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Emergent Research from Southern Africa

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About the journal

The International Journal of Education and Development using Information and Communication Technology (IJEDICT) is an e-journal that provides free and open access to all of its content.

Regional economies and communities are facing increasing economic, social and cultural hardship in many parts of the world as economies adjust to the demands of the new orders of commerce and governance. A part of this is the paradox that regional economies and communities can be either enhanced or disadvantaged by information and communication technologies (ICT) products and services. The potential enhancement comes from the increased social, economic and cultural capital that comes from harnessing ICT products and services in a community sense. The disadvantage comes from the power that ICT products and services have in centralizing commerce, service provision and governance away from the regional community.

Unless we get a greater level of access AND adoption of information and communication technology (ICT) for education and development at community level, we will miss the opportunity to turn the "digital divide into a digital opportunity for all, particularly for those who risk being left behind and being further marginalised" ("Declaration of Principles", WSIS-03/Geneva/Doc/4-E, Principle 10). The International Journal of Education and Development using Information and Communication Technology (IJEDICT) is an e-journal, with free and open access, that seeks to address this issue.

IJEDICT aims to strengthen links between research and practice in ICT in education and development in hitherto less developed parts of the world, e.g., developing countries (especially small states), and rural and remote regions of developed countries. The emphasis is on providing a space for researchers, practitioners and theoreticians to jointly explore ideas using an eclectic mix of research methods and disciplines. It brings together research, action research and case studies in order to assist in the transfer of best practice, the development of policy and the creation of theory. Thus, IJEDICT is of interest to a wide-ranging audience of researchers, policy-makers, practitioners, government officers and other professionals involved in education or development in communities throughout the world.

Coverage

IJEDICT has a major emphasis on the use of ICT in education and development in hitherto less developed parts of the world. The journal includes descriptive case studies about ICT projects in developing countries and in rural and remote regions of developed countries, as well research articles evaluating such projects, developing policy or creating theory. Topics covered include, but are not limited to, the following areas:

Community informatics and development in remote, rural and regional areas;
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This section contains articles that have been reviewed by at least two academic peers in a process that ensures that authors and reviewers remain unknown to one another. To be included in this section, articles must be based on research and scholarship, and contribute "new" and significant knowledge to the field of ICT for education and/or development. Reviewers for research articles are selected from the Editorial Board, the Review Board and the Peer Review Panel.

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This section includes peer-commented and editorially reviewed case studies (2000-5000 words) of the use of ICT in education and/or development.

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This section includes peer-commented and editorially reviewed articles describing research in progress.

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Project Sheets

This section includes brief descriptions (500-1000 words) of education and development projects that utilise ICT.

Notes from the Field

This section contains short comments or notes that are useful for practitioners working in the field of ICT in education and/or development.

Book/Media Reviews

This section contains editorially reviewed reviews of books that are relevant to the use of ICT in education and/or development.

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- Please use Arial 12-point font for the Title, which should be in bold "title" (upper and lower) case.
- Use Arial 10-point font for the remainder of your article.
- First level headings should be in bold uppercase.
- Second level headings should be in bold "title" (upper and lower) case.
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- References should relate only to material cited within the manuscript and be listed in alphabetical order, including the author's name, complete title of the cited work, title of the source, volume, issue, year of publication, and pages cited. See the following examples:

  Marshall, S. (1991), "A genre-based approach to the teaching of report-writing". English for Specific Purposes, vol. 10, no.1, pp. 3-13.

  Taylor, W. & Marshall, S. (2002), "Collaboration: the Key to Establishing Community Networks in Regional Australia", Informing Science, vol. 5, pp. 155-162.

Marshall, S., Taylor, W., & Yu, X. (eds.) (2003), Closing the Digital Divide: Transforming Regional Economies and Communities with Information Technology, Greenwood Publishing, Westport CT.

- Citations in the text should include the author's name and year of publication where you use the source in the text, as in the following examples:

  In this way, information technology can be seen to effect and influence changes in organisational structure (Orlikowski & Robey 1991).

  Edwards (1995, p.250) views the globalising of distance education as "invested with the uniform cultural messages of modernity".

  Globalisation, especially in relation to open and distance education, will reduce the tolerance of difference and so "how can local issues and contexts be addressed?" (Evans 1995, p.314).

- Further information about the Harvard editorial style can be found at:

  http://lisweb.curtin.edu.au/referencing/harvard.html
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Editorial: Emergent Research from Southern Africa

Tony Carr and Laura Czerniewicz
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INTRODUCTION

Welcome to this Special Issue of IJEDICT which features peer-reviewed papers from the e/merge 2006 online conference on the use of online and mixed mode collaborative learning in Southern African tertiary and secondary education.

Educational technology is being taken up in African countries in difficult conditions, arising from both national infrastructural challenges and specific challenges faced by the education sector itself. The uptake of ICTs for education is to a large extent dependent on how enabling the national environment is, particularly in terms of the availability of national telecommunications and ICT infrastructure. This is particularly relevant in the developing world (Shabani, 2007). Although the 'digital divide' is said to be shrinking with respect to fixed line telephones, mobile telephones and the internet, crucial gaps still exist. There are still enormous gaps between low income countries and high income countries; for example the US has approximately 40 times more telephone main lines per 1000 people than Ghana.

A second generation of the digital divide is emerging through differential access to bandwidth. Limited access to bandwidth restricts access to information and communication and the ability to use new media applications, social software and virtual worlds. The cost of international bandwidth is also a major constraint for developing countries which often have to pay the full cost of a link to a hub in a developed country, thus up to more than a thousand times more[1]. For example the cost of bandwidth in Uganda is 288 times more expensive than the in US yet Internet connections in Uganda are 8 times slower than the US.

How can educators find ways to use educational technologies in these diverse and difficult contexts? While lobbying for better conditions and infrastructure is an ongoing essential strategy, other effective strategies include the harnessing of ubiquitous technologies such as cell phones, clever uses of relatively low-end technologies and the sharing of human capital in the form of collaborative work. The papers in this Special Issue provide examples of interesting and innovative uses of technologies in difficult circumstances, and the way that these innovations are being conceptualized and understood.

The papers are themselves an output of an African collaborative venture -the e/merge online conference - designed to share experiences, enable synergies and facilitate research/practice interaction.

ABOUT E/MERGE

The e/merge online conferences were initiated in June 2004 with funding from South Africa's TENET (Tertiary Education Network) as a conscious response to the lack of interaction between educational technology researchers and practitioners across Southern Africa. In fact it was observed that Southern African educational technologists often had closer collaborative relationships with research partners in other continents than with colleagues in the same country or city. One of the worrying implications was that good practices developed in one setting were often unavailable to colleagues across the region. Both the 2004 and 2006 conferences were

designed to share good practice and knowledge about educational technology innovation within the tertiary and secondary education sectors in the region, as well as to strengthen communities of researchers and practitioners. They also shared a focus on collaborative learning involving a blend of online and face to face interaction in the Southern African context of unequal access to technology.

E/merge 2006 involved 237 participants including 40 presenters from 12 African countries and across 5 continents in two weeks of asynchronous and synchronous interaction in July 2006. The 29 presentations and 4 online workshops were scheduled in four phases of online interaction which focused on high level examination of the environment and research methodologies, online and mixed mode learning in organizations, collaborative learning communities and online learning environments. Each phase of conversation lasted three days to allow for the mostly asynchronous conversation to develop. Many of the presentations inspired lively conversation well beyond the end of their scheduled phase. All of the abstracts and ten of the papers were peer reviewed. Between e/merge 2006 and this Special Issue of IJEDICT one of the peer reviewed papers was withdrawn and a further two e/merge 2006 papers have been peer reviewed. A few of the authors in this issue are well established and extensively published researchers while several represent a new generation of researchers which will provide the future leadership in this field.

The papers in this IJEDICT are a contribution to the growth of research into educational technology in developing contexts. In many Southern African universities and school systems the establishment of educational technology systems is likely to take higher priority than researching these rollouts. Educational technology is still a severely under-researched field even in South Africa when compared with regions such as Europe, North America and Australasia. Thanks to funding from the Ford Foundation we will soon be able to announce the dates for e/merge 2008. We hope that many of you will be able to join us as participants or authors.

MAKING SENSE OF THE RELATIONSHIP BETWEEN EDUCATION AND TECHNOLOGY

Educational technology issues in Africa are both deeply specific and closely aligned with global educational technology issues. Global issues are refracted through local contexts, and sometimes their omission is as telling as their presence and in the way they are expressed.

Global educational technology trends are not neatly divisible by location: the divide is not only between developed country and developing country, although the broadband divide is certainly maintaining this abyss. Divides may also be between the connected and the disconnected within countries; it has been noted that new geographies of space and access have reconfigured the world and we are now defined by our place within or outside of information based nodes (Castells 1996).

In a world that is shifting and changing at so many levels, how does one make sense of the relationship between education and technology? Three of the papers in this Special Issue address this question, from three different perspectives - political, strategic and theoretical.

Neetha Ravjee's paper asks hard questions about the role of ICTs in relation to higher education as a sector and specifically considers the nexus of ICTs and educational change. This paper problematises generally held assumptions, and provides a probing political analysis of the approaches informing the relation of new ICT-mediated practices to higher education change. The paper supports a framework that both embraces the possibilities offered by online pedagogies, and problematises central aspects of the political economy and cultural politics of e-learning in higher education.

Nhanhla Mlitwa asks how to make sense of ICT in HE, and specifically what theoretical lenses will provide assistance in order to adequately explain emerging patterns. The paper explores a possible framework for the analysis of goal-directed applications of technology in teaching and learning environments, arguing for the value of both activity theory and actor-network theory.

Shaheeda Jaffer, Dick Ng'ambi and Laura Czerniewicz take a strategic view of the possibilities of ICTs for addressing HE challenges and for ensuring that technological possibilities are viewed in the context of educational needs. Using case studies from one higher educational institution, this paper shows how specific and carefully considered interventions using ICTs can be used to address these teaching and learning concerns.

SOCIAL-ECONOMIC ISSUES

The socio economic issues which frame and are influenced by ICT in education include the pressure to produce new kinds of ICT-literate citizens for a transforming knowledge society; the possibilities of "borderless education" as an outcome of the networked society; new forms of digital divides emerging out of existing social divisions based on class, gender, nationality and disability; the need for specific national policies to enable educational technology in education to build information societies; and the profound resource challenges dogging education throughout Africa.

In such fraught resource and policy terrains, informed decisions about appropriate use of scarce funds are essential, making the kind of research undertaken by Andrew Paterson and reported on in his paper quite crucial. He observes that despite the steady decline in the relative cost of acquiring ICTs, the cost of owning and maintaining sustainable computer systems in schools is rising, while simultaneously, Ministries of Education in sub-Saharan Africa are under pressure to invest. Based on a survey of total costs of owning computer rooms in 62 schools across Botswana, Namibia and the Seychelles, the argument is made that high expenditure is not necessarily associated with efficiency of resource usage, and that internationally benchmarked research is needed in order to support optimal decision making.

ORGANISATIONAL ISSUES

As the use of ICTs in institutions becomes an expectation and a demand, complex organisational issues arise. These include the development and implementation of ICT integration strategies, given that organisational culture shapes the implementation of ICTs for teaching and learning; the need for appropriate educational technology structures; the pressure for effective staff development. It is these multi-faceted staff development strategies, so essential to the successful integration of ICTs into teaching and learning, which are addressed in a cluster of papers in this Special Issue.

Juliet Stoltenkamp, Carolynne Kies and James Kariuki reflect on the lessons learnt from creating a new structure and institutionalising ICTs in one university. A newly established centre experienced rapid growth, and required complicated alignment with existing structures. Hard lessons were learnt regarding realistic expectations in the face of the wide range of attitudes held by educators. The shift from a pioneering phase to a mainstreaming phase where elearning is implemented as a core strategy of the whole institution included the design and implementation of a systematic training programme for staff and students.

Similar challenges are faced at a university in the neighbouring country of Botswana, where a more formal programme is run with an accredited certificate as one of the outcomes. Daniela Gachago, Spoon Mafote, Anne Munene-Kabanya and Marilyn Lee's paper reports on the evaluation undertaken to ascertain the effectiveness of the programme. While workshops were considered valuable by academics, only a small percentage of academics managed to fulfill the certificate requirements, highlighting institutional constraints and raising important issues about accreditation and recognition.

From an entirely different perspective, Andrew Deacon and Catherine Wynsculley use rhetorical analysis methods to illuminate the informal strategies utilized to build a sense of community amongst academics. They demonstrate how seminars in staff development programmes where academics share their experiences with one another take a form quite distinct from workshops, best practice seminars or research seminars. The original use of rhetorical analysis provides a credible lens to describe the ceremonial manner in which academics persuade one another of the value of their experiences.

PEDAGOGICAL ISSUES

At heart, educational technology is about learning. There are a considerable number of inter-related issues which fall into the pedagogical domain. These include: the percolation of new ICT-mediated social practices into the educational arena; the challenges to traditional methods of content creation and sharing; the rise of open education resources, the increased possibilities for plagiarism, the ways that teacher-student relationships are being challenged and reconstituted; the disjunctures between new online activities and traditional forms of assessment; and the pressures faced by students as ICT-literacy becomes a foundational competence. How does one ensure that ICTs really support deep conceptual learning? What happens when pedagogical activities and beliefs about assessment clash? How can new possibilities for ICT mediated informal learning be understood? Can unusual subject areas be effectively taught online? These are the questions addressed in the papers with a pedagogical focus in this special issue.

Andrew Scholtz's paper addresses the assessment issue head on when he explores the tension that exists between social constructivist-informed authentic assessment practices and the belief systems and expectations of educators, administrators, employers and parents. The paper highlights the concerns that psychometricians have with assessment in constructivist learning environments, particularly with respect to high stakes accountability testing. Scholtz concludes that this difference is of particular concern given that the literature is fairly unanimous in its support of social constructivism as the pedagogy of choice in technology-mediated learning.

Steven Yates' paper focuses on the unusual phenomenon of an online course in the area of martial arts. He uses an evaluation framework, called the 'eclectic-mixed methods-pragmatic paradigm' that allows for a flexible approach to the design, delivery and evaluation of interactive learning systems, and the systematic use of questionnaires, expert reviews, and course interactions. The findings indicate that learners gained favourably in knowledge, skills and attitudes.

Joanne Hardman's paper provides a deeply theorized way to understand learning in context. It demonstrates a methodology for studying the object of mathematics lessons (in a primary school classroom) by exploring notions of object-oriented activity, before discussing the conceptual challenges arising from its use in two contemporary versions of activity theory. The paper elaborate a methodology for using activity theory to analyse observational data and finds that an evaluative episode can serve as a moment in which the dynamism of an activity system is momentarily frozen, enabling one to model human activity in the system under investigation.

Raymond Kekwaletswe's paper shifts the focus from the formal to the informal. Learning does not only take place in classrooms and courses, and ICTs offer unprecedented opportunities for informal peer-to-peer communication in support of learning activities. This paper conceptualises a mobile learning environment that provides social presence awareness as a learner traverses different learning contexts. It highlights how through synchronous mobile instant messaging, social presence provides learners with continuous awareness of available social support, thus facilitating the on-demand and opportunistic sharing of knowledge.

CONCLUSION

Reflection on practice and research on educational technology in developing and difficult contexts is an essential way for lessons to be learned and shared. This Special Issue is a contribution to this process. We hope that you will find the papers as illuminating, challenging and intriguing as we have. We are grateful to Stewart Marshall of IJEDICT for the opportunity to publish in an excellent journal which is focused on developing contexts. The authors will welcome engagement concerning their papers and research contexts, and can be contacted directly. We will soon be announcing the dates for e/merge 2008 which will be broadening its geographic base to include active recruitment of educational technologists in East, West and Central Africa as well as Southern Africa.

ENDNOTE

[1] The range is enormous - from 2,448 US dollars per month in Mozambique for high speed broadband to 20 US dollars per month in the United States (ITU, 2005 Internet of things). If speed of the broadband is compared, the differences between the cost of broadband become more glaring with differences ranging from 512 kilobits per second in Uganda to 4 Megabytes per second in the United States (ITU, 2005 Internet of things).

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RAT Online. The Wheel Spanner: An online self-defence course

Steven Yates
Derivco

ABSTRACT

The task of design, delivery and evaluation of online learning environments is a complex one. There is a multitude of learning approaches, software design tools and evaluation methods from which to choose. This paper focuses on the design, delivery and evaluation of an online course in Rough and Tumble (RAT), a South African martial art (wheel spanner for self-defence). The researcher uses the 'eclectic-mixed methods-pragmatic paradigm' as a theoretical framework, which allows researchers to link in other relevant theories. Development research forms the core research methodology, allowing the researcher to carry out both formative and effectiveness evaluation. Learner output, as well as questionnaires, expert reviews, and course interactions indicate that learners gained favourably in knowledge, skills and attitudes. Positive and less positive feedback forms a useful part of the evaluation guiding the researcher in further decision making for other online courses of this nature.

