

4.2 CHANGE AS INNOVATION

In contrast to the “improvement” paradigm’s focus on adding-on new elements to make the existing system more efficient, innovation approaches emphasize “doing things differently” and are more likely to pay attention to the teaching and learning contexts of technology. The various examples discussed below suggest the meanings attached to “something new.” The associated meanings of ICT-enhanced change as innovation stress the original, the unique, and that which was not previously possible.

The first set of examples focuses on the advantages of the new media forms arising from and part of ICTs. These examples also refer to the use of artefacts for purposes for which they were not originally designed. As more than one respondent suggested, change is about innovation. It is not more of the same thing in a different way “like putting existing stuff behind glass” (I.O.), but it is about doing something new.

Another view emphasizes the role of technology as “forcing” a kind of reflective practice, leading to positive educational outcomes. For example, the requirement in some institutions (locally and elsewhere) for a significant percentage of courses to have an “online presence”, means that all course outlines are now open to public (including other lecturers and students’) scrutiny. It has also led to changes in practice, as one respondent observed. However, it can also be experienced negatively as an imposition with “online presence” requirements at some higher education institutions being met by strong faculty resistance to this kind of mandatory use of ICTs, viewed as diminishing faculty autonomy and independence.³

Another set of examples focuses on the ways that ICTs are understood to offer something new pedagogically, with pedagogical practices comprising relationships between key agents (teacher, student and content) and consisting of a repertoire of teaching and learning activities. Many reported practices (from both respondents and the literature) focus on these new activities and new relationships.

The kinds of examples found locally feed into the large, growing international literature, which demonstrates the myriad possibilities and experiences of new teaching and learning activities now occurring owing to ICTs. References were made to activities to do with content presentation (such as online animations), practical activities, simulations and real life activities, as well as activities that benefited from anonymous learning environments. It was observed that technology provides practical activities with opportunities for safe, self-paced and varied activities not possible in a non-digital context. Ironically, in a medium criticized for policing (Noble, 2002), the opportunity for anonymity as a safe learning experience was noted. The opportunity provided by networked computers for students to create authentic productive activities was also noted.

3 For example, the recent two-month long faculty strike at the University of York in Canada and the similar faculty and student resistance at UCLA provide two comparative cases of resistance to requirements imposed by university administrators to put aspects of courses online. For a further discussion of this see Noble (2002).

Interactivity is believed by many to lie at the heart of the educational experience. It is therefore perhaps not surprising that several respondents and case studies mention the possibilities of ICT-enabled interactivity forming a part of a whole range of different activities online. Indeed, it is even argued that ICTs make it possible for universities to get back to the interactivity that should be central to their work. ICTs are seen to offer tremendous possibilities in improving communication and a sense of presence in large undergraduate classes. Not only does the technology enable lecturer-student communication, but it also specifically highlights the way that it enables peer communication in large classes. It has been argued that technology makes it possible for different interest groups to communicate.

Clearly, online communication and collaboration is an important new practice, one acknowledged at the South African policy level.

ICT has created one specific new form of contact... Online communication allows learners and educators to remain separated by time and space (although some forms of communication assume people congregating at a common time) but to sustain an ongoing dialogue. In online discussion forums for example, spatial separation between educator and learner is removed by the 'virtual' space of the Internet but temporal separation remains... This suggests that there may be cause to suggest a new descriptor of educational methods of educator-learner contact that are not face- to-face but are mediated through new communication technologies. (CHE, 2004: 76)

In addition, new staff and students roles may arise from ICTs. Staff, such as tutors, can play a supportive, monitoring role. At the same time, it is emphasized that ICTs do not mean that there is no longer a role for staff. Student roles are changing, as "this [e-learning strategy] puts much more learning in the hands of the student." (I.D.)