Keywords: *Multimedia, martial arts, knowledge representation, constructivism, development research*

INTRODUCTION

In this paper, the researcher evaluates a Rough and Tumble (RAT) online course on how to use a wheel spanner for self-defence. This paper forms part of a larger project known as the RAT Online project, which consists of a series of online courses and a multimedia resource CD-ROM known as the RAT CD-ROM. This project was initiated mainly because of an increasingly geographically dispersed learning community.

RAT is a martial art of South African origin. Practitioners may use principles from various martial arts from around the world and from a wide variety of martial arts disciplines. RAT is a martial art developed to answer the practical needs of specific real-life applications. The researcher created, developed and expanded RAT in the early 1990s to deal with a greater number of self-defence situations than conventional martial arts can offer.

The wheel spanner used for this course is the four-sided variety used for changing car wheels. Because of the incidence of violent crime on the roads in South Africa, the wheel spanner course may be beneficial to motorists who find themselves stuck on the roadside. RAT practitioners generally do not carry weapons, but they are expected to be able to use implements found in their environment as weapons should they be required to do so. This mindset is similar to some old martial arts where practitioners adapted farming implements as weapons.

RAT and other martial arts learning situations do not only involve learning physical skills. Learners need to develop a high degree of creativity as well as appropriate and ethical attitudes. In the RAT Online courses, the researcher aims to develop creative and evaluative cognitive abilities in learners through well-planned learning activities and collaborative tasks with tools such as discussion forums and simulation tools. The tasks encourage the development of appropriate attitudes, and the final video grading exam tests that physical skills have been developed. These exams have to be unedited video recordings showing a continuous flow of activities and skills.

This enables course examiners to observe whether participants have taken the time to practise the skills, as the exam covers a broad range of activities. It would be difficult to record the grading exam in an unedited version without first having practised the skills.

The next section of this paper states the main aims of the course and then describes the theoretical framework, followed by the methodology section. There is a discussion of the course and the evaluation, and, in conclusion, some closing remarks.

AIMS OF THE COURSE

The aims of this course and evaluation are reflected in the main research questions of the RAT Online project. This study set out to determine the following:

Can RAT martial arts knowledge, skills and attitudes (KSAs) be facilitated in computer-supported learning environments?
What design would constitute effective martial arts computer-supported learning environments?
What kinds of learning activities and software tools are effective in martial arts computer-supported learning environments?

These questions help guide a formative process of RAT Online course design, delivery and evaluation based on a theoretical framework and methodology.

THEORETICAL FRAMEWORK

The researcher makes use of an evaluation framework, called the 'eclectic-mixed methods-pragmatic paradigm' (EMMPP), which is a theoretical framework that allows for a flexible approach to the design, delivery and evaluation of interactive learning systems (Reeves & Hedberg, 2003). The EMMPP allows researchers to adopt different perspectives and theoretical approaches depending on the practical needs of a project. In this project, there are three main theoretical sections: EMMPP, RAT, and learning. EMMPP is the theory that binds the study together. The RAT section includes the underlying principles of RAT, Chomsky's universal grammar (UG) (Chomsky, 1965; Cook, 1988; Cook & Newson, 1996), and the prototype theory of semantics (Taylor, 1989). The learning section includes social constructivism and Vygotsky's Zone of Proximal Development (ZPD) (1978), cognitive flexibility theory (CFT) as discussed by Spiro, Feltovich, Jacobson & Coulson (1991), and Bloom's Taxonomy (cognitive, affective and psychomotor – KAS/KSA) (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956; Krathwohl, Bloom, & Masia, 1964; Singer, 1982).

Outside martial arts practitioners consider RAT an eclectic martial art, as RAT practitioners use principles and techniques that are found in a variety of martial arts. RAT practitioners, on the other hand, think of RAT as a complete martial art that allows learners to incorporate any self-defence principle.

Chomsky's UG provides an analogical framework, as Chomsky (Cook, 1988) tries to provide a framework of principles that apply to all languages, in which individual languages, such as English, are instances of the universal set of language rules. RAT practitioners encourage an open-minded approach to combat where all principles of combat are important and individual martial arts are instances of the universal set of martial arts principles. The course facilitator encourages this approach in all courses.

Prototype theory (Taylor, 1989) is another analogical linkage from linguistics. Prototype theorists recognise that different people understand concepts in different ways and have different mental images of concepts, such as 'shoe' for example. Females and males may have different mental images of these words and yet individuals somehow know what is meant when speaking. In this approach, it is possible for people to change attributes of concepts to 'create' different mental images. For example, if we change one attribute of a female's high heel shoe, such as the heel, to a flat heel, it would be a different shoe. One could create a 'meaning chain' by continuously changing the attributes of the shoe until it included all examples of shoes and also peripheral examples of the word shoe, such as 'boot', or 'slipper'. RAT practitioners use this to develop new techniques by applying the idea of meaning chains to self-defence techniques. RAT practitioners call this multiple contextual training (MCT). In all courses and training, facilitators encourage learners to (1) change the characteristics of individual techniques, such as a straight punch to a hook punch along such meaning chains to create new techniques; and (2) to change the attributes of self-defence situations using a single technique. For example, a particular defence to a front strangle might be used in multiple situations, such as a punch attack, or a hair grab attack.

Vygotsky (1978) speaks of a Zone of Proximal Development where learners can solve problems with the help of more knowledgeable peers. Learning occurs in socially mediated environments. The researcher applies a social constructivist approach in the wheel spanner course. Learners are expected to construct new techniques from self-defence principles through a process of dialogue and collaboration. This is far more valuable in self-defence situations compared to merely mimicking the techniques of others, as you can develop and improve the techniques and principles to deal with new self-defence problems.

The researcher structured the course around Spiro et al's (1991) Cognitive Flexibility Theory, which says that learning can be structured at less advanced levels, but at advanced levels, learning is far more ill-structured and does not necessarily follow a linear path. The wheel spanner course began with tasks to introduce learners to topics that they may want to think about and techniques that they could experiment with, but later tasks were far more complex, requiring learners to create a syllabus based on their own understanding, experience and what they gained from others. The objectives and assessment criteria of such tasks were clear, but the tasks were open-ended.

Bloom (1956) classified educational objectives into three broad objectives: knowledge, attitudes and psychomotor, which is known as Bloom's Taxonomy. All the tasks in the wheel spanner course were constructed with objectives that addressed one or a combination of these objectives. Learners had easy access to the assessment criteria that were derived from the objectives. Learners had to physically demonstrate their knowledge and skills; create and evaluate knowledge, and this was done through a collaborative approach.

The researcher uses a methodological approach that logically conforms to the EMMPP: development research; this is discussed next.

METHODOLOGY

Development research allows the researcher to make design decisions based on a theoretical framework and evaluate the design according to the framework (Reeves & Hedberg, 2003, p 274). This is a formative process where learning system designers can use theory in a practical way. The researcher uses formative and effectiveness evaluation in the RAT Online project. The researcher will use the results of this study to improve the next online course, the Belt course. This course and evaluation is an 'experimental course' to move closer to better course design and evaluation principles.

Methods, Instruments and Analyses

The researcher uses Reeves & Hedberg's (2003, p144) evaluation criteria to evaluate the wheel spanner course: functionality, usability, appeal, and effectiveness, which are incorporated across several research instruments. Such a multi-dimensional study requires several methods of data collection and several data collection instruments. The researcher adopts a mixed-methods approach to data collection and analysis in this study. The research methods are grouped into the following three categories in this study: expert evaluation (user interface rating form and teaching evaluation form), learner feedback about the course (online questionnaire, post-questionnaire interview, and course assessment) and records (participant observation and email communication).

Due to the small number of participants in this study (see The Wheel Spanner Course: Participants), the researcher makes minimal use of quantitative data. The researcher uses SPSS (a statistical software package) to generate basic frequency statistics to analyse the online questionnaire. Most of the data analysis is qualitative in nature and the researcher uses QSR NVivo (a qualitative software analysis package) to analyse the data. In cases where the textual data is minimal, the researcher uses a manual reading approach to analyse the data.

Some of the instruments allow researchers to gain a visual sense of the data collected, such as the expert review instruments. The researcher uses the instruments as a convenient method of analysing data and to make practical design decisions.

Expert review

User interface rating form

For the expert evaluation, the researcher administered a user interface rating form and a teaching evaluation form. The user interface rating form (Figure 1) helps the researcher make decisions and comparisons between evaluators about the functionality, usability, and appeal of the learning environment (Reeves, 1997). This evaluation tool is a blend of criteria used by Nielsen (1994b), Reeves & Hedberg (2003) and Tognazzini (2003) and has been adapted accordingly. The researcher constructed the instrument with the aim of incorporating as inclusive a range of evaluation criteria, while at the same time ending up with a tool that would not be too demanding on evaluators' time. The power of the instrument lies in its visual characteristics, and therefore the instrument would need to fit onto a medium (e.g. a single A4 page) that would allow easy viewing. Evaluators were given a user interface rating form that contained a full description of each criterion.

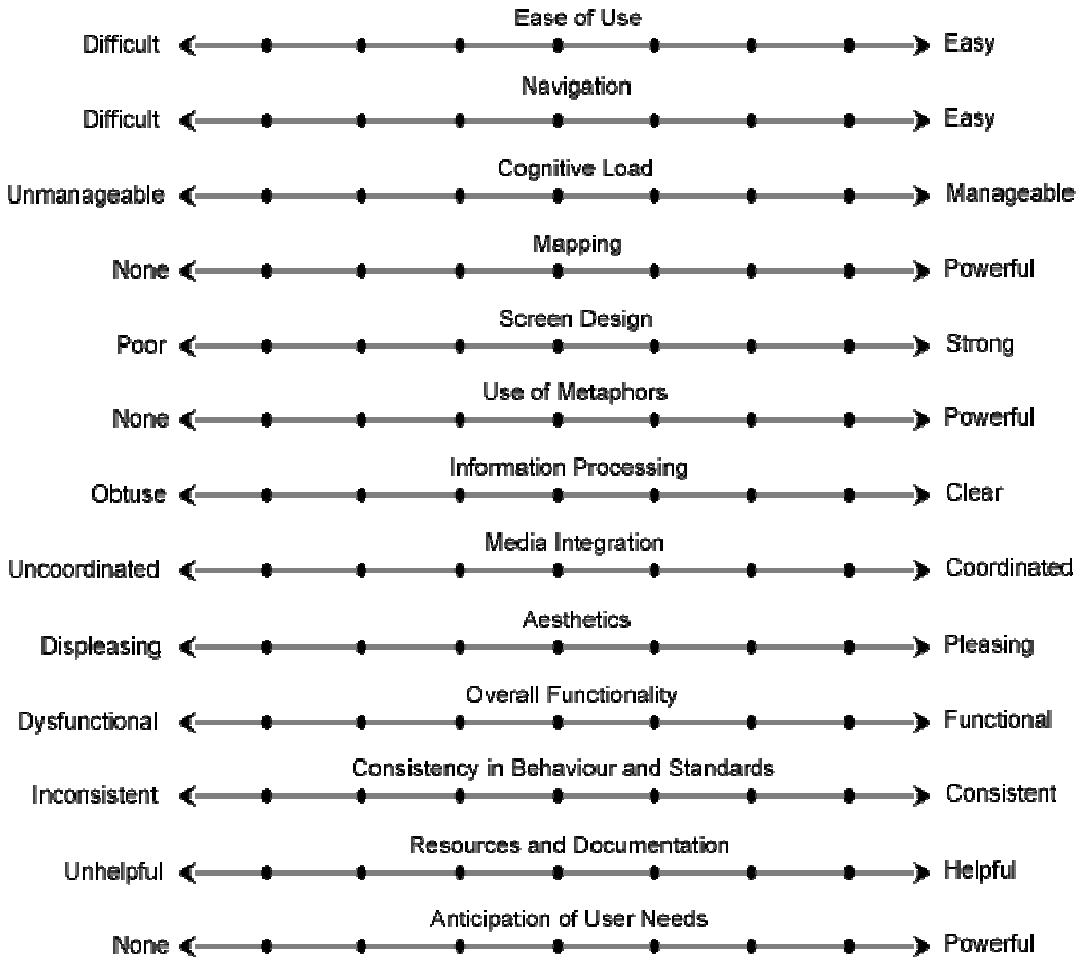

Figure 1: *User Interface Rating Form*

In the next paragraph, the teaching evaluation form is briefly outlined.

Teaching evaluation form

The teaching evaluation form (see Figure 2), which is adapted from Reeves & Hedberg (2003, p191) helps guide the researcher in the teaching effectiveness of the learning environment. The researcher constructed this tool by combining the characteristics of effective learning environments and important characteristics of martial arts learning environments. These scale diagrams provide a quick and rich visual summary of the evaluation dimensions. Researchers can quickly see where they can improve certain evaluation dimensions and make further design and delivery decisions by making comparisons with expected evaluation outcomes. Each criterion is based on the underlying theories of the theoretical framework. As with the user interface rating form, the teaching evaluation form contains a full description of each criterion.

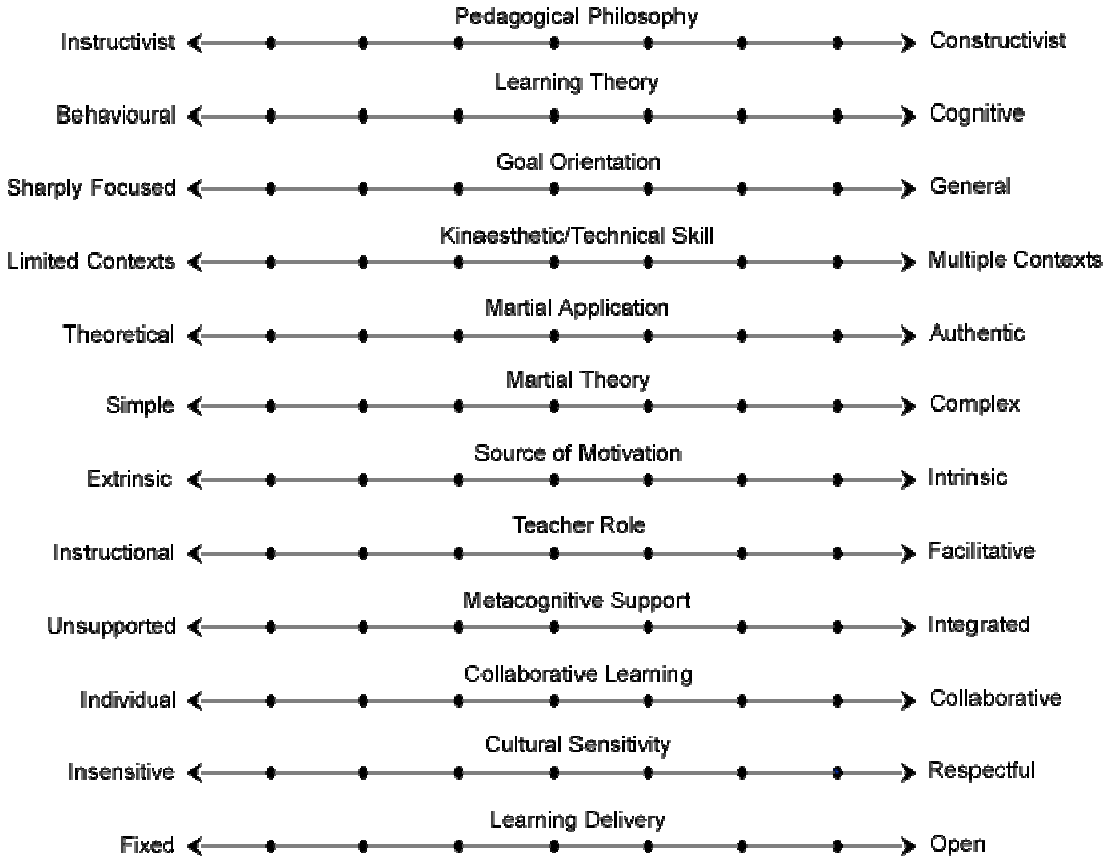

Figure 2: *Teaching Evaluation Form*

The learner feedback about the course is crucial in a study of this nature where the researcher is attempting to establish the effectiveness of the learning environment and process.

Learner feedback about the course

Online questionnaire

An online questionnaire administered to the course participants covered questions relating to functionality, usability, appeal and effectiveness of the course and course environment. The learners had to rate each criterion according to a five-point rating scale (1=Strongly Disagree, 2=Disagree, 3=Neither Agree nor Disagree, 4=Agree, 5=Strongly Agree). The data was then analysed using simple frequency statistics. Some learners added additional feedback in the comments sections.

Post questionnaire interview

The online questionnaire was followed by some small-scale semi-structured interviews with a random selection of available participants.