While the examples observed provide a glimpse of emergent innovation in South Africa, there is a need for detailed investigations of these kinds of ICT-enabled activities in South African education with regard to their extent, nature, quality and effectiveness. It was noted too that the meaning of technology-enhanced changes as "innovation" in higher education change tends to focus optimistically on exciting possibilities, but it can be critiqued for undermining existing power relations. This lack of attention to issues of power, knowledge, institutional cultures, and the dynamics of historical redress is also part of a general critique of the information society argument, which generally frames this approach to ICTs (See Ravjee, 2002 and 2004b). Thus, ICTs and innovation are often spoken of in one breath as twinned concepts inextricably linked to the idea of a knowledge society, as can be seen in South African policies at the national and institutional levels.

4.3. ICT-ENHANCED CHANGE AS TRANSFORMATION

In the South African landscape, "clusters of meanings" of change are observed as transformation occurring in two dimensions. The first emphasizes ICT in relation to institutional transformation, while the second is about the relation of ICTs to the transformation of pedagogies.

The cluster of meanings associated with ICT-enhanced institutional transformation emphasizes the power dynamics of integrating ICTs into the very fabric of the institution. Thus, as ICT-related learning structures continue to expand – with differential levels of funding across and within different institutions – they raise new issues that intersect with existing issues facing higher education institutions. ICTs are therefore more likely to form one thread in a complex net of transformation, including historical redress, curriculum transformation, diversity and equity.

Terms, such as “pervasive” and “total”, are observed, forming part of the argument that the introduction of ICTs is extensive and systemic. This understanding is alluded to in a comment on the inter-connectedness of the various elements of the work of the university, how changes in one element inevitably cause changes elsewhere; “all of these old elements [are] like a spider’s web; you pull on one little aspect and all the others start moving, so there was no way we could have done just e-learning ... that is what we found. It was just amazing what jumped out of the cupboard when you start moving the one little piece and still does and it is just amazing... So teaching and learning impacts on research, impacts on admin., impacts on... Incredible.” (I.H.)

This view is also evident in some policies and structures including the National Plan, the Presidential International Task Force on Information Society and Development and the Foresight Report which explicitly associate technology with transformation. This understanding of ICT-led transformation can also be associated with a developmental approach, evident in the strategic location of learning in educational development structures in some institutions. The choice of structures – for example, the location of e-learning structures within a Centre for Higher Education Development as in the DUT, UFS and UCT – itself suggests an integrative approach to institutional transformation. Further empirical studies into the history of these new structures and their emergence out of (or not) existing IT or teaching and learning structures would clarify the understanding of these changes.

Research and reflections published by South African academics consider the tensions implicit within such transformation. For example, one study critically investigates the implementation of online learning technologies at higher education institutions, with the accent on the needs of society and the role of business. The conclusion is that the process may be directed towards the needs of business, while the overarching needs of society are neglected (Heydenrych, 2000a). Another study explores the dilemmas of distributive justice with regard to whether South African universities should introduce or develop online learning for flexible mode delivery under circumstances in which some students do not have access to Information Communication Technologies (Broekman *et al.*, 2002). And yet another study provides some sober reminders of the difficulties dictated by the context, in the form of enabling or constraining conditions. This stance is useful in understanding both how contested meanings of ICT actually shape everyday, normal practices – for example, the choice of what type of technology to use, and what kind of practices emerge to support that choice – and also what power relations are in place to either support or challenge these choices and related practices.

For some, ICT-lead transformation is useful “at the level of techniques” but is unable, if isolated from other transformation initiatives, to speak to the “essence of transformation”. And for others, there is simply no choice. The generally accepted view of technology is the idea that ICTs are necessary if institutions are to survive. One interviewee asserted: “quite frankly, I don’t think if this place has to say we will no longer use ICT technology, so then this place might as well shut down.” (I.P.) While this “do or die” view is widely shared, its dangers are noted in a more critical perspective that suggests that hidden behind the assumptions of the general value of technological innovations are protectionist mechanisms supported by legislation and specific practices, which ironically turn out to be obstacles to innovation.

Because what people usually mean when they talk about knowledge economy is hiding knowledge and protecting it through legislation and keeping it from people and dishing it out to people in bite size chunks that one pays for, and human society has developed over the years largely because knowledge is available and freely shared. ...copyright, patenting everything under the sun ... [these practices are] not protecting innovation, they are killing it. ... So yes, the knowledge economy, yes you can make money out of knowledge but you don't have to do it by protecting and hiding it. (I.H.)