Course Assessment

The assessment of the learners' outputs during the course helps make informed judgements about the effectiveness of the course. The assessments relate to the three domains of Bloom's Taxonomy: cognitive (knowledge), affective (attitudes), and psychomotor (skills), or KASs (KSAs). Each task in the course was assessed according to explicit marking criteria. The assessment consists of analysis of written activities (discussions and chats), assessment of learner output (mind maps), and video recorded performances. The researcher used QSR NVivo to search for and code the results according to the marking criteria of the course.

Records

Participant observation

The researcher acted as participant observer and documented an implementation log, then made appropriate changes during the delivery of the course.

Email communication

Finally, the researcher recorded email communication between the researcher and learners during the course. This last stage was used as a means of bringing any other issues to the fore that were not covered by the other instruments.

Next, the researcher documents the course development, delivery and findings.

THE WHEEL SPANNER COURSE

Description

The wheel spanner course was scheduled to run for one month (23 February - 31 March 2004), but continued for two weeks longer, as learners required more time to complete tasks.

The course was based on a previous smaller scale RAT Online course that ran for a period of two weeks (Bear Hug course). Bear Hug course participants requested that future RAT Online courses include more opportunities to engage with multimedia (i.e. more images and videos) and requested that the course run for a longer period. Learners recognised the potential of learning martial arts online and thus agreed to take part in future courses of this nature.

While the Bear Hug course served as a pilot to this study, the Wheel Spanner course would serve as part of a practical formative process to develop a high-level design template for future RAT Online courses and to satisfy the aims of the study described above. The researcher set out to design a more in-depth course.

Participants

There were two participant groups in this study, the course participant group and the expert reviewer group.

Course participants

The course participant group consisted of 12 registered participants. Eight participants actually took part in some of the learning tasks, while only six participants completed most of the tasks. Two out of the six participants did not complete the final task.

Due to the high quality of the learner output, the course facilitator awarded all six of the course participants their course completion certificates.

The all-male course participant group was homogenous in terms of interest, as all participants had participated in martial arts before (9 months – 27 years experience). The age group category was quite broad (14 years of age – 50 years of age), with the majority of participants falling in the 20 to 36 years age group. Only three out of eight participants had taken part in a previous online martial arts course. The participants had an interesting mix of backgrounds and experiences. Between them, there were 12 different martial arts types.

The course participants were located in various places. Out of the eight active participants on the course, five were from Durban (South Africa), one was from Johannesburg (South Africa), one was from London (United Kingdom), and one was from Melbourne (Australia).

Expert reviewers

The expert reviewer group (two participants) took part in the study after the course was complete. The expert reviewers took part in two areas of post-course evaluation, User Interface Evaluation and Teaching Evaluation. Both expert reviewers in this study were located in Durban (South Africa).

Experts were chosen for their education and teaching experience. Both have a Master's degree in a field associated with online learning (one is working towards a PhD) and both teach using online technologies in a higher education institution. Each evaluator also has experience creating, developing and evaluating online learning environments.

The researcher addressed issues of consent by setting in place an informed consent process. The researcher then began the development process.

Development

The Bear Hug course was limited in scope to a single self-defence situation. The Wheel Spanner course would have to cover a much broader range of situations, as it would need to serve as a course that learners could apply in any self-defence situation. The course needed to cover principles of self-defence, weapons (the wheel spanner in particular), strategy, self-defence attitudes and performance (skills). The online course design and environment therefore required tasks and tools that would enable learners to acquire and create knowledge, skills and attitudes in all these areas. In addition, learners needed to develop attitudes that demonstrated that they could collaborate on tasks, as the success of the course relied on social interaction.

The researcher designed and delivered a course with eight tasks using the theoretical framework described above. The course was structured enough to guide learners, but was also open-ended enough to conform to Spiro et al's (1991) theories around cognitive flexibility. The eight tasks were structured so that learners could engage with theory, practice and develop attitudes appropriate for self-defence and for collaboration (i.e. Bloom's Taxonomy). To encourage reflection and evaluation the participants were required to mark each other's work. The eight tasks were:

Task 1: Reflect, research and experiment (a non mark-bearing task designed to encourage reflection and experimentation with the wheel spanner);
Task 2: Watch a movie (a movie clip showing how the wheel spanner can be used in a self-defence situation);
Task 3: Comment and practise (a mark-bearing discussion eliciting knowledge and shared experiences by participants);
Task 4: Video chat (a mark-bearing live text-based chat with web cams where learners can demonstrate techniques) (see Figure 3);
Task 5: Experiment and discuss (a mark-bearing focused discussion around specific techniques – learners could upload example media such as images, animations and video clips);
Task 6: Represent your knowledge (a mark-bearing two-part task – first a live chat with an online whiteboard [a shared space where participants can draw and write] and then an asynchronous group activity [discussion forum] to develop a mind map of wheel spanner techniques, principles and self-defence strategies) (see Figure 4 and 5). See Buzan & Buzan (1993) for the benefits of mind-mapping;
Task 7: Virtual self-defence (a mark-bearing discussion and simulation) (four chat rooms with movable images of people in different settings where learners can discuss strategy) (see Figure 6); and
Task 8: Practise and record your knowledge (a mark-bearing unedited video recording of a learner constructed syllabus and demonstration of development of skills).

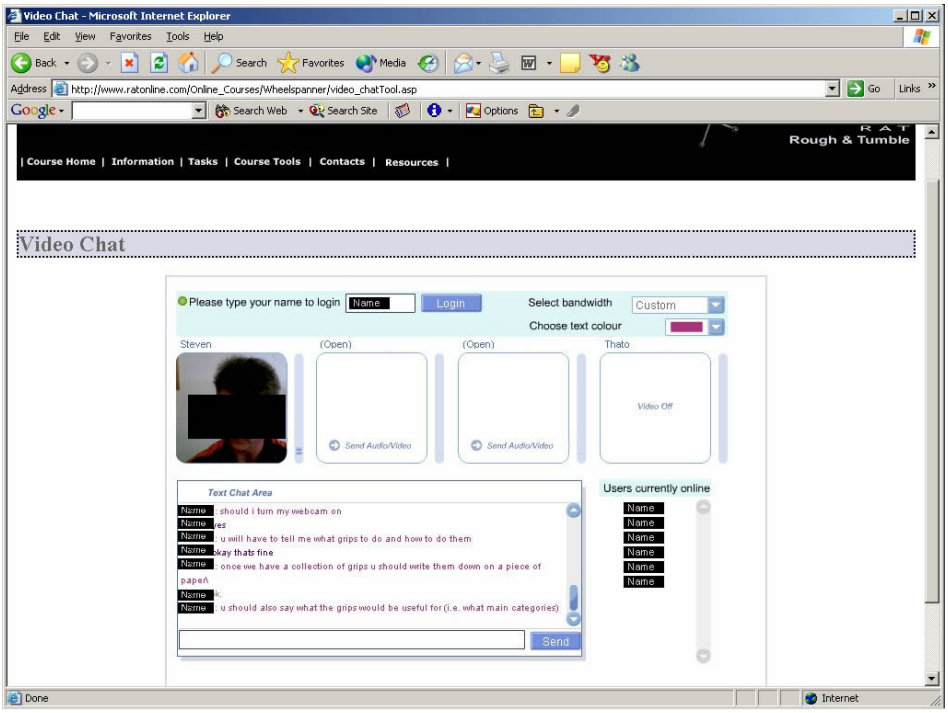

Figure 3: *Video chat tool*

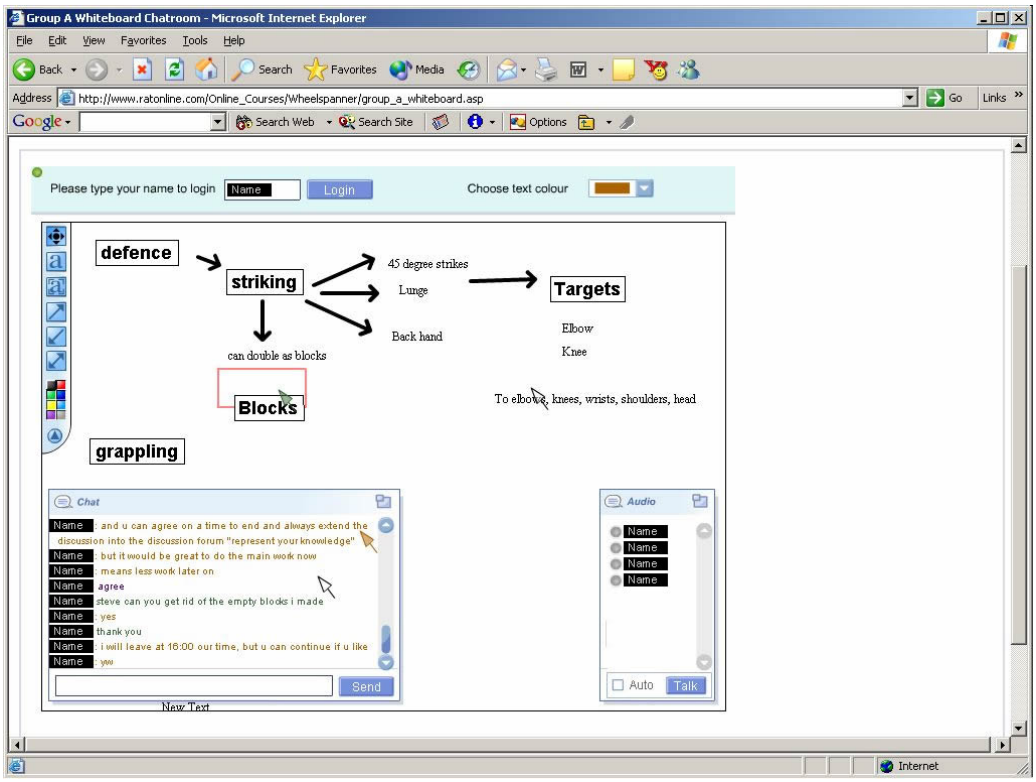

Figure 4: *Whiteboard chat*

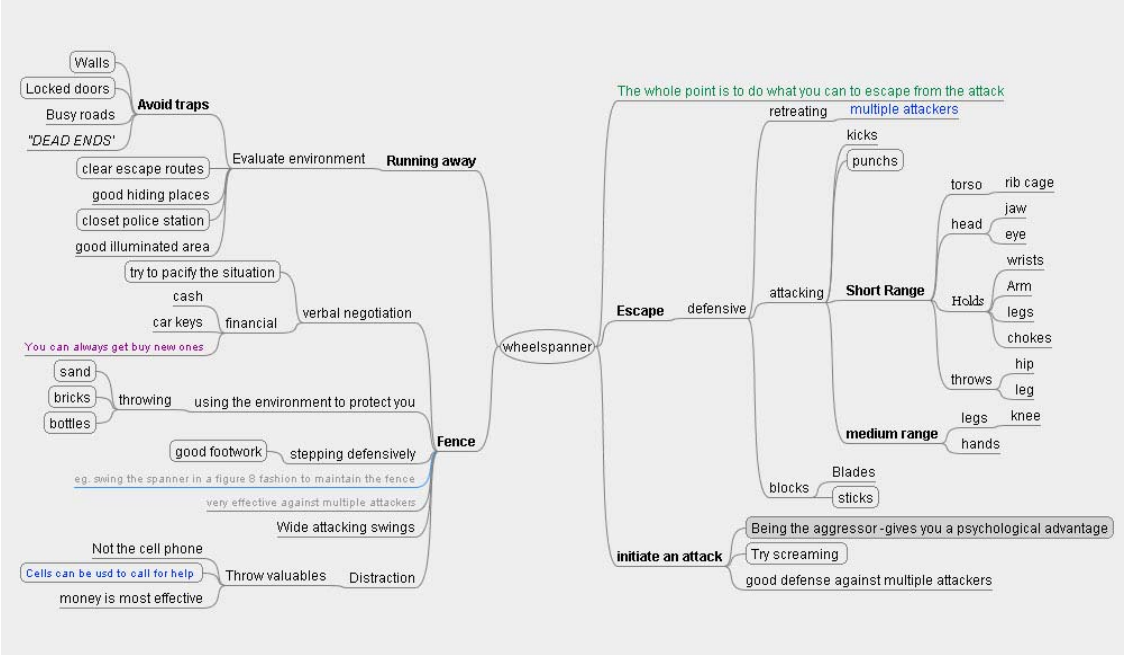

Figure 5: *Example: Free-mind mind map*

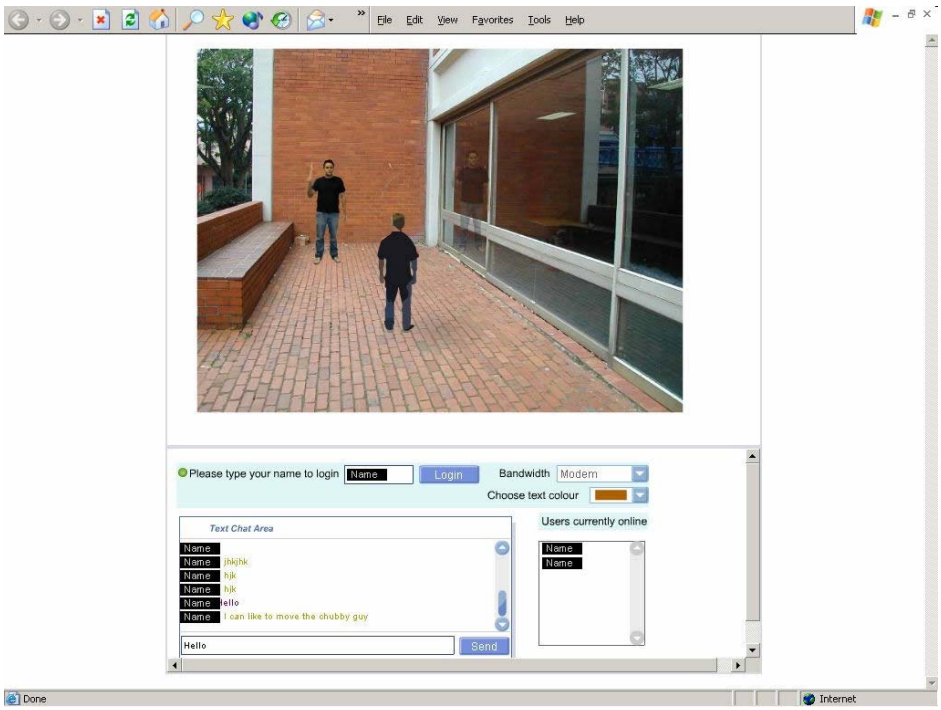

Figure 6: *Virtual self-defence room 2*

The researcher intended to extend the learning experience by enabling communication between learners, creating learning situations that are difficult to simulate in real life (virtual self-defence), and to give learners the opportunity to represent their knowledge in different ways with the course tools. This would be an example of using computers as 'mind tools', as espoused by Jonassen, Carr & Yueh (1998).

The site also contained a Resources page that had links to useful example images (such as an example mind map), the movie, the old wheel spanner course, a mark sheet, certificate and software.

The researcher created a website with Dreamweaver MX using Active Server Pages (ASP), HTML, Macromedia Flash MX and Macromedia Flash Communication Server 1.5. The discussion forum was a free web-based discussion forum called Web Wiz Forums. A video camera captured the movie clip and a digital camera was used to capture the images. Adobe Photoshop 6.0 and Macromedia Fireworks MX were used to prepare the graphics to appropriate Web usable file formats.

Next, the results, analyses and findings are presented.

RESULTS, ANALYSES AND FINDINGS

Expert review

User interface rating form

Figure 7 contains a visual summary of the user interface rating form results, analysis and findings. The squares represent the researcher's development goals, the circles represent the expected ratings based on the course design and implementation, and the dashed and solid lines represent ratings by evaluator 1 and evaluator 2 respectively.