The question is therefore about innovation, but “towards what end?” Is it towards “more of the same” but more efficiently; or is it about “doing things differently” in ways that can fundamentally transform the political economy of neo-colonial higher education practices? There is a strong view in the findings of this research project that these shifts towards supporting teaching and learning require a change in focus, and a change in “mindset” regarding the new functions of ICTs. Thus, the second cluster of meanings relates ICTs to the transformation of pedagogies, where in contrast to much of the international literature, a strongly determinist view was not found in the data collected. The respondents perceived ICTs not as the inevitable cause of change, but rather as an opportunity for rethinking practice. The argument is that it is not technology *per se* that causes change in pedagogical practice. Rather, it is the act of using a new kind technology (usually networked computers), which provides an opportunity for academics to reflect on their practice. Thus, for a sizable group, ICTs play the role of a catalyst for pedagogical transformation. This group of changing practices views technology as neutral, with change occurring in the pedagogy, because of a disruption rather than because of the nature of the technology itself. This view is strongly located in the social shaping approach, one that locates all impetus for change in the social dimension rather than the ascribing any causative effects to technology itself. Using the same pedagogical practices in a different medium can show those practices up in a new light, or it may be the examination of and focus on the new medium, which provokes the attention to existing practices. So,

I see it as an opportunity to go back to the people and say, ‘Listen, let’s just rethink this whole thing, there is a medium that we can use that can open up a whole different approach ... so you can get away from this chalk and talk, which nine times out ten is totally mindless and let’s try and see if we can use it in another way and see what happens’, and the interesting thing about it is that those who have done it, their experiences has been so positive and they have become so excited by it that it just keeps driving them on and on to change more and more and to keep rethinking the whole thing, that has been the interesting part. (I. M.)

There is also evidence of a view that the use of ICTs changes the way not only activities happen, but indeed also the way that thinking itself happens. This perspective accords with learning theories, which argue that activity and cognition are interrelated, with ICTs forming an inextricable mediational link between social and mental cognition. The growth of such theories is important and is being explored by local researchers (such as Frith *et al.*, 2004, Hardman, 2004) following activity theorists (such as Wertsch and Engestrom) to understand cognition, tools and context.

This attention to pedagogical change in context can be observed in many local and international studies, which support the idea that ICTs will enhance teaching and learning if certain other things are in place, particularly if there is a paradigm change (King, 1993; Rogers, 2000) from traditional ways of teaching, and if they are linked to the overall instructional design (Cronje, 1997; Baldwin, 1998; Czerniewicz, 2001) as a central part of the course, not an “add-on” (Green & Gilbert, 1995; Coetzee & du Bruyn, 2003). These explore how ‘modern offerings of programs [sic] can be enhanced considerably [by technology] if planned and implemented properly as long as critical conditions to integrate technologies into teaching and learning are adhered to to ensure optimal application in HE’ (Broere, *et al.*, 2002).

It is illuminating to review the statements in the National Plan:

Some institutions see information technology-related approaches as the central solution to the problems experienced by disadvantaged students. While the innovative use of technology is to be welcomed, there is a strong risk that approaches which focus only on improving delivery through information and communication technology, and which leave traditional curricular structures unchanged, will not provide a comprehensive solution. (National Plan, 2001: 2.3.2)

The understanding of pedagogically led, ICT transformation described in this section indicates that the plea made in the National Plan in 2001 for ICT innovation to be closely aligned with curriculum transformation has been heard, and owned, at least by some.

Overall, the observation was that the first cluster of meanings – of ICTs as improvement – was the least common in the findings. The second two sets of meanings of change – as innovation and as transformation – were more dominant, with both emphasizing local contexts as determining the extent to which ICTs will enhance the quality of the educational experience. Of the various approaches identified in the introduction of this paper, these views coincide most strongly with the social shaping approach to the relation between technology and social context. The third meaning evident in the data corresponds in addition, although in a weak sense, with aspects of critical theories of technology which problematize technology in its different contexts.

5. KEY ISSUES

It became evident during the course of this study that how ICTs are understood and taken up (or not) is context-specific. Thus “context” is a significant theme, because the potential for technology

to enhance teaching and learning happens at certain times and under certain conditions, which are institution specific. This means that technology-led changes need not necessarily lead to improving or changing teaching and learning paradigms in any substantive way, and that ICT-enhanced learning may be contradictorily superficial or deep. These observations about context are linked to four issues, which emerged as significant in this study, each of which is discussed briefly below.

5.1. NEW COSTS, UNEQUAL RESOURCES AND COMPETING PRIORITIES

The growth of ICTs in higher education requires the consideration of new costs in the context of unequal resources and competing institutional priorities. While it was impossible to determine the actual institutional budgets for IT, in general, and for e-learning, in particular, it is clear that ICT related expenditure is a new and rapidly increasing cost item for institutions.

The new cost areas include new infrastructure (networked computers, Internet access, computer laboratories), maintenance and upgrading of existing infrastructure, software staff capacity, training, and other general administrative costs. Several areas, in particular, demand annually escalating costs and involve huge budgets: bandwidth, computer security and new software and information systems (Greaves, 2005).

Overall, the fact that South African institutions are spending more on ICTs as a percentage of their total expenditure than they did five years ago (Greaves, 2005), raises important issues for the higher education sector. The amount that institutions devote to ICT-related expenditure differs by institution and clearly leads to unequal student access to ICT resources, both across institutions (nationally, regionally, and by historical privilege) and within institutions (by faculty, department, student residences, and the status of students by class, level of study, and so on). The possibility of further institutional collaboration, beyond a legal arrangement through the Tertiary Education Network of South Africa (TENET) and via a sharing of ICT resources, deserves further study.

5.2. INSTITUTIONAL MERGERS

The institutional mergers have a number of implications at the infrastructure level, including the integration of operating systems and additional operational costs (see Paterson 2004, for details). Mergers may in themselves be leading to the use of ICTs, particularly in the cases where there are already, or are going to be, multiple campuses.

The merger may itself be seen as the priority, with other matters, such as ICTs, simply having to take a back seat. In contrast to the view that nothing will happen until the newly created institution develops a joint strategy, there is a more common view that the “stronger” partner, the one already using ICTs, is likely to be the dominant one in this domain.

This strategy might be viewed positively with regard to ICTs, as in the comment that, “I’d rather be honest about it and say we’ve been taken over and hence all their policies and procedures and that kind of thing have [been, or] will be transferred here at some stage, ok. But I don’t have a problem

with the ICT, because they really were progressive in relation to what we've done here." (I.D.) Perceptions of being either ICT haves or ICT have-nots are evident from both sides. One respondent observed that his institution was the dominant partner, because the institution it was going to be merging with had shown no interest to date, but that they would have to show an interest once the merger had taken place. In another case, the institution that had already been working with ICTs had assumed responsibility for the institutions that would be joining them and had prepared detailed plans. These kinds of identities can be seen as problematic and can lead to situations of "othering" when potential partners in an institutional merger do not meet as equals. (Such cases are referred to as incorporations.) An unequal partnership is exemplified by a case where students were somehow seen to be at fault for their perceived weaker computer skills, and stigmatised; "The fact that these students who really do not deserve to have an XX University badge on their degree certificate are going to get that, has to do with the merger." (I.J.)

There is a danger that the othering of the partner perceived to be weaker may set up an "us-they" antagonism, where "we" are those who know, and "they" are those who need to be taught. Many of the issues arising from institutional mergers illustrate the fact that the contextualization of change is clearly crucial to exploring the power dynamics of ICT-related change in higher education; particular historical and national contexts present institutions with unique challenges. It is possible to argue that changes arising from the innovative use of ICTs are dependent both on the broader socio-economic and political contexts, and on the local institutional struggles and strategies around the distribution of resources as well as the relational aspects of redressing historical inequities in educational institutions.