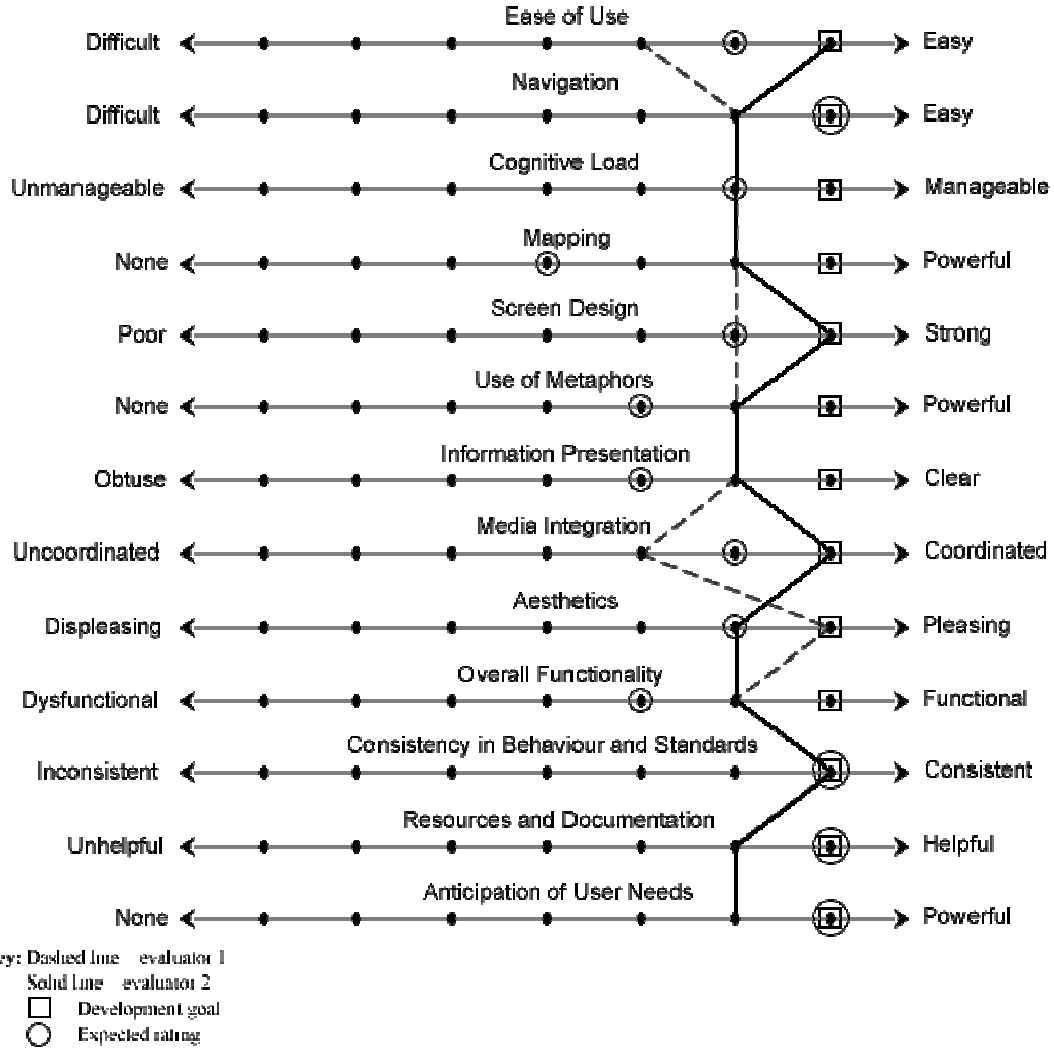

Figure 7: *Evaluation results of user interface evaluation form*

The ratings of both evaluators do not stray too far from the development goals (Figure). It would be ideal if all the ratings could form a straight line through the squares. Despite there being room to improve, especially in the areas of ease of use, navigation and media integration, the ratings

are satisfactory and do not reveal much of a problem with the user interface. The researcher expected rating also reveals that more could be done to improve cognitive load, mapping, screen design, information presentation, and overall functionality of the site. Although the expected rating for use of metaphors is not as high as it should be, it is not a concern, as a standard Web page metaphor was used with drop-down menus to each relevant task, course tool, or resource. Evaluators seemed happy with the result. One evaluator commented: "Interactive reference library metaphor?" which is satisfactory. It is therefore not necessary to change the metaphor in the next RAT Online course.

While the user-interface evaluation results seem straightforward, the teaching evaluation results visually represent more of an irregular pattern.

Teaching evaluation form

Figure 4 is a visual summary of the teaching evaluation form results, analysis and findings. Each symbol denotes the same meaning as in the user-interface rating form.

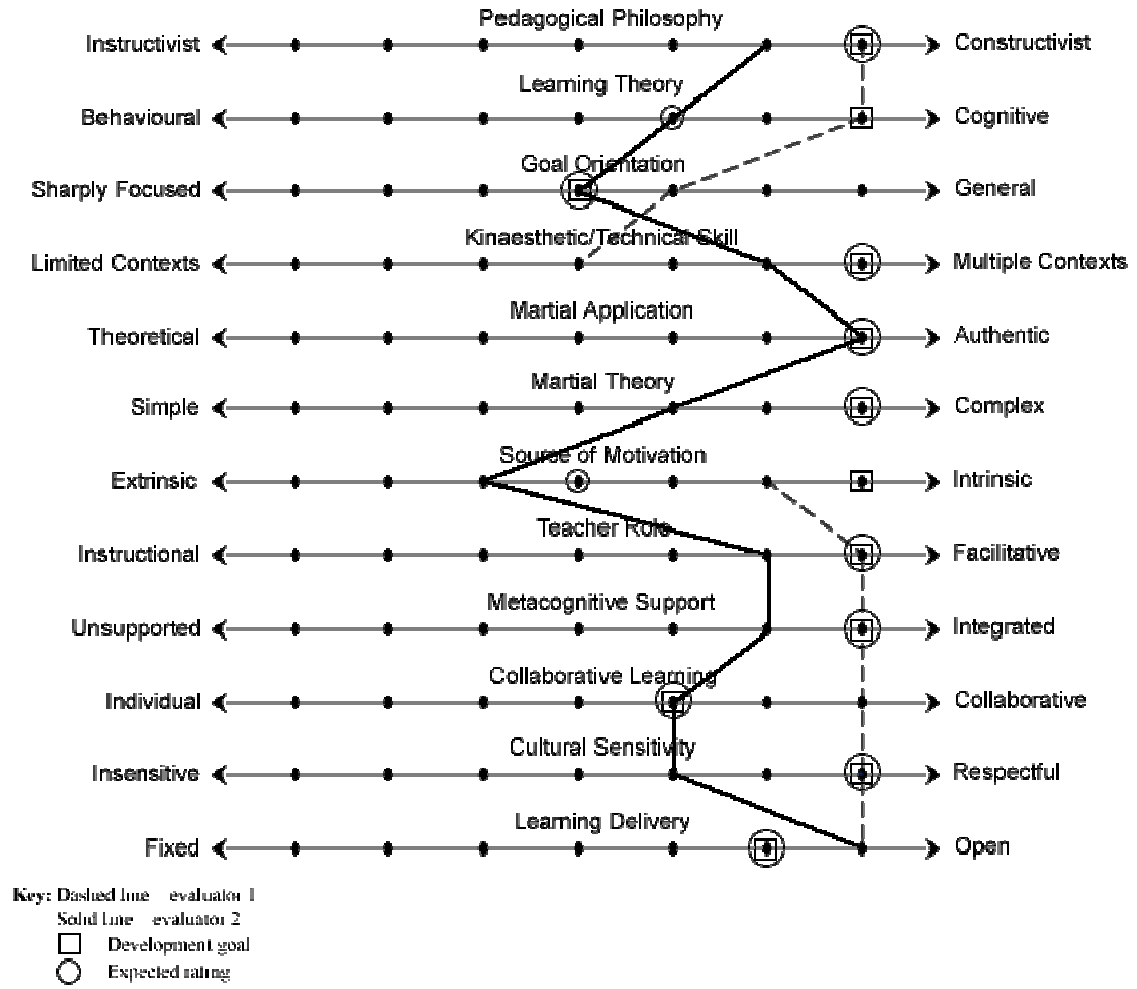

Figure 4: *Evaluation results of teaching evaluation form*

The results reflect that the evaluation closely matches the development goals. The biggest areas of concern are the 'source of motivation' and 'cultural sensitivity' dimensions. The development goal for 'source of motivation' is intrinsic, but this is not easy to achieve. As a participant observer, the researcher observed that he had to issue many statements of encouragement and reminders about incomplete tasks. These statements of encouragement could have been based on a biased perception and might have been unnecessary.

For the 'cultural sensitivity' dimension, one of the evaluators commented that: "I think all the 'shoulds' in the language might alienate those unused to disciplined fields of endeavour? Can these be rephrased on the course info?" This observation is useful and indicates that the language on the course website needs to change.

The teaching evaluation instrument needs to change in future iterations of the evaluation process. One evaluator did not complete the two dimensions: 'martial application' and 'martial theory'. These two dimensions might be better placed on a Content Expert Evaluation Form. One evaluator indicated the difficulty of evaluating the teaching dimensions on the rating scale. She suggested a quadrant graph format, but the rating scale would have lost its visual effect. In later courses, the researcher included a third dimension, 'integrated' along the rating scale.

While the user-interface rating form and the teaching evaluation form help developers make informed decisions based on expert evaluations, the learner feedback about the course contributes much to the effectiveness evaluation.

Learner Feedback About The Course

Online questionnaire

There are too few respondents to make any significant statistical measures, but based on the frequencies of the eight participants who did complete the questionnaire combined with learner comments, the results of the expert reviews, course assessment, and records, the course was functional (but with several technical difficulties), usable, appealing, and effective. Rather than using only mean values for all decision-making, the researcher considered each response on a case-by-case basis and adopted the approach that qualitative feedback would be valuable and support decisions.

The questionnaire elicited data about specific tasks and tools in the course, as well as more general issues, such as the appeal of the environment, and facilitator behaviour. The results suggested a need for further analysis and corroboration in the following areas: the usefulness and usability of the 'represent your knowledge' task and tools, the whiteboard tool, peer marking, the video chat, and the 'watch a movie' task.

Learner comments indicate that the 'represent your knowledge' task was a useful task.

Participant 1: "Represent your knowledge (mind map) – Encouraged a free flow of interesting ideas and forced one to really think, test and formulate what they had learnt."

Participant 2: "The mind map…this was a more do it yourself task than any other task, it was like you [were] presenting your "whole" self to be marked, commented on, criticised…best learning experience and also I learned a lot from looking at other people's mind maps."

Participant 3: “Mind map. By creating a mind map, one gets a better understanding of the entire system. Once you actually look at a mind map, you can apply it to almost every weapon based system that fit[s] similar parameters. Also there is no such thing as a complete mind map.”

The ‘represent your knowledge’ task was divided into two parts: a synchronous activity where everyone got together in the whiteboard room, and the asynchronous activity where they created individual or group mind maps. The conflicting questionnaire results point to an ineffective task, but the learner feedback about the task says something more positive about the task. The feedback suggests that learners leverage on Bloom’s taxonomy higher cognitive levels, such as application, analysis, synthesis, and evaluation (Krathwohl, Bloom, & Masia, 1964, pp 191-193). The feedback also suggests that learners found value in organising their own knowledge from this open-ended task, which points to evidence of both the affective domain of Bloom’s taxonomy (Krathwohl, Bloom & Masia, 1964, pp 180-183) and CFT. The learners also seemed to enjoy the social nature of the task, which is support of social constructivist learning environments. The comments around the ‘least useful tool’ show that it was not the ‘represent your knowledge’ task that was ineffective but the tool used for the synchronous part of the task.

Learner feedback suggests that the whiteboard tool, used for the synchronous part of the task, was not easy to use.

Participant 1: “Don’t know what to call it but when we got together in groups with the whiteboard to discuss and formulate the mind maps. The mind maps were great but I found the disjointed process of trying to communicate without talking over each other frustrating.”

Participant 2: “Whiteboard – too technical or too simple – I don’t know. It just didn’t do it for me. The mind maps consolidated everything.”

Participant 3: “Wasn’t enough control – too chaotic, but the idea is possibly useful.”

Most participants agreed that the peer marking aspect of the course was useful, but most did not take part completely. One participant’s comment reflects more accurately how participants might have really felt: “It took too much time, was difficult to remember who had done what and felt counter-productive.”

The questionnaire results reveal that one person thought that the video chat was the ‘least useful learning task’, but three people thought the video chat tool was the least useful tool. The effectiveness of the chat task requires further testing in future courses. One participant’s comment provides a reason to investigate the chat task further: “Video chat – it was like entering the others people’s minds and see[ing] what and how they think; in a way also opening yourself also, increasing your awareness.”

For the most part, participants agree that the ‘watch a movie’ task was useful, but one participant’s thoughts on this task are interesting support of learning environments that foster the generation of new martial arts knowledge: “‘watch a movie: to be honest, one does not need to actually see the wheel spanner being used. It also can work negatively whereby we assume that the techniques used in a video may be the only techniques that are possible. It would be better to start with a blank mind and see what we can develop, then watch the video.” The researcher used this feedback in later courses to develop example learning material and better placement in the sequence of tasks.

The discussion forum and virtual self-defence rooms came out strongest in the ‘most useful learning tool’ rating, which both support the social constructivist approach used in this course, as

the success of these tools relied on collaboration and discussion tasks between course participants. Once again, participant feedback provides evidence of the effectiveness of these two tools.

Participant 1, commenting on the discussion forum: "Discussion forum – Able to communicate your ideas, receive feedback and encouragement. Able to review at own convenience and revisit to refresh oneself if one had been away for a while."

The discussion forum seemed to be the main 'meeting place' for any course activity and, as the comment above shows, the 'asynchronicity' of the tool corresponds to the expert ratings of an open course delivery.

Participant 1, commenting on the virtual self-defence rooms: "Virtual self-defence room…you can visually represent your thoughts and actions and (…) the technology works well and it's easy to use."

Participant 2, commenting on the virtual self-defence rooms: "I liked the virtual self-defence tool [that allowed me to] move the people around and comment on the positions. Good for tactical and visualising situations. Strangely enough, the chat attached to it seemed to work for me, even though I did not like the 'plain' chat. Perhaps this is because it focuses the conversation and only [one] situation at a time can be displayed."

Even though the virtual self-defence chats failed for technical reasons at times, the value of learning self-defence strategy in such a simulated environment has potential, given the positive learner feedback above about the task and the rich discussion observed by the researcher during these tasks. The researcher therefore included a discussion forum and investigated other means of delivering the virtual self-defence task in the next course.

Three (3) people felt that there was no 'least useful task'. Perhaps they feel that all the tasks contribute holistically to the learning experience, which is the intention of the course designer.

Seven (7) out of the eight (8) participants feel that after taking part in the RAT Online Wheel Spanner course that you can learn martial arts online. Respondent 8 neither agreed nor disagreed that you could learn a martial art online, as he felt that people might think that it is too easy to get a certificate, because much more practice and reinforcement would be required to acquire skill and this is a valid observation. As in any kind of class, it would be up to individuals to be motivated to continue their practice. The video grading demonstrated to the researcher that participants had acquired skills to complete the physical part of the course successfully.

Three comments made by different participants in the 'further comments' section offer concise and rich support of the theoretical framework, expert evaluations and participant observation, with concepts such as application, physical skills, discussion, exploring, social learning, active learning, development of prior knowledge, creation, and motivation coming to the fore.

Participant 1: "In the beginning I was a bit apprehensive [about whether] learning online would work. But discussing and exploring opened my mind to things I would have never thought of. I learnt most when I tried to apply all the theoretical skills to practice. When I made the video I can definitely say I learnt the most."

Participant 2: "This course I would say challenges your knowledge of martial arts and also expands it too, you learn new things all the time so you just got to have a go."

Participant 3: “Overall I thought the course was excellent and I have developed as a martial artist. The design of the site is very professional and the content of the course kept you interested. Thanks to (…) and all who participated for their hard work.”

After conducting the questionnaire, the researcher did a small-scale interview with some participants.

Post-questionnaire interview

The post-questionnaire interview was a short interview with four of the participants, but it helped expose areas of weakness in the questionnaire by providing further information on questionnaire ratings. One example is where one participant rated the question item “It was easy to find my way around the site” with a 3 (neither agree nor disagree). The interview revealed that it was the not the site that was difficult to use, but that the site address was difficult to remember. The learner also commented that: “It took me a long time to get orientated [referring to the emails with the site addresses]. When I’m in the site, it’s fine. When I got used to it, it was fine.”

These findings demonstrated the need for more in-depth post-questionnaire interviews in the next RAT Online course.

Course Assessment

Most of the course tasks were assessment tasks. Although not everyone took part in each task, participants were able to demonstrate new knowledge, attitudes and skills. Participants’ participation and artefacts generated in the course tasks were measured against the learning objectives and explicit marking criteria. The researcher coded the interactions for each participant in NVivo and then awarded each participant a mark for each task. The researcher recorded each participant’s marks for each task and calculated the total in a Microsoft Excel spreadsheet.

The various discussion forum tasks reveal that online course participants can use existing knowledge and create new martial arts knowledge. During the discussion activities, they showed that they could work collaboratively to construct knowledge. In the ‘represent your knowledge’ task, some participant groups submitted text documents; one submitted a scanned hand-written mind map and others created digital mind maps. These submissions were all high in quality (see Figure for an example), showing that they could analyse and synthesise knowledge covered in the course.

The live chat tasks also generated some lively debate and ideas and showed that learners gained in collaborative attitudes. However, the video chat server crashed before the chat session was complete and some participants could not take part due to problems with access from work. The whiteboard chat was not fully successful, but it was a useful way to get the ‘represent your knowledge’ task going. The virtual self-defence chat worked well. Participants discussed a wide range of topics on self-defence strategy, including ethics, law, body language, techniques, escape, the environment, multiple attackers, weapons, body structure of the opponent, and psychology. The researcher believes that the virtual self-defence task contributes to an effective martial arts course and favourably affects the final video grading by giving learners insight into a broad range of self-defence problems that they could apply in the video grading.