5.3. INCLUSION AND EXCLUSION: ICTS AND ACCESS

The strong view found in broad literature until recently that ICTs are great equalizers (see Coombs, 2000, for example) has receded, as the local realities and complexities of implementing ICTs in education in a diverse and divided terrain have become more evident. Increasingly, there is an acknowledgement of new digital divides, emerging out of existing social divides around class, 'race', gender, nationality and disability as impediments to that potential role. These divides restrict higher education access and participation and therefore lead to the continued exclusion and under-representation of historically excluded groups in ICT fields. This makes access to ICTs a redress issue (Ravjee, 2004b).

There is surprisingly little local research into the redress, access and use of ICTs in higher education in South Africa (Van der Westhuizen, 2004). However, a regional study in the Western Cape describes the resources people use, need and draw on in order to gain or acquire access to specific ICT uses and practices; and this study argues that the very resources that people need access to are the same resources to which they will be able to contribute (Warschauer, 2003). Thus, access and use are closely interrelated: access to resources and the creation of resources are interdependent. These resource groupings (see Czerniewicz & Brown, 2004, for details) are a useful way of commenting on the data texts of this present study.

Lack of physical access remains at the forefront of all accounts of access in the literature. As one respondent put it bluntly, “the issue is access – physical access”. This includes the tangible resources of computers and associated telecommunication infrastructure, including appropriate location, availability and adequacy. Estimated personal computer density in South Africa is low at 7.2 in 100 people. There were 3 523 000 South African Internet users in 2004, 7.4% of the population (according to Internet World Statistics). Higher education statistics are hard to find, but it appears that one-sixth of South African users are in the academic sector (Czerniewicz, 2004).

Access to computers is limited, often has a limited starting point, and is very uneven across the sector. One institution reports that less than ten years ago it had 20 computers on campus for students. Another institution reported that the current ratio is still 1:100. The problem is exacerbated by slow telephonic connections, network connections to residences, and lack of broadband access. These problems occur elsewhere in the world.

What is considered adequate access, varies too. In one case, 1:20 is considered a major improvement, but in general this is considered too low. Existing laboratories are full to capacity. At one institution, laboratories are open 18 hours a day, everyday of the week. At another, they are open until midnight, and are reported to be always full. Most institutions have general all-purpose laboratories open to all students, as well as faculty or department-based laboratories in certain disciplines. While these may be discipline appropriate in terms of ICT (for example, it would be difficult to teach Information Science [IS] without computers), there are nevertheless inequalities of resource allocations across faculties.

Access to computers is stressed as an issue throughout the sector, with both previously advantaged and historically disadvantaged institutions complaining of inadequate access to computers. Even those historically advantaged institutions that have prioritized ICTs in both policy and resources are struggling with access, especially as computer-curriculum integration increases, and as varying student needs have to be met.

It is also noted that there is a growing interest in the possibilities of wireless technologies across higher education institutions as the cellular telephone phenomenon, which burst upon South Africa less than a decade ago, offers an opportunity for innovation in a country where 5 million landlines exist in locations which have electricity, yet 18.7 million mobile telephone users are spread across the population at large. This is a particularly promising opportunity to bridge the digital divide as, unlike other kinds of access, students from disadvantaged backgrounds are just as likely to have cellular telephones as their more privileged counterparts (see Barnes, 2004, for details).

In order for individual students or academics to use ICT’s meaningfully for teaching and learning, they need access to personal, collective and contextual resources. Respondents for this project empathized with the relevance of attitudes. However, an interesting difference emerged between students and staff: “I think the students are more ready for it than staff are. And I think

it's due to the fact that it's something new for staff members" (I.O.). This introduces an additional complicating divide, based on age and expectations, and emerging from the cultural context in which the different generations grew up.

5.4. SOFTWARE ISSUES

There is, at present, an increase in South African higher education institutions in the use of online learning environment (OLE) software with the choices essentially being between proprietary software or free and open source software (FOSS). The debates raging over these OLE choices in higher education are not entirely technical. Entangled in them are political, pedagogical and resource issues, many of which relate to broader debates in society about the choices, priorities and decisions for higher education institutional transformation as a whole.