Participants had to make a video recording of their constructed syllabus in the final task: Practise and Record Knowledge. Only four participants took part in the video grading. The performances in this task demonstrated that learners could gain in skills in online martial arts courses.

Records

Participant observation

The implementation log reveals that there were several technical difficulties; participants arriving late for chats, or participants not arriving at all. The researcher had to contact participants by telephone on several occasions to remind them to take part. These issues contribute to an ineffective course experience and one that is less than perfectly functional.

In the questionnaire, some participants rated as 'least useful learning task' the synchronous part of the 'represent your knowledge' task (whiteboard tool), marking each other's work, the video chat, and the movie clip in 'watch a movie'. As a participant observer, the researcher observed that participants did not seem willing to mark each other's work. The problems with the nature of the whiteboard tool caused some difficulty with the synchronous part of the 'represent your knowledge' task, as it was difficult to control with everyone trying to have their say at the same time. However, it was a useful task to kick-start the process of the 'represent your knowledge' task. The implementation log reveals that the video chat crashed and the movie clip was not of a high quality, both reasons for these two components of the course not to be fully effective.

E-mail communication

The course generated a substantial amount of e-mails, mostly from the course facilitator/researcher (80 e-mails received, 109 sent by the facilitator). This represents a substantial amount of work in addition to the time required by the facilitator in the course activities. The e-mails mostly covered topics about technical issues and negotiation around task deadlines. The facilitator observes that it is necessary to maintain communication in order to promote motivation. Course participants can sometimes 'get lost' from the course environment and e-mail seems to be an effective way to 'bring them back'.

The findings above provide positive evidence to pursue this research project further, although much investigation is still required.

CONCLUSION

This paper began with an introduction and background to the RAT Online Wheel Spanner course. Next, the researcher provided the aims of the course, followed by a theoretical framework to the study. The binding theory for the study is the eclectic-mixed methods-pragmatic paradigm, which has several linked theories. The other theories include RAT, Chomsky's universal grammar, prototype theory, social constructivism, cognitive flexibility, and Bloom's Taxonomy. Following the theoretical framework, the researcher introduced the methodology, development research, and the various instruments and analysis methods. The study is a mixed-methods one incorporating minimal quantitative data from the online questionnaire, and qualitative data in the form of learner feedback about the course, visual rating scales and evaluator comments, and coded texts derived from course tasks and records. The researcher then described the course development, results, analyses and findings.

Potential martial arts teachers wanting to develop and deliver online learning courses in martial arts need to be aware that these courses demand substantial investments in time. There is also some frustration resulting from learner dropouts, setbacks when certain learners do not complete tasks on time, user problems, motivation issues and technical difficulties. The design,

development, implementation, and evaluation of the wheel spanner course reflected many of these frustrations.

Despite the negative aspects of the course, this study shows that martial arts (in this case RAT: the Wheel Spanner) can be learned online with the chosen theoretical framework, which answers the first question in the aims of the study. The researcher used universal grammar and prototype theory to guide him as course facilitator, as this approach kept negotiation around techniques and principles open and diverse. These theories form part of the foundations of RAT, the effectiveness of which has been tested in numerous situations, competitions and demonstrations.

Expert evaluation, learner feedback about the course, and participant observation, provide evidence of social negotiation of knowledge and that this was effective. The social nature of the course provides observable evidence of desirable attitudes for the creation and sharing of knowledge. This supports the social constructivist part of the theoretical framework. The final tasks, such as 'represent your knowledge', 'virtual self-defence', and 'video grading' suggest that cognitive flexibility theory might be a useful theory to ground the high level design of such courses. Learner feedback about the course and participant observation about the final tasks show that the open-ended nature of the final tasks where learners could draw on new and shared knowledge from earlier more structured tasks was a useful learning experience. Furthermore, the learner assessment results and participant observation show that learners can gain in all of Bloom's Taxonomy domains: cognitive, affective and psychomotor.

The learners demonstrated their construction of knowledge and development of attitudes in the collaborative tasks of the course, such as the discussion forums, the chats, virtual self-defence chats and 'represent your knowledge' tasks. They also showed that they could create new self-defence techniques and demonstrate their physical skills in these techniques. The chosen theoretical framework therefore contributes to a useful design in computer supported learning environments, which helps toward answering question two in the aims of this study. The successes and failures of the learning tasks and software tools suggest that minor changes to the sequence of some tasks is necessary, and some new tools are necessary. This answers the third question in the aims of this course and helps in sequencing tasks and choosing tools in subsequent RAT Online courses.

The EMMPP forms a useful theoretical framework and development research is a useful methodology allowing a mixed-methods approach. The expert reviews, online questionnaires, assessments and records help to make effective design and delivery decisions in the areas of functionality, usability, appeal and effectiveness of online learning environments. The researcher recognises such evaluation as a complex task in which much work is still needed in this formative process.

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The politics of e-learning in South African higher education

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INTRODUCTION

The appearance of information and communication technologies (ICTs) at the intersection of competing perspectives on higher education transformation in South Africa suggests that the increasing use of ICTs is not an automatic 'good in itself' but needs to be problematised. This paper first describes the new ICT-related practices emerging in South African higher education institutions, and then identifies and compares four broad approaches informing the relation of these new practices to higher education change. The first three approaches conceive of this relationship in terms of the role of ICTs in effecting specific changes in higher education institutions, while the fourth approaches the relation discursively. The final section describes access patterns in 'dual-mode' institutions, and asks whether the emerging trends are redefining the meanings of access to higher education. In thinking about how to re-imagine current e-learning practices outside of the tight globalisation script, this paper supports a framework that both embraces the possibilities offered by online pedagogies, and problematises central aspects of the political economy and cultural politics of e-learning in higher education.

NEW INSTITUTIONAL PRACTICES: FROM E-LEARNING TO THE E-UNIVERSITY?

The notion of e-learning, commonly understood as 'learning facilitated online through network technologies' (Garrison & Anderson, 2003), has emerged across South African higher education institutions since the 1990s. As in other national contexts, e-learning practices appear together with an entirely new vocabulary, institutional policies and structures, and substantial institutional budgets. E-learning also appears as one of many ICT-enhanced practices in universities from the provision of e-mail, online journals, and networked libraries, to the development of creative software solutions for information management tasks in teaching, research and all sorts of institutional administrative systems for online registration, finance, human resources, student performance data, course evaluations and so on. The new practices have provoked a range of issues around online pedagogies, patterns of access and of exclusion, increasing ICT costs in the context of unequal resources and competing institutional priorities, and the relation of e-learning practices to other institutional interventions seeking to transform the colonial fabric and cultures of South African higher education institutions. It is therefore useful to view ICTs as 'one thread in a complex net of transformation, including historical redress, curriculum transformation, diversity, equity and so on' (Czerniewicz, Ravjee & Mlitwa, 2006: 43).

Organisationally, the emergence of full-scale 'digital universities', such as the African Virtual University (Juma, 2003), which involves more than 30 higher education institutions from 17 African countries, and the increasing use of online learning in contact universities, are seen to blur the traditional distinctions between distance-mode and contact-mode institutions (Butcher 2003: 13-19). Butcher suggests that these kinds of 'dual-mode' institutions are increasing in developing countries. The universities of Stellenbosch and Pretoria as two clear examples in South Africa, where the number of 'distance' students enrolled in traditionally 'contact' institutions increased by almost 500% between 1993 and 1999, particularly in the historically Afrikaans language universities (Jansen, 2004: 303).

The emergence of new kinds of global e-learning collaborations involving various combinations of public and for-profit partnerships has resulted in the creation of remote branch campuses for international students (e.g. Monash University, Australia, has branch campuses in South Africa); the formation of consortia, involving universities in several countries offering joint academic programmess, especially at postgraduate level, and the increasing involvement of industry in e-learning initiatives (Beebe, 2003: 72-73). Examples include Microsoft partnering with Blackboard, the establishment of spin-off companies for Internet service provision, and various outsourcing relationships for the online delivery of courses. A recent player in South Africa is eDegree, which operates internationally in the provision of online higher education through partnerships with universities in South Africa (University of the Free State, Stellenbosch, and UNISA), Kenya, Uganda, Tanzania, and the United Kingdom. [1]

These technology-inspired alliances and organisational forms have sparked intense international debates about the relationship of the new e-learning practices to alternative pedagogies and to the general nature and direction of change in higher education institutions. For example, how do these practices relate to other processes of change? What is the relation of the ICT interventions to interventions aimed at de-gendering and de-racialising different aspects of the academy, such as changing student and staff profiles, or decolonising research, curricula and institutional cultures? How do these practices relate to the tensions in the broader context of South Africa as a deeply divided society and an emerging democracy entering an unequal global economy composed of cores and peripheries?

COMPETING PERSPECTIVES ON THE RELATION OF ICTS AND HIGHER EDUCATION CHANGE

This section examines four broad frameworks informing the relation of e-learning practices to higher education change. Underlying each approach is a particular politics of e-learning and differing interpretations of higher education transformation. It begins with the dominant globalisation thesis in education, and then considers three alternative theorisations of this relationship – evident in studies of the digital divide, the commercialisation of higher education literature, and in research around the decolonisation of higher education – that problematise, to different degrees, the relationship of ICTs to higher education change. These alternative theorisations suggest that we adopt a cautious approach to the new e-learning practices, and not assume that they will unproblematically increase access to higher education or automatically enhance the quality of teaching and learning. They ask that we pay attention to the power dynamics of digital divides, the political economy of e-learning, and the cultural politics of higher education.

The Globalisation Thesis in Education

The first approach is evident in the globalisation literature, which presents technological change in terms of 'progress', often conceived as inevitable, and embraces an overly optimistic view of ICTs as the central tools for higher education change. It privileges 'knowledge' in the characterisation of contemporary society, takes global economic changes as its analytical starting point, and generally supports models of market-driven, technology-led higher education transformation. [2] This position sees the new information technologies and recent initiatives in e-government, e-business and civil society networks, as being able to unproblematically challenge traditional communication paradigms and offer new possibilities for democratising access to information and to various kinds of social services. The related literature typically emphasises the role of educational institutions in teaching the skills necessary to participate in knowledge societies and knowledge economies – ICT competencies, notions of re-skilling and lifelong

learning, working in small groups, etc. – and is often based on the questionable assumption that integration into the dominant global economy will automatically lead to various 'goods' (such as the elimination of poverty, the provision of basic services, job creation and increased wages).

The knowledge society argument is strongly evident in international agreements and initiatives: the numerous NEPAD initiatives, the WTO's General Agreement on Trade in Services (GATS), and in various World Bank and UNESCO reports. In South Africa, clear policy support for the role of ICTs in enhancing education and in contributing towards broad post-apartheid reconstruction is evident in the 1997 White Paper on Higher Education, the 2001 National Plan for Higher Education, the 2003 Draft White Paper on e-Education 2003, and the 2004 ICT Charter. [3] The intersections among the three levels of policies and related structures – international, nation state, higher education institution – suggests that the South African state and higher education institutions may be actively constructing globalisation as a discourse relevant to shaping the nature of broad post-apartheid change.

Digital Divides

The second approach appears in terms of a 'divide' metaphor that permeates the research on differential access to ICTs, and relates the new digital divides to existing intersecting socio-economic, political or cultural divides and multiple oppressions or privileges that any one individual (or group, institution, or nation state) can be caught up in. Digital divide studies generally assume a neutral view of technology, emphasise local contextual issues, and tend to support some form of state and institutional intervention to address these divides.

It is possible to place most of the digital divide literature on a continuum between an optimistic and cautious view of ICT-enhanced change in higher education. The overly optimistic view – which is mostly evident in the early digital divide literature – has been critiqued for underplaying existing power relations, and is evident in the focus on increasing access to ICTs without necessarily asking why, or without necessarily problematising the higher education space to which access is sought and which access to ICTs will presumably enhance. Critics of the overly optimistic view clearly acknowledge the democratic potential of the new technologies, but question the degree to which they are able to challenge existing asymmetrical relations in contemporary society. As Stromquist & Samoff (2000: 325-326) explain:

This [optimistic] perspective regards the shift from contemporary forms of knowledge production to a knowledge production economy as unproblematic and commonly does not address the existing and widening gap between those who have access to the Internet and those who do not and most likely never will. Others, however, for example Castells (1998), warn us that the increasing prominence of and reliance on information technologies is at present strongly intertwined with rising inequality and exclusion throughout the world.

Digital divide studies emphasise two kinds of issues. The first involves issues of resource distribution, which refer to differential access to hardware, software and Internet connectivity, including bandwidth issues, across nation states (with numerous north-south uneven patterns) and within nation states (regional, urban-rural, by category of difference such as class, race or gender, and across and within educational institutions, by faculty and department). The second type of issues emphasise, in addition to physical access, numerous individual, social, cultural, economic and institutional factors that influence the extent to which people will actually use the ICT resources to which they have physical access. While much of the early digital divide literature focuses on increased access to physical resources (computers, modems, connectivity) as the way to overcome the new divides, and adopt a neutral position about their role in effecting social and educational change, recent studies (Burbules & Callister, 2000; Czerniewicz, 2001;

Warschauer, 2002; Bridges.org, 2002; Beebe et al., 2003; Le Grange, 2004) argue that physical access alone is an insufficient condition for meaningful ICT access. [4]

The emergence of new digital divides around existing socio-economic and other divides is seen as a barrier to participation, and often to even exclude participation, in ICT contexts across and within nation states, institutions and groups (e.g. genders). [5] These studies emphasise thicker notions of access to ICT that identify a broad range of additional social and educational issues around individual and institutional capacities, pedagogical environments, online content, language, ensuring accessibility for students with physical disabilities, and so on. [6] For example, an increasingly common observation in the e-learning literature is that good quality online education is resource-intensive, requires strong administrative support structures, relies on large numbers of enrolments for costs to decline, and is crucially dependent on the inclusion of frequent opportunities for face-to-face communication (Schiller, 1996; Lax, 2001; Noble, 2002; Johnson, 2003; le Grange, 2004). [7]

As Beebe et al. (2003) argue, the early focus at the level of infrastructural patterns of exclusion leaves no space to problematise other broader social issues relating to how the digital divide works, including the dimensions of knowledge, the ways in which scarce resources affect the use and diffusion of new technologies, and issues of cost and content. At the policy level, the poor infrastructure development and Internet access in African countries have been ascribed to constraining factors imposed by state policies and telecommunications regulatory frameworks, and the lack of specialists in telecommunications (Beebe et al., 2003: 3). It also involves the different political and economic interests of higher education institutions, software and hardware companies, telecommunications companies, and state regulatory authorities. In other words, the recent digital divide studies generally accept that ICTs can play a role in increasing access to education, or in enhancing teaching and learning, but emphasise the challenges presented by local contextual issues and particular histories that influence the role of online pedagogies in enhancing learning or increasing access to higher education. The argument is that technology can make a difference to the quality of the academic experience, but only in combination with other variables in the context.

To summarise, while the overly optimistic view unproblematically sees a straightforward causal relationship between the use of ICTs and the enhancement of teaching and learning, the more cautious approach insists on taking into account, in addition to technology, other variables in the context. These other contextual variables may include a consideration of the colonial histories, the division of universities by race, the inherited inequalities and academic cultures, the ideologies of the administrative elites, student and staff protests, etc. But an alternative critical approach exists, and it accepts that the use of technology may sometimes improve pedagogical practices; at other times it may function to stigmatise and exclude people. This alternative method asks that we problematise technology (its assumptions, role, effects and meanings), because ICTs always operate within broader socio-economic, political and cultural contexts, and within specific educational contexts, which determine not only the rules governing how and where they will be used and towards what end, but also who will use them. [8] This view accepts what Lelliot, Pendlebury & Enslin (2000) refer to as both the 'peril and promise' of ICTs in education – the double-edged sword of technology – that has the democratic potential to enhance anything, but is constrained by its very groundedness in the broader context. This alternative critical method intersects with the third and fourth broad approaches discussed in the next two sections.

Twin Forces of Change: ICTs and the Market

A third approach views information technologies and the market as 'twin forces' (Stromquist & Samoff, 2000) permeating educational spheres across national contexts, and appears in critiques

of market-led change in education. This perspective questions both the efficiency paradigm that dominates the globalisation literature and the universal acceptance of online education as inevitable (Clegg et al., 2003; Noble, 2002; Zeleza, 2002). This critical thread in the literature suggests that ICTs do not operate outside of dominant socio-economic, ideological and educational contexts, which determine the rules governing how they will be used, and by whom, and argues that ICTs cannot effect change independently of the broader context of its application, which today is largely defined by a dominant neoliberal economic order.