Institutions, which have developed home-grown solutions, are generally realizing that this is a relatively expensive option, and are either looking at alternatives, or positioning their products as open source projects, which can gain wider use and attract external resources, thereby reducing overall development costs for the institution.

At first glance, the choice between proprietary and open source solutions appears to be about cost with proprietary software (such as WebCT) requiring a licence denominated in foreign currency, whereas open source software requires no licence costs. However, in educational and pedagogical terms, the issue is more usefully located within the debate about standardization and flexibility (see Agre, 2000, for elaboration) with a key premise being that ICTs increase incentives to standardize considerably. The key tension lies in separating those elements that need to be standard from those that need to be particular. A university is a particularly diverse environment, a "diverse assemblage" of social and situated practices. These institutions need to have space to be diverse and locally located (in disciplines, levels of study, educational objectives and so on), but they also need to be interconnected, to be able talk to one another, and their hardware needs to be reusable. Standardization can either be a force for uniformity or for diversity depending on how it is designed. The ongoing issue is the extent to which it is able to serve flexibility and diversity and the extent to which its design encourages and supports specific pedagogical practices (while potentially discouraging or constraining others). Complex decisions have to be made regarding competing requirements, balancing affordability, features, flexibility and risk.

A common response to these concerns in open source projects is for institutions to join open source consortia. It is for this reason that institutions, such as UCT and NWU, have joined initiatives like the Sakai Project, which is designed to build a standardized framework within which local solutions can be created. Moodle is another open source solution being adopted by local institutions, including Rhodes University; and the University of the Western Cape is developing a consortium (AVOIR) around its own Knowledge Environment for Web-based Learning (KEWL) product.

Software choice is a hotly contested issue and as Agre (2000) notes, the future is not yet foretold. As he says, “the forces that encourage higher education to standardise its technologies interact with other forces that may push in other directions. Information technology is uniquely malleable and is easily shaped by the ideas and interest of whatever coalition has the wherewithal to guide the development and implementation of new systems”.

It is impossible to do justice to the complexity of these issues here. However, the importance of this debate has been highlighted and the fact that decisions have ramifications beyond the practical question of a software choice has been stressed.

6. CONCLUSION

This chapter has reviewed the current state of play with regard to the conceptualization and utilization of ICTs in South African higher education. It has been noted that, in all senses, this is a new and developing field. There is, as yet, no unanimity in the conceptualization, visualization or utilization of ICTs at institutional level. There has been a great deal of growth in the taking up of ICTs – but it has been uneven growth, largely dependent on individual energy, expertise and on conflicting visions. This diversity was illustrated by the metaphors used by ICT practitioners who were interviewed for this project. These practitioners have a variety of titles, work in a variety of organizational structures and forms, report through a variety of institutional channels, and use a set of metaphors to describe ICTs that are, to some extent mutually exclusive. ICTs – are they neutral, or value-laden tools? Are they stand-alone implements, or parts of larger, complex systems? There is currently no consensus on these fundamental issues in South African higher education.

This lack of consensus could be seen as an opportunity or as a threat. An optimistic view might be that the use of ICT is growing organically, where and as required. And in a field where, internationally, the hardware and software are literally changing on an hourly basis, it would be dangerous to try to impose frameworks and understandings on those individuals who have been with this field at the different institutions, since its inception. From this point of view, the lack of a well-defined national policy – or indeed, of any substantive national policy at all – could be seen as enabling.

On the other hand, the lack of consensus among practitioners could lead to situations where national resources are being lost in institutionally-based enterprises that duplicate one another, or that find scarce funding to go off on the intellectual equivalents of wild goose chases. It also leaves the institutions carrying greater burdens and falling farther and farther behind in a race, which is, by definition, dependent on resource allocation.

With regard to the relationship of ICTs to higher education change, three different notions of change have been observed – as improvement, as innovation and as transformation, with the overarching globalization discourse cutting across these meanings. This discourse forms part of

one playing out in different forms internationally. Also, a strong view of ICTs across these three meanings is in terms of their function or role in higher education.

It is possible to identify other discourses on higher education change, which ask different kinds of questions, and which do not examine ICTs in terms of their function to some end. The decolonization and democratization projects in higher education may be seen as examples of alternative discourses on change that are being submerged or displaced by the hegemonic globalization discourse (Ravjee, 2004b). These debates did not appear in the current data. Given that there is also little consensus in the literature about the relation between ICTs and higher education transformation, it is hardly surprising that the intersection of these debates is fraught with contradictions, ambiguities, and contentious issues.

At the same time it is also possible to identify various intersections and overlaps in meanings as discourses interact and coexist in contradictory practices claiming to support efficiency and improvement on the one hand, and equity and redress on the other. These tensions are most clearly evident in the policy tensions on higher education change in South Africa. For example, recent work in alternative pedagogies draws from both critiques of the commercialization of higher education literature, and the debates around power and knowledge and the recognition of difference in decolonization discourses.

It is therefore emphasized that it is important to problematize technology, which should not be viewed as an automatic good that will automatically enhance teaching and learning in higher education, or straightforwardly change historical patterns of access to higher education. Contextual factors play a crucial role in determining the democratic potential of ICTs in contributing to higher education transformation. South Africa is finding its way to understanding how best this can be done. It can only be said with any certainty that the intersection of ICTs and teaching and learning in South African higher education has put down roots – some shallow, and some deep.

REFERENCES

Agre, P. 2000. Infrastructure and Institutional Change in the Networked University. *Information, Communication and Society* 3(4):494-507.

Baldwin, R. 1998. Technology's impact on faculty life and work. *New Directions for Teaching and Learning* 76:7-21.

Brey, P. 2004. Feenberg on Modernity and Technology. [Electronic] Available: <http://www.rohan.sdsu.edu/faculty/feenberg/brey.htm> [Accessed: 2004/08/06].

Barnes, T. 2004. UWC student perceptions and experiences of aspects of academic and student development services. Unpublished report, CSHE, UWC.

- Bridges.org. 2001. Spanning the Digital Divide: Understanding and Tackling the Issues [Online] Available: <http://www.bridges.org> [Accessed: 2004/0717].
- Broekman, I, Enslin, P. & Pendlebury, S. 2002. Distributive Justice and Information Communication Technologies in Higher Education in South Africa. *South African Journal of Higher Education* 16(1):29-35.
- Broere, I, Geysers, H. & Kruger, M. 2002. Technology Development: Imperatives for Higher Education. *South African Journal of Higher Education* 16(3):5-12.
- Coetzee, G. & Du Bruyn, R. 2003. The Benefit of Introducing Audit Software into Curricula for Computer Auditing Students: A Student Perspective from the University of Pretoria. *South African Journal of Higher Education* 17(2):21-30.
- Coombs, N. 2000. Transcending distances and differences. *AAHE Bulletin* 53(2):3-5.
- Cronje, J. 1997. Interactive Internet: Using the Internet to Facilitate Co-operative Distance Learning. *South African Journal of Higher Education* 11(2):
- Czerniewicz, L. 2001. Reflections on learning online – the hype and the reality. *South African Journal of Higher Education* 15(3):17-23.
- Czerniewicz, L. & Brown, C. 2004. Access to ICTs for Teaching and Learning – From Single Artefact to Interrelated Resources. Paper presented at Emerge Conference, Cape Town.
- Czerniewicz, L. 2004. Cape of Storms or Cape of Good Hope? Educational Technology in a Changing Environment. *British Journal of Educational Technology* 35(2):145-159.
- Department of Arts, Culture, Science and Technology. 2002. *South Africa's National Research and Development (R&D) Strategy*. Pretoria: Government Printers.
- Department of Education. 1997. *White Paper 3: A programme for the transformation of higher education*. Pretoria: Government Printers.
- Department of Education. 2001. *National plan for education*. Pretoria: Government Printers. Online [Available]: <http://www.polity.org.za/html/govdocs/misc/higheredu1.htm?rebookmark=1>
- Department of Education. 2003. *White Paper on e-education*. Pretoria: Government Printers.
- Department of Science and Technology. 1999. Foresight ICT Report. Available at http://www.dst.gov.za/reports/foresight_reports.htm