The phenomenal rise in ICT-enhanced for-profit institutions, the selling of Internet courses, the use of proprietary 'learning management' software, and ICT-related intellectual property issues are clear examples of the increasing market influence in higher education internationally. The growth of online cross-border provision of higher education has contributed to what is now being referred to as a form of international trade in educational services, especially since the 1990's. [9] These developments are supported by the WTO's General Agreement on Trade in Services (GATS) which views higher education as a commodity to be traded, and supports the deregulation and liberalisation of national higher education systems to favour 'foreign providers'. [10] The effect is that developing countries face the possibility of unequal benefits when strong states use protectionist policies. While reduced state funding for the provision of social services is an international trend not limited to education (healthcare is another obvious example), a reliance on corporate models may mean that profit motives will increasingly guide educational decisions about what will taught, how it will be taught, to and by whom. [11]

Noble's (2002) thought-provoking study of the effects of these kinds of techno-commercial twinning relationships on higher education practices in the US context is relevant to this discussion. In Noble's view, the commodification of teaching is evident in the organisation of virtual universities and in their reliance on packaged courses, which results in the loss of lecturers' autonomy, the loss of jobs and the erosion of quality teaching. He suggests that the movement towards the commodification of teaching occurs in a series of steps involving first, a shift in focus from the educational experience towards content and the production of course materials (syllabi, lectures, exams); second, the arrangement of the course materials into independent stand-alone courses resulting in the alienation of this content from its original context (from the process, from the teachers); and finally, the exchange or selling of these original courses or 'instructional commodities' for 'a profit on the market, which determines their value, by their "owners", who may or may not have any relationship to the original creators and participants in the educational process' (Noble, 2002: 3).

As academics are drawn into the production process of these courses, the resulting labour issues include a restructuring of teaching activities, a reduction in faculty autonomy and control over their work, more administrative monitoring of lecturers, an increase in teaching time to all hours (for chat rooms, discussion groups, e-mail, virtual office hours), and an increase in contract workers (for, once lecturers convert their courses to courseware they become redundant as their course becomes automated). Drawing a parallel between the uses of these new technologies in education and in the automation of industries, Noble (2002: 33) suggests that 'the new technology of education … robs faculty of their knowledge and skills, their control over their working lives, the product of their labor, and, ultimately, their means of livelihood'.

Finally, intellectual property issues emerge most strongly in debates about the choices institutions make on whether to use proprietary software (e.g. WebCT, Blackboard) or open source software (e.g. KEWL, Sakai) for teaching and for institutional management functions. The commercial packages have been critiqued for often being US-centric, costly, and creating a relationship of dependency on the software industry when creative open source and open content options can be developed for the common good in universities. The issues here relate to costs, profit, ownership, outsourcing of IT functions and capacity building in the local development of

technology, and raise questions about the dominant ideological interests in the broader contexts that allow educational software developed and tested at public institutions with public funds to be turned into the private property of a single company.

The Cultural Politics of e-Learning

It is possible to understand the above three approaches in terms of the functional logic of the globalisation discourse on higher education change. If we understand these three perspectives as examining ICT in terms of its functionality – as positive in the globalisation literature; as generally neutral in the digital divide literature, which emphasises differential access; or negative as in the commercialisation of higher education literature – then a fourth perspective makes itself visible, which asks different questions, and which does not examine ICT solely in terms of its function to some end. It asks that we question the functionality of technology, and that we revisit the meaning of higher education transformation. [12]

In this section I argue that the first three approaches have set the parameters of the debates about e-learning. Together, they present a certain understanding of this relationship that hides, under causal relations, the political meanings of the various perspectives. The fourth perspective approaches the relation discursively – it does not look at causality, but at meanings – and deconstructs the above three approaches, showing how they are particular constructions of technology and social change presented as inevitable.

The emphasis on the displacement of subaltern discourses as an effect of the dominant discourse on higher education transformation – evident in the language of efficiency and innovation and in dominant ideas on the functionality of technology – would constitute a fourth approach to the relation between ICTs and higher education transformation. The decolonisation and democratisation projects around knowledge, for example, may be viewed as cases of alternative discourses that are at risk of being submerged or reshaped under the hegemony of the globalisation discourse. A now common critique of post-1994 South African higher education debates and management practices – as evidenced in the recent changes towards corporate management structures, institutional mergers, outsourcing of teaching, increases in contract staff, increasing public-private partnerships, and an emphasis on technological innovation, accountability and efficiency (sometimes at the expense of what it is that is being done efficiently) – is their privileging of global economic trends over the politics of curriculum and the inherited institutional and disciplinary cultures.

A sole focus on higher education in terms of its functionality, to whatever end, underscores the extent to which educational institutions are contradictory spaces; simultaneously sites for reproducing hegemonic practices and ways of thinking and sites of struggle, contestation and resistance. [13] Remembering what Mkhatshwa (1996: 2) [14] calls our ‘dangerous memories … those manifestations of suffering that constitute a historical memory as well as immediate conditions of poverty, moral decay and human exploitation’, is central to critical educational approaches, which see this kind of individual and institutional remembrance as central to transforming apartheid educational institutions into vibrant democratic intellectual spaces. One could argue that by taking global economic trends as an analytical starting point to theorise higher education change, current models of technology-led change may be too narrow to adequately conceptualise or address many of these issues. Consider the example of collaborative frameworks. Regional institutional collaboration (around ICTs, academic programmes, libraries, etc.) is seen as a way to share institutional resources, break apartheid identities, and deracialise the system (National Plan, 2001: 7), yet the South African debates are silent about whether the frameworks currently informing regional collaborative projects are adequate to facilitate the equal participation of individuals (and institutions) – as equals – in collaborative interventions. [15] Many questions

require further empirical exploration: Do the current frameworks for institutional collaboration challenge historical relationships? Through which specific ongoing practices do colonial, patriarchal and elitist ideas and mindsets prevent authentically collaborative models for the transformation of curricula, institutional cultures, research paradigms, historical patterns of access and retention, the quality of the academic experience, pedagogical styles and relationships, and so on?

The differing educational implications of adopting different analytical starting points – global trends in industry, or historical and contemporary social struggles – are a stark reminder that educational choices about pedagogy, software, research topics, curriculum content, language of instruction, collaborative frameworks, etc. are not neutral activities. Similarly, technologies and technological spaces are not neutral, but are the 'products of real historical social relations … already inscribed with gendered [and other] assumptions and the accumulation strategies of their purveyors' (Clegg et al., 2003). Recent critical theories of race, gender and technology can shed light on the 'already inscribed' part of the above quotation, and on the historical exclusions from ICT fields. Both issues can be understood in relation to the social construction of the scientific subject (as western, white and male) and the simultaneous construction of various 'others' (women, colonised people) as non-scientific outsiders to scientific and technological social spaces.

Significant strands in the broad literature on apartheid education as a dominating practice have analysed universities as mirroring larger social systems, describing apartheid higher education as a reflection of apartheid society. For example, the historical exclusion of indigenous sciences, technologies and languages from educational curricula and research was central to the organisation of the colonial education system. In 2006, these omissions are still evident in the construction of most higher education curricula around models from Europe, in the institutional cultures and language of instruction, in the demographic profiles of students and staff, and in the institutions' contradictory relationships to surrounding communities. In what ways do these issues, closely related to differing meanings of access to higher education, influence the quality of students' experiences, and ultimately their academic success or failure? The next section examines recent enrolment patterns at 'dual-mode' institutions to explore the ways in which e-learning may be redefining access to higher education.

ARE ICTS RESHAPING ACCESS TO HIGHER EDUCATION?

A clear possibility offered by ICTs is the potential to increase access to higher education, to be, in Coombs' (2003: 90-91) words, the 'great equalizer'. Recent studies suggest that ICTs are reshaping (Dutton & Loader, 2002: 7) access to higher education in various ways across national contexts. Sometimes this may occur in problematic ways. For example, the increasingly corporate models of access to higher education raise questions about whether public funds should be used for corporate skills training, or whether the educational aims of for-profit institutions are always in conflict with a need for profits. [16] As Noble (2002: xii) asks in the US context, will these new institutional forms and traditional campus-based and distance education institutions offer online options to extend higher education access to working class students, while middle class students attend campus-based programmes, so effectively excluding students from working class communities (through restricting access to online options) from campus-based programmes?

This cautious approach is evident in South African higher education policies, which support the recent growth in 'dual-mode' institutions as a way to increase access to higher education (National Plan: Section 3.1.2), but question the role of technology-led approaches in re-shaping access to higher education in several ways: the continuing low participation rates of African (apartheid classification definition) students, which leads to further differential access to

professional jobs; the narrow focus on delivery at the expense of critical thinking, curriculum transformation and academic development; and the appearance of a pattern of enrolment of black students in online or mixed-mode programmes, rather than in contact programmes.

The ways in which ICTs may be re-shaping access to South African higher education strongly suggests that we problematise both their role and their effects. The following student enrolment figures for historically white 'contact' institutions during 2002 provide a good entry into some of the issues surrounding 'dual-mode' or 'mixed-mode' institutions, in which various technology-market twinning relationships – public-private partnerships; choice of software; shifting costs to students; regulatory frameworks – play a central role.

Table 1 does not consider the historically black institutions or the traditional 'distance providers' (note that 400 'contact students' were registered at UNISA, traditionally a distance education institution, during 2002). Statistics from the Department of Education (2004: 32) show that in 2002 there were no 'distance students' enrolled at the seven historically black technikons, and only three out of the ten historically black universities had enrolled distance students: Fort Hare (2,120), North West (950) and Vista (9,744), and these students were enrolled predominantly in the humanities, which is also surprisingly the pattern reflected in all the institutions represented in Table 1.

Table 1: *Comparison of 'contact' & 'distance' student enrolments at selected institutions*

University/Technikon	Headcount Enrolments in 2002			Black students as % of enrolments*	
	Contact	Distance	Total	Contact	Distance
Universities					
Cape Town	19 560	0	19 560	48	n/a
Free State	15 819	1 632	17 451	59	24
Natal	20 472	8 556	29 028	75	92
Port Elizabeth	6 756	14 579	21 335	56	99
Potchefstroom	15 308	10 134	25 442	38	93
Pretoria	32 780	7 993	40 773	32	96
Rand Afrikaans Univ.	17 506	4 628	22 134	35	96
Rhodes	6 397	1 028	7 425	49	98
Stellenbosch	19 408	1 987	21 395	22	92
Wits Univ	22 181	0	21 181	63	n/a
Technikons					
Cape Technikon	14 032	31	14 063	62	100
Free State Technikon	7 473	313	7 786	72	79
Port Elizabeth Tech.	9 452	41	9 493	72	83
Pretoria Technikon	28 900	8 586	37 486	74	98
Vaal Triangle Tech.	15 340	0	15 340	91	n/a
Wits Technikon	13 717	0	13 717	88	n/a

Source: Department of Education (2004: 32)

* Black students in the above table include the apartheid categories of African, Coloured and Indian.

The above snapshot shows a clear difference in student enrolment patterns according to historical institutional type. Eight out of ten historically white universities (HWU) and four out of six historically white technikons (HWT) enrolled distance students during 2002. At the University of Port Elizabeth distance students made up the majority of enrolments, while at five other

institutions they constituted a significant proportion of the total students enrolled in 2002: 40% at University of Potchefstroom, 29% at University of Natal, 23% at Pretoria Technikon, 21% at Rand Afrikaans University and 20% at University of Pretoria. Many of these traditionally contact institutions are able to deliver their distance programmes through various combinations of public-private partnerships for administrative support, technical support, student registration and so on; and by using a variety of web-based or telematic programmes (Jansen, 2004: 306).

With the exception of the University of the Free State (24%), Free State Technikon (79%) and Port Elizabeth Technikon (83%), black students represented between 92% and 100% of all distance students in the above institutions. In contrast, with the exception of the University of the Witwatersrand (63%), the University of Natal (75%) and the technikons, black students constituted between 22% and 59% of contact students in these institutions. There is a clear continuity in the physical university space in 2002 as a predominantly white academic space, particularly if we compare these figures to the percentage of black instructional and research staff at the above universities – under 10% (Free State, Potchefstroom, Stellenbosch), between 10% and 15% (UCT, PE, Pretoria, RAU, Rhodes) and above 15% (Wits – 24%, and Natal - 39%) (DoE, 2004: 43).

Table 2: *'distance' & 'contact' student enrolments in dual-mode universities in 2002*

Institution	Apartheid classification				Total	Gender	
	African	Coloured	Indian	White		Female	Male
Distance Students							
Free State	234	59	104	1,235	1,632	496	1,136
Natal	6,613	331	899	713	8,556	5,803	2,753
PE	14,252	153	60	114	14,579	9,669	4,910
Potch	7,849	162	34	753	10,234	6,517	3,617
Pretoria U	7,443	77	116	357	7,993	6,204	1,789
RAU	4,335	40	47	296	4,628	3,187	1,441
Rhodes	941	69	1	17	1,028	701	327
Stellenbosch	1,719	107	12	149	1,987	1,589	398
Contact Students							
Free State	8,352	683	243	6,541	15,819	8,999	6,842
Natal	7,297	583	7,548	5,039	20,472	10,437	10,035
PE	2,770	794	224	2,968	6,756	3,798	2,958
Potch	4,682	613	222	9,516	15,308	9,216	6,092
Pretoria U	8,636	482	1,450	22,212	32,780	17,070	15,710
RAU	4,189	620	1,305	11,392	17,506	9,543	7,963
Rhodes	2,391	272	467	3,267	6,397	3,694	2,703
Stellenbosch	1,558	2,217	421	15,212	19,408	9,736	9,669

Source: Department of Education (2004: 35)

Table 2 breaks down the categories 'black' and 'gender' across distance and contact enrolments in the eight 'dual-mode' universities shown in Table 1. The figures show that the historical gender ratios at most institutions were reversed in 2002; the majority of students were women in both contact and distance programmes at all institutions except Free State University, University of Cape Town and University of the Witwatersrand. [17] This was not the case for enrolment by race for contact students. The enrolment figures below show that white students remained in the

majority in contact programmes, and African students constituted the majority of distance students. The exceptions were Free State University, where the majority of distance students were white and male and the majority of contact students were African and female, and the University of Natal, where the majority of distance students were African and female while the majority of contact students were Indian and female.

In the absence of recent statistics it is unclear whether these enrolment patterns, and the corresponding campus spaces, have changed since 2002, especially since the success rates of undergraduate distance students were lower in 2002 than for undergraduate contact students (DoE, 2004: 41). While this trend, of the lower success rates of distance students, is not unique to South Africa, it demands a serious investigation of the access patterns, success rates, campus spaces and quality of the academic experience of distance and contact students.

The following three quotations from the National Plan for Higher Education (Department of Education, 2001) capture some of the policy dilemmas of equity and redress associated with narrowly constructed ICT approaches that may be functioning to re-shape access to higher education in some of the above ways.

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: Section 2.3.2)

As the White Paper states, 'equity of access must be complemented by a concern for equity of outcomes. Increased access must not lead to a "revolving door" syndrome for students with high failure and drop-out rates' (White Paper: 2.29). Neither must the increased access of black students through distance education programmes and satellite campuses – students who are 'neither seen nor heard', be allowed to parade as a commitment to equity of access. (National Plan: Section 3.2)

However, it is important to guard against the uncritical introduction and adoption of distance education as a panacea for the challenges that confront higher education in South Africa. Nor must we be blinded by the suggestions that in the context of globalisation and the development of virtual universities, especially by multinational telecommunications companies, distance education is the beginning and end of higher education. The notion of the virtual university and the role of distance education must be interrogated to assess both its promise and peril for higher education in South Africa and the Continent as a whole. (National Plan: Section 4.4)

CONCLUSION

The model of technology-driven change implied in the dominant globalisation discourse is inadequate to speak to redressing past and existing inequalities in deeply divided societies because it pays insufficient attention to the ways in which the power dynamics of technology-led change may function to uphold existing structural inequalities and colonial relationships. It is possible to argue that the new kinds of digitally-enhanced institutions display an ambiguous relationship to redress initiatives designed to tackle existing inequalities, but a strong relationship to the dominant global economic order, with its in-built inequities. For example, is it possible that the increasing use of ICTs is introducing a new discourse on higher education change – through various policies, structures, practices, dominant ideas and language – that may be actively constructing universities into new types of 'digital' institutions to fit into the dominant economic order, and in the process, creating new structures as 'power agencies' having authority over staff

and students, and empowering administrators? Are these new institutions ('digitised' to different degrees) influencing, and possibly changing, the meanings of access, quality, and higher education transformation? How do the meanings of technology-enhanced change relate to other meanings of change?