- Feenberg, A. 1999. *Questioning Technology*. London and New York: Routledge.
- Fregona, C. & Pete, M. 2004. Re-derivars, Scaffolders and Explicators: the Role of WebCT in Knowledge Design for 21st Century Learners. Paper presented at WebCT Innovative Impact Conference, 5-6 April 2004, University of Stellenbosch.
- Frith, V, Jaftha, J. & Prince, R. 2004. Evaluating the Effectiveness of Interactive Computer Tutorials for an Undergraduate Mathematical Literacy Course. *British Journal of Educational Technology* 35(2):159-173.
- Garrison, R. & Anderson, T. 2003. *E-Learning in the 21st Century: A Framework for Research and Practice*. London: Routledge Falmer.
- Greaves, D. 2005. e-mail communication.
- Green, K.C. & Gilbert, S.W. 1995. Great Expectations: content, communications, productivity, and the role of information technology in higher education. *Change* 27(2):24-27.
- Hardman, J. 2004. Activity Theory as a Potential Framework for Technology Research in an Unequal Terrain. Paper presented at Emerge 2004. [Online] Available: <http://emerge2004.net/profile/abstract.php?resid=10> [Accessed: 2005/04/28].
- Heydenrych, J. 2000a. A Critical Appraisal of the Implementation of Online Learning Technologies: Society, Higher Education and Business. *Progressio* 22(2):58-68.
- International Telecommunication Union (ITU) (2003.) Africa, ICT Indicators [Online] Available: <http://www.itu.int/ITU-D/ict/statistics/> [Accessed: 2004/06/17].
- King, A. 1993. Making the transition from “sage on stage” to “guide on the side”. *College Teaching* 41:30-35.
- Misa, T., Brey, P. & Feenberg, A. 2004. *Modernity and Technology*. Cambridge, Mass.:MIT Press.
- Noble, David F. 2002. *Digital Diploma Mills: The Automation of higher education*. New York: Monthly Review Press.
- Paterson, A. 2004. Information Systems and Institutional Mergers in South African Higher Education. Paper presented at Emerge 2004 Cape Town. [Online] Available: <http://emerge2004.net/profile/abstract.php?resid=25> [Accessed 2005/04/28].

Ravjee, N. 2002. Neither ivory towers nor corporate universities: moving public universities beyond the “mode 2” logic. *South African Journal of Higher Education* 16(3):82-88.

Ravjee, N. 2004a. Problematising the Relation of ICTs to higher education transformation in South Africa. Paper presented at the HictE mini-conference, UWC, Cape Town, South Africa.

Ravjee, N. 2004b. Competing Perspectives on ICTs and Higher Education Transformation. Unpublished paper. Cape Town: CSHE, UWC.

Rogers, P.L. 2000. A Paradigm Shift: Technology integration for higher education in the new millennium. *Educational Technology Review* Spring/Summer. pp.19-33.

University of Pretoria. 2002. Strategic Plan: Inspiring the Innovation Generation 2002-2005. [Online] available: http://www.up.ac.za/beta/about/eng/strategic_plan.pdf [Accessed: 2004/06/05].

University of Pretoria. 2004. Education for Technology, Technology for Education, University of Pretoria Technology Plan. Pretoria: University of Pretoria.

Van der Merwe, A. & Pool, B. 2002. The E-Campus Initiative at the University of Stellenbosch. University of Stellenbosch, Paper published at the www2002Conference, RAU, See URL: http://general.rau.ac.za/infosci/www2002/Full_Papers/VdMerwe%20A_%20PB/VdMerwe&Pool_ECampus.pdf [Accessed: 2004/06/03]

Van der Westhuizen, D. 2002. Online learning in the South African context: a meta-analysis of research trends, issues and topics, published in proceedings of SASE conference 2002, South African Society for Education, Pretoria.

Warschauer, M. 2003. *Technology and Social Inclusion: Rethinking the Digital Divide*. Cambridge, MA: MIT Press.

Wertsch, J. V. 1991. *Voices of the mind: A Sociocultural Approach to Mediated Action*. Cambridge, MA: Harvard University Press.