An alternative model of change is required, one that is able to more adequately address both the current unequal material distribution (the source of digital divides) and the recognition of difference beyond its liberal application in mainstream multiculturalist approaches, which see as unproblematic the higher education space into which access is sought. Finally, the contribution of ICTs to transforming higher education, and the nature of that transformation, will depend on the extent to which current ICT practices actively support, undermine or ignore several competing perspectives on higher education change, namely, the dominant globalisation project with its focus on skills training and affirmative academic practices, or alternative projects such as the decolonisation and democratisation projects that emphasise critical thinking and transformative academic practices.

Endnotes

[1] eDegree is a South African owned e-learning company whose shareholders include Johnnic Ltd., as the majority shareholder, and Pricewaterhouse Coopers. See http://www.edegree.co.za

[2] For a critique of the 'knowledge society' argument, see Fuller (1995), who suggests that this narrow characterisation inadequately captures the complexities of contemporary society as it assumes first, that knowledge was not a salient feature of previous societies, and second, it isolates one dimension – knowledge – at the expense of other salient features (e.g. persisting material inequalities).

[3] This is evident in the prioritisation of the telecommunications sector, and in the creation of new structures such as the Presidential National Commission on Information Society and Development and the Presidential International Task Force on Information Society and Development, initiated to advise the South African government on digital divide issues and development. The PIAC identifies three areas that would benefit from the innovative use of ICTs: education, health and SMMEs.

[4] Burbules & Callister (2000) further distinguish between 'conditions of access' and 'criteria of access'. (For example, how right-handedness as a criterion of access can restrict access to people with dominant left hands.)

[5] See, for example, Lundell & Howell (2000), Bridges.org (2002), Ravjee (2002), Beebe et al. (2003), Butcher (2003), Adam (2003), Czerniewicz (2004) and Le Grange (2004).

[6] Fraser's (1995) discussion of critical recognition as a framework for redressing race and gender imbalances (and requiring both redistribution and recognition as solutions) is relevant to this discussion.

[7] Many ICT innovations have failed because of costs. An illustrative example is the recent plan to dismantle the UK's e-university project, which was marketed internationally from 2000 to provide UK degrees online, but succeeded in recruiting only 900 students internationally after an initial investment of 35 million pounds. See *Times Higher Education Supplement*, 30 April 2004, cited in *Industry and Higher Education*, June 2004: 142.

[8] See Ravjee (2004).

[9] Man-Sheng & Chun-meng (2003: 43) cite a 1999 report of the Australian Commission of University Presidents showing that '35 Australian universities set up 750 overseas programs, mainly sited in Singapore, Malaysia, China and Hong-Kong, with enrolments of 31 850. UK statistics report that 75% of British universities have set up at least one legal overseas course, with a total enrolment of between 135 000 to 140 000 students'.

[10] Many countries, including the United States, Kenya, Norway and New Zealand, have made requests through the WTO for South Africa to provide unlimited access to international providers seeking to offer educational programmes in South Africa. See Pillay, Maasen & Cloete (2003) for a further discussion of GATS and higher education in the SADC region.

[11] See Stanley Aronowitz (2000) *The Knowledge Factory: Dismantling the Corporate University and Creating Higher Learning*. Also see Sheila Slaughter and Larry L. Leslie (1997) *Academic Capitalism: Politics, Policies and the Entrepreneurial University.*

[12] The international literature is dominated by empirical studies (often donor funded) based in the United States, Europe and Australia. Interestingly, most of the South African research in this area also has a local empirical focus, and few studies directly address the relation of ICTs to higher education change. Many of these studies are located firmly in the globalisation literature, or at the boundaries of the globalisation and digital divide literatures, and largely underscore the power dynamics surrounding the use of technology in higher education. There has also been a growth in the research on ICTs in African higher education (Beebe et al. 2003; Adam, 2003; Butcher, 2003), and on the role of higher education institutions, through their engagement with ICTs, in the national development of African states and economies (Adesida, 1998; Ballantyne, 2002; Johnson , 2002; Nwuke, 2003).

[13] See for instance Paulo Freire (1985) *The Politics of Education: Culture, Education and Power*. Granby, Mass.: Bergin and Garvey.

[14] Cited in Birgit Brock-Utne (2000).

[15] I draw here from a recent study of the INFOLIT programme of the Cape Higher Education Consortium (Ravjee, Koen & Reagon, 2002).

[16] A case study of eDegree may untangle some of these issues in the South African context.

[17] The figures for the University of Cape Town and the University of the Witwatersrand do not appear in Table 2. Both universities did not enrol distance students in 2002.

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An analysis of the impact of an authentic assessment strategy on student performance in a technology-mediated constructivist classroom: A study revisited

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ABSTRACT

Assessment performs a number of important and well documented roles in learning environments where it is used as both a formative and a summative tool. However, one of the most contentious roles that assessment plays is its role in high stakes accountability testing. Over the years a degree of standardisation of summative assessment has occurred that appears to satisfy society's need for certainty about the validity and reliability of summative assessment practices, particularly in the case of high stakes accountability testing. Promotion of competent learners at schools and tertiary institutions depends on the outcome of this assessment, as does the process of warranting learning, while employers rely on these outcomes when deciding on whom to employ. This form of assessment practice has strong roots in the behaviourist paradigm and relies on 'scientific measurement of ability and achievement' for its authority. So strong is the hold of the behaviourist approach on summative assessment practices that it is 'presumed to hold the high ground' even in constructivist classrooms.

In this paper a study undertaken in 2002 that considered the implementation of a computer-mediated, constructivist learning environment is revisited in light of tensions concerning validity and reliability between the behaviourist-informed measurement community and the authentic assessment practices of the social constructivist community. The results of student performance in the assessment that took place in the original study are reassessed and discussed in terms of the behaviourist versus constructivist debate with respect to assessment. Apart from the obvious wider implications, this debate has particular relevance with respect to institutional online learning implementation via staff development programmes.

Keywords: *Assessment; authentic assessment; accountability; validity and reliability; measurement community; constructivist learning environments*

INTRODUCTION

This study revisits an assessment strategy employed in a study undertaken in 2002 (Scholtz, 2005) which documented the design, development and implementation of a computer-mediated constructivist learning environment and its effect on students at an historically black institution. Of particular interest to the author is the tension that exists between social constructivist-informed authentic assessment practices and the belief systems and expectations of educators, administrators, employers and parents (Shepard, 2000a: 1; Shepard, 2000b: 6), which justify the continuation of the status quo, supported as it is by the practices of the measurement community (Shepard & Bliem, 1995: 1).

It is important to point out early on in this discussion that the design of the module presented in the original study – and by implication the assessment approach followed – was informed by Herrington & Oliver's (2000) work on technology-mediated authentic learning environments. Herrington & Oliver's (2000) work is, in turn, a synthesis of the ideas a number of authors in the social constructivist school, in particular Brown, Collins & Duguid's (1989) notion of situated

learning and cognitive apprenticeships and Lave & Wenger's (1991) notion of legitimate peripheral participation within communities of practice.

Social constructivists are adherents to Vygotsky's Social Development Theory and Blumer's symbolic interactionist point of view (Kanuka & Anderson, 1998: 60; Kanuka & Anderson, 1999: online). They emphasise the importance of the role of language and communities or groups, with common interests or 'shared practices', in the construction of knowledge through interaction (Kanuka & Anderson, 1998: 60; Kanuka & Anderson, 1999: online). In other words, as Kanuka & Anderson (1999: online) point out:

> *. . . knowledge is constructed in the context of the environment in which it is encountered through a social and collaborative process using language.*

Obviously the theoretical foundation on which this module was developed is important, however the discussion that this paper seeks to stimulate focuses on the issues raised by Shepard in 1991 when she asks why it is that the behaviourist-underpinned approach to assessment of the measurement community is 'presumed to have the high ground' (Shepard, 1991: 9).

THEORETICAL FRAMEWORK

The influence of behaviourist psychology on education has endured for more than five decades. While there is evidence that the influence of social constructivism on education practice in the classroom is on the increase, there is also evidence that this influence does not extend to assessment (Shepard, 2000a: 4). On the contrary, Shepard (1991: 1) contends that the implicit beliefs and theories of teachers, administrators and other key role-players, including parents, are so influenced by the dominant paradigm of their formative professional and lived experiences that the contemplation of alternatives to the behaviourist concept of 'scientific measurement of ability and achievement' (Shepard, 2000b: 5) is difficult (Shepard & Bliem, 1995: 1).

This is particularly true of high stakes accountability testing, where the results of the assessment determine whether learners are promoted or their learning can be warranted (Knight, 2002: 276). Born out of the need to address 'embarrassing inconsistencies in teachers' grading practices' (Shepard, 2000b: 14), it is the very notions of evidence and fairness that go to the heart of the issue, namely that the behaviourist approach to assessment is 'presumed to have the high ground' (Shepard, 1991: 9). Such assumptions shape 'beliefs about the nature of evidence and principles of fairness' (Shepard, 2000b: 17).

Behaviourists have, over several decades, developed an approach to testing that they believe measures the ability of learners objectively against a set of norms or criteria designed specifically for that purpose. This approach is based on the classic behaviourist assumption espoused by Skinner that discipline-specific knowledge can be deconstructed into discrete, 'tightly specified behaviourally-stated objectives' ((Entwistle, 1988: 8; Shepard, 2000b: 9), the mastery of which must be demonstrated through explicit testing before learners can proceed to the next level. In this way behaviourists applied Thorndike's principles of scientific measurement (see Thorndike, 1904 and Thorndike, 1927) to these tests in order to standardise their outcomes. This process of 'making the study of education more scientific' (Shepard, 2000b: 14) resulted in an increasing confidence in the outcome of the assessment process in the minds of teachers, parents, administrators and politicians alike.

Critics of the behaviourist approach to testing and assessment argue that such tests have had the effect of sustaining the gap between knowing and doing, and the decontextualisation of learning (Brown, Collins & Duguid, 1989: online; Ramsden, 1992: 39; Laurillard, 1993: 15-17; Kings, 1994: online; Herrington & Oliver, 2000: online; Herrington, Reeves, Oliver & Woo, 2004: 4).

Furthermore it is asserted that behaviourist 'commoditization of learning' promotes 'conflicts between learning to know and learning to display knowledge for evaluation' (Lave & Wenger, 1991: 112). This has, in the opinion of Shepard (2000b: 3), led to the moulding of classroom activities around both the 'content and format of external standardised tests', resulting in the 'complexity and demands of the curriculum' being lowered and a reduction in the 'credibility of test scores'.

The social constructivist alternative to behaviourist pedagogy sees learning as the construction of knowledge within the context of real life situations and assessment integrated into the process of learning (Wild & Quinn, 1998: 76-77; Brown, Collins & Duguid, 1989: online; Cognition and Technology Group at Vanderbilt, Learning Technology Center, 1993: 75; Laurillard, 1993: 15; Herrington & Oliver, 2000: online; Shepard, 2000b: 1). In other words, if assessment is to be meaningful it should in some way reflect the practice of the profession, vocation or practice being assessed, while at the same time giving learners the opportunity to demonstrate their knowledge and skills.

Shepard describes this approach to assessment as performance based (Shepard, 2000b: 43), in which:

> *Teachers' close assessment of students' understandings, feedback from peers, and student self-assessment are a part of the social processes that mediate the development of intellectual abilities, construction of knowledge, and formation of students' identities.*

The study that this paper revisits involved the design, development and implementation of an authentic learning environment – and by implication an authentic assessment strategy – based on Herrington & Oliver's (2000: online) nine characteristics of authentic learning environments, namely that authentic leaning environments should:

1. Provide authentic contexts that reflect the way knowledge will be used in real life;
2. Provide authentic activities;
3. Provide access to expert performances and the modelling of processes;
4. Provide multiple roles and perspectives;
5. Support collaborative construction of knowledge;
6. Provide reflection to enable abstraction to be formed;
7. Provide articulation to enable tacit knowledge to be made explicit;
8. Provide coaching and scaffolding by the teacher at critical times; and,
9. Provide for authentic assessment of learning within the tasks.

The issue under consideration is whether assessment based on social constructivist principles can overcome the concerns of teachers, parents, administrators, politicians and other commentators whose thinking is so influenced by the notion of validity and reliability that is inherent in behaviourist psychology's concept of 'scientific measurement of ability and achievement' (Shepard & Bliem, 1995: 1; Shepard, 2000a: 1; Shepard, 2000b: 6).

THE STUDY REVISITED

One of the questions posed in the original study (Scholtz, 2005) concerned the effect of an authentic assessment strategy in a technology-mediated, constructivist-informed learning environment on the performance of students who participated in this study. When posing this

question one is immediately aware of the tensions between constructivism and behaviourism in this study. Before examining these tensions more thoroughly it is important to briefly describe the module designed for the original study.

The Module

Support for the design of the module that was developed for this study was drawn from a number of theoretical perspectives and represents an attempt to develop a technology-mediated authentic learning environment based on the ideas of Herrington & Oliver (2000), whose work is influenced by both Brown, Collins & Duguid's (1989) notion cognitive apprenticeship and Lave & Wenger's (1991) notion of legitimate peripheral participation in communities of practice. The design process also acknowledged the importance of:

- interaction in learning environments as an influence on student attitudes and student achievement (Hillman, Willis & Gunawardena, 1994; Sutton, 2001; and Moore, 1989). The use of online learning environments to promote interaction between learners and content, learners and learners, learners and teachers, learners and the interface is usually intended to satisfy the learner's need for support (Ally, 2004);
- communication in support of these interactions (Anderson, 2002);
- assessment as central to the learning experience (Brown, et al., 1994; Kings, 1994; Hodgman, 1997 and Rovai, 2000), and its influence on the 'choice' of learning made by the learner (Hodgman, 1997; Marton & Säljö, 1984; Dahgren, 1984 and Entwistle, 1988); and,
- the generic outcomes required by the National Qualifications Framework of the South African Qualifications Authority (undated).

At the beginning of the course a group of final year Physiology students were asked to form groups of six. No criteria were used in this process and students were able to choose their group mates as they saw fit. However, the class was informed that participation in the module required a degree of computer literacy and they were advised to ensure that at least one group member was reasonably computer literate, if possible. Each group member was assigned a role within the group by consensus amongst the group members. No particular thought was given to structuring the groups or the roles within the groups other than the generally-acknowledged importance of group work in social constructivist learning environments. Students performing the same function within the group were brought together to learn about their particular function within the group and what was expected of them. Table 1 lists the required roles and concomitant responsibilities.

After dealing with the roles and responsibilities of individuals within a group, the groups were introduced to the tasks they were to undertake. Each task was tackled by two groups so that the students could participate in a peer assessment process with some exposure to the subject matter and a degree of understanding of the topic. In designing the tasks an attempt was made to present these tasks in an authentic a manner as possible, situated in the real world context that physiologists might have to contend with in their working environment.

Table 1: *Individual Roles and Responsibilities within a Group*

Role	Responsibility
Group Leader	Group leaders were responsible for co-ordinating the group's activities and the development and implementation of an action plan, in conjunction with group members, in order to ensure that the tasks set were accomplished.
Researcher - Internet	Internet researchers were given a short course on the use of the Internet and pointed to a number of online resources dealing with Internet searches.
Researcher - Library	Library researchers were given a tour of the university library by a subject librarian and were briefed on how to make use of the library to find suitable information.
Scribe	The scribes were given a short course on the use of MS Word and pointed to a number of online resources that they would find useful in completing their role in the team.
Presenter	The presenters were given a short course on the use of MS PowerPoint and pointed to a number of resources that they would find useful in completing their role in the team.
Assessment Co-ordinator	The assessment co-ordinators were advised of their responsibilities as co-ordinators of the assessment processes and their roles in guiding and understanding the processes required to complete the task. They were given access to a resource that explained assessment to them and the difference between formative and summative assessment. The assessment process was explained to this group and assessment rubrics were given to the assessment co-ordinators as guides to the assessment process.

Assessment Strategy

Groups were expected to make use of the Internet and the university library in order to access the resources necessary to successfully complete the task. Each group was expected to submit electronically a five-page typed report on their task, in the format required, which stressed the importance of citations in the text and references at the end of the document. The documents submitted were made available to the class on the module website. These initial submissions became the focus of a formative assessment exercise undertaken by the groups and by a panel of experts made up of the class lecturers, three graduate assistants and the author as facilitator of the module. Each group was required to comment on the submission of the group doing the same task as they were, i.e. peer group assessment. An assessment rubric was made available electronically for the purpose and was completed by groups and the panel of experts alike. This rubric also contained an area where groups could post detailed comments about the submission that they were assessing. Groups were obliged to provide a detailed report justifying their criticisms as well as pointing out where improvements could be made.

In order to ensure that the process of formative assessment undertaken by the peer group was taken seriously the group was assigned a mark for their efforts. These marks were given equally to group members and assigned to a category called 'Contribution to discussion and assessment of tasks'.

On completion of the formative assessment process, groups were given an opportunity to reflect on the input of their peers and of the subject experts and to reconsider their submission based on what they had learned from both the formative assessment process. This reflective process culminated in the resubmission of the tasks by the groups. This resubmission was for summative

evaluation, which was undertaken by the module lecturers. When undertaking this assessment the lecturers concerned themselves not only with the content but also with how the group had dealt with issues arising from the comments received on their submission. Feedback was given by the lecturers to the groups before completion of the next step, the creation of a presentation.

Subsequently, groups were required to create an oral presentation on their task for delivery to the class. The class and the panel of experts participated in the assessment of the presentation making use of an online rubric designed to guide the assessment process. Participation by the class in this process was assessed and marks allocated to the category 'Contribution to discussion and assessment of tasks'.

Finally, in order to ensure that students were rewarded for their participation within the group, student-participants were required to assess the contribution of each of their peers within their group. Students could earn or lose up to 12% of the final mark awarded to the group, based on the results of this peer assessment. Students who did not participate in this process were penalised. Students who did not take the process seriously, for example by awarding the same rating to each question contained in the poll or the same rating to all participants in the group, were also penalised, and their ratings were discounted in the final calculation. This was reflected in the assessment category called 'On-going assessment of attitudes to the module'.

RESULTS

Student performance in the study module, which I will refer to as Module 1, was revisited and compared to student performance in the module following the study module, which I will refer to as Module 2, in order to ascertain whether student participation in a technology-mediated constructivist learning environment had any influence on their performance when compared to performance of the same group of students in a traditionally-presented chalk-and-talk classroom. An exploratory analysis of student performance in these modules using MSExcel indicated that there was a difference in student performance between modules and that the degree to which student performance differed was not uniform throughout the class.

Indeed, the difference in performance between the modules for the class as a whole and the performance of students at the top of the class as determined by their performance in Module 2 was not the same as that of students in the middle of the class or at the bottom of the class. While there are a number of factors that could have been instrumental in the cause of this manifestation, the pattern was compelling enough to warrant further investigation given the tensions between constructivist learning environments and summative assessment practices.

In order to do so the class was divided into tertiles based on their individual performances in Module 2, the follow-on module. A paired samples t-test was undertaken on the performances of the class as a whole in both modules and on the performances of each of the tertiles in both modules using SPSS. The results of this test are given in Table 2.

Table 2: *Results of the Paired Samples t-test*

Tertile	Module	Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Low	Module 1 - Module 2	38.53	10.06	2.31	33.68	43.37	16.70	18	0.00
Middle	Module 1 - Module 2	24.65	7.11	1.59	21.32	27.98	15.50	19	0.00
High	Module 1 - Module 2	11.83	7.96	2.30	6.77	16.89	5.15	11	0.00
All	Module 1 - Module 2	26.80	13.32	1.87	23.06	30.55	14.37	50	0.00

The paired-samples t-test compares the means of two variables that represent the same group at different times. In this case the two variables are the different approaches taken in the modules in which the group participated, i.e. in Module 1, the study module, students participated in a computer-mediated constructivist classroom, while in Module 2 students participated in a traditionally-presented chalk-and-talk classroom.

Like z-scores, the paired-samples t-test standardises individual items in a population distribution by taking into account the mean and standard deviation of that population, thus allowing for comparisons to be made. From Table 2 the fact that the significance values for the difference between means of each tertile is zero, (i.e. $p = 0.00$), and the fact that the upper and lower 95% confidence interval do not contain a 0, indicates a significant difference between the means of student performance in each tertile. This also applies to the analysis for the module as a whole, i.e. that there is a significant difference between student performance in each of the modules.

Furthermore, the difference between the means for the performance in each module of the class as a whole is 26.80, while for the students in the middle tertile this difference is 24.65, which is little different from the class as a whole. However, when considering the difference between the means for the students who fell into the low tertile, we see that there is a greater difference between the difference in means between the performance of the class as a whole (26.80) and the difference in means between the performances of students in this tertile (38.53).

The results of this test appear to indicate that students in the low tertile were advantaged by the approach taken in the study module (Module 1) over the approach taken in the follow-on module (Module 2). Finally, when considering what happened to students in the high tertile, we find that the difference in their performance (11.83) when compared to the difference in means between the modules as a whole (26.80) was a great deal smaller than for the difference in means between the modules.

The results of this test appear to indicate that students in the top tertile were disadvantaged by the approach taken and did not, or were not able to fulfil their potential in the study module (Module 1) when compared to their performance in the follow-on module (Module 2). These results of the paired samples t-test analysis would seem to indicate that the group approach

taken in Module 1 seems to have a 'uniforming' effect on student performance when compared to student performance in a traditional chalk-and-talk classroom.

A One Way Anova analysis of the means was performed on each of the tertiles within each module in an attempt to confirm this pattern. The results are given in Table 3.

Table 3: *One Way Anova Analysis of Means*

		Sum of Squares	df	Mean Square	F	Sig.
Module 1	Between Groups	113.493	2	56.747	1.629	.207
	Within Groups	1671.801	48	34.829		
	Total	1785.294	50			
Module 2	Between Groups	7037.830	2	3518.915	84.490	.000
	Within Groups	1999.151	48	41.649		
	Total	9036.980	50			

In the Anova analysis of the modules one can see that the difference in means between the tertiles in Module 1 was not significant ($p<0.05$). While for Module 2 the difference in means between the tertiles was indeed significant ($p = 0$). This indicates that students in the bottom tertile performed statistically significantly worse than those in the middle tertile. Students in the top tertile performed significantly better than those in the middle tertile. In other words, there is a significant difference in student performance depending on which tertile students find themselves. When the situation in Module 1 is considered there is no statistically significant difference between the mean results obtained by the students in any of the tertiles.

This would further suggest that the assessment strategy in Module 1 had a the effect of advantaging the poorer performing student as determined by student performance in Module 2; had little effect on the participants in the middle tertile and disadvantaged the top students as determined by student performance in Module 2. This seems to be a further indication of the 'uniforming' effect on student performance of the group approach taken in Module 1 when compared to student performance in a traditional chalk-and-talk classroom.

DISCUSSION

The assessment approach used in the study can certainly be criticised on a number of counts. Firstly, the strong reliance on group assessment used needs to be reconsidered to provide students with opportunities to show individually what they are capable of doing. Secondly, this preoccupation with group assessment will tend to have a 'uniforming' effect on the performance of a group and, ultimately, on the performance of a class. It is conceivable that the statistical results obtained may have been determined by the low limit of 12% which was set for the maximum variation between the group mark and the individual mark. Finally, it is clear that more consideration needs to be given to the theory with respect to authentic tasks and collaboration in authentic learning environments.

However, these criticisms should not detract from the issue at hand, namely that:

> *'The dominance of objective tests has . . . shaped beliefs about the nature of evidence and principles of fairness' (Shepard, 2000b: 17).*

Clearly, the results obtained from revisiting aspects of this earlier study – no matter how flawed they might be – lend credence to the concerns that the measurement community have about authentic assessment practices, particularly with respect to the validity and reliability of high stakes summative assessment practices. It would appear that these concerns regarding assessment are shared by many who otherwise embrace social constructivist learning environments, hence the concern raised by Shepard (2000: 5) and others that traditional testing remains the predominant form of assessment, even in constructivist classrooms. This is of particular concern given that the literature is fairly unanimous in its support of social constructivism as the pedagogy of choice in support of technology-mediation in learning.

Successfully challenging the implicit beliefs and theories of teachers, administrators and other key role-players is therefore a vital step if alternative or authentic assessment practices are to gain acceptance in the modern classroom. In order to do so analysis of these assessment practices need to present a more convincing picture, particularly as far as the validity and reliability of the outcome of these practices are concerned. It is interesting that, while constructivist literature is fairly clear about what learning is and the sort of learning environments we need to create in order to bring learning about, little seems to be written about how we determine whether learning is, in fact, taking place and, if so, to what degree.

If authentic assessment is to acquire the sort of legitimacy that the assessment practices of the measurement community have acquired then we as critics of these assessment practices need to find ways and means of confronting the criticisms levelled at alternative assessment.

CONCLUSION

This paper attempted to highlight the sort of concerns that psychometricians have with assessment in constructivist learning environments, particularly with respect to high stakes accountability testing. The results of the analysis undertaken in this study revisited indicate that an argument can be made that stronger students, academically speaking, were disadvantaged by the assessment strategy employed in the study, while weaker students were advantaged. Exponents of alternative assessment strategies are clearly convinced that these strategies more fairly reflect Shepard's (200b: 17) 'nature of evidence and principles of fairness'. However, it is this author's understanding that a great deal more energy needs to go into consideration of the issues surrounding high stakes accountability testing and the implicit beliefs and theories of all participants and stakeholders in that assessment, if alternative assessment practices are to play a meaningful and convincing role in assessment in general, and high stakes accountability assessment in particular.

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Technology for teaching and learning in higher education contexts: Activity theory and actor network theory analytical perspectives

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ABSTRACT

There is a growing body of literature which argues that technology enhances teaching and learning processes in higher education. The adoption of teaching and learning technology such as elearning and the learning management systems (LMSs) is also on the rise among higher education institutions. The patterns of this growing trend are also incoherent and inconsistent. In addition, there is no general agreement on the meaning of concepts of adoption and use within academia. In the midst of the existing conceptual stampede it remains difficult to adequately explain emerging patterns. This paper explores a possible framework for the analysis of objective (goal)-directed applications of technology in a teaching and learning environments, and implications thereof. The work of Miettinen, of Rajkumar, and as well as Miettinen and Hasu encourages the use of Activity Theory (AT) for this purpose. The paper draws on three case studies from technology usability studies to explore a possible AT analytical framework. AT is found to be helpful for analysis of practical applications of technology, but not without shortcomings. AT tends to advocate an instrumentalist view of technology as a neutral tool. Both AT and Actor Network Theory (ANT) subscribe to the contextual embedded nature of technology but differ on implications and the status of technology in a socio-technical process. ANT supports the critical view of technology as value-laden, thus encouraging the critical engagement with a technology in social environments. Its symmetrical assumptions however, limit its scope in accounting for differences between human cognitive capabilities and the non-cognitive nature of artefacts. Additional studies towards an AT and ANT framework of contextualising e-learning and LMSs are recommended

INTRODUCTION

Technological innovation has changed the social, political, economic, and cultural fabric of life since the end of the Cold War (Taylor, 2001). Information and communication technology (ICT) has been instrumental in social transformations – from the industrial society of the 20th century to the ‘network society’ of the new age of ‘Informationalism’ - where even intercontinental neighbours are now one button-push away (Castells, 1996).

Higher education has not been left untouched, and predictions are that in just a few decades time the pressure of the changing times will have reduced big university campuses into relics. Universities as we know them, according to Drucker (1997), just won't survive. In the context of higher education there is a shift from the pursuit of knowledge for its own sake, to a more pragmatic economically-oriented paradigm (Gibbons, 1998). Information, awareness, and the ability to use information are key features of knowledge. Knowledge production and dissemination, research and teaching are no longer self-contained but involve interactions with a greater variety of knowledge producers than in the past. Universities worldwide are improving their competitiveness in the new and challenging distributed knowledge production system (Mlitwa, 2005). In this quest, they are making extensive use of new kinds of ICTs - to attract and teach new students, and to improve co-operation with different stakeholders (Gutlig, 1999; Middlehurst, 2003). The reaction in South Africa has been a move by the more established higher

education institutions from cultural conservatism to a more entrepreneurial university (Gutlig, 1999; van der Merwe, 2004).

Such traditional universities are dealing with the pressures of globalisation, the technology revolution, new kinds of competition, and the global push for an information society. Survival however, will depend on how universities re-position themselves in distributed knowledge production systems, the type of partnerships they forge (Gibbons, 1998; van der Merwe, 2004), and how they use available tools and resources such as ICT to improve their activities (Mlitwa, 2005). ICT for teaching and learning should be conceptually and operationally clarified if it is to have a positive impact. The purpose of this paper therefore, is to find a theoretical framework within which elearning practices in teaching and learning at higher education institutions can be contextualised.

The paper opens with a survey of literature about the role of technology in a changing higher education sector. Drawing on a recent investigation into the meanings and implications of ICT for teaching and learning by educators, practitioners and researchers working in higher education institutions in South Africa (Cerniewicz, et al., 2005), it shows the incoherence in existing concepts and held views on technology in education. Andrew Feenberg's (2003) perspectives on technology and social contexts are used to categorise dominant assumptions concerning technology in teaching and learning. Activity theory (AT) is then outlined and motivated as an analytical framework. The author acknowledges dominant arguments that call for effective, innovative or appropriate uses of technology in the literature, and draws on case studies from the technology usability discipline to investigate the meaning and implications of technology usability. The paper investigates these meanings can contribute towards the development of an analytical framework for elearning applications.

DIVERSE MEANINGS OF EDUCATIONAL ICT

ICTs may play a key role in effective responses by universities to the challenges posed by changing global, local, and technology related forces. However this requires the addressing of a pervasive lack of conceptual clarity concerning the nature and uses of ICT.

In research reports, government and higher education institutional policy documents as well as statements by academics and IT practitioners, technology is generally discussed in relation to its multiple uses (Mlitwa, 2005). The expanding range of technology uses leads to a proliferation of the meanings and implications attached to technology. In tertiary education reference is made to 'educational technologies' (UCT, 2003), 'learning and elearning technologies' (Badenhorst and de Beer, 2004), 'online teaching and learning technologies' (Van der Merwe and Möller, 2004), 'digital library technologies' (Peters, 2002), and 'digital learning objects' (Smith, 2004), among others. Technology is further viewed within the context of communication, as a communication tool and or network. Relevant descriptions include 'IT networks and communication protocols' (University of Natal, 2003), 'electronic Information and Communication Technologies' (Van der Merwe and Pool, 2002), 'information agents' (Razek, et al. 2003), or just 'communication technology' (Blanchette and Kanuka, 1999). These terms are often used inconsistently, with minimal or no attempt to define them (Mlitwa, 2005).

Many definitions emphasise the links between technology and knowledge. As a tool for example, it can extend human capabilities to solve problems (McLuhan, 1994), and to assist students in the acquisition of knowledge (Sanbenito.tx, undated) or to empower teachers and administrators to stimulate learning more effectively. Technology is also conceptualised as a domain either of knowledge, for knowledge advancement (UCT Policy Document, 2003:1) or for underpinning

innovation (South African Research and Development Strategy 2002:13).Technology also includes the knowledge and skills necessary to use technology as a tool (Bergen.org, undated).
For many practitioners in higher education according to Czerniewicz, et al., (2005) using ICT implies using the web. Hence, the term 'web-based' is equivalent to ICTs even when in reality, the two terms are not the same thing. As an example Muianga (2004:2) contends that many aspects of ICT relate to a web-based course management system. Uncritical reconciliation of the view of technology as knowledge in the earlier discussion and simultaneous acceptance of technology as the web can be confusing. It may be even be understood that since both knowledge and the web means ICT, that the web means knowledge. The following section investigates recent literature on the impacts of ICT.

PERSPECTIVES ON NEW TECHNOLOGIES IN TEACHING AND LEARNING

ICT is often considered part of a solution addressing the changing learning needs of societies (Garrison and Anderson, 2003). Beyond these positive perceptions there are fierce debates concerning the meanings and implications of ICT in teaching and learning. Technology may be viewed as neutral and autonomous (determinist) or neutral and human controlled (instrumentalist) (Feenberg, 2003). At the one extreme stands the view of technology as both autonomous and value-free (substantivist), while at the other technology is human controlled and value-laden (critical perspective). Where technology is seen as neutral and autonomous, the belief is that it is merely a tool and an indifferent instrument. This is the instrumentalist view of ICT (Feenberg, 2003).

For the constructivists, technology should be learner- centred. Arguments are made that when applied correctly, technology improves the quality of learning experiences (Tinio, 2002) or of education itself (Muianga, 2004). Its decentralized nature frees the learner from the educational provider (Khan, 2000). Elearning technologies should enable students to actively engage in the construction - rather than the passive receipt - of knowledge (Muianga, 2004). It could even help eliminate some debilitating factors in education, such as time, space, and pace (Sekgwelea, 2004). Authors such as Fox and Mills (1997) even expect web-technologies to totally change distance education. Technology such as elearning for example, will inevitably transform all forms of teaching and learning in the twenty-first century (Brown, 2002). The implications of these perspectives on elearning will be explored next.

INTERPRETATIONS OF ELEARNING

Elearning is also discussed within the contexts that mostly reflect 'whether or not distance education forms part of the meaning, whether the term relates to networked computers or stand-alone computers (or even computers at all) (Czerniewicz, et al., 2005)'. A computer is obviously presented as a significant part of elearning. Most academics and IT practitioners in higher education institutions however, tend to emphasise a network and learning more than single computers (ibid.). Computer networks become significant environments in their own right since they allow the use of the Learning Management Systems (LMS) which are so fundamental to elearning processes. A LMS can best be defined as a hardware and software environment for network-enabled learning programs and processes (Carliner, 2005) and in terms of its functionalities.

A LMS as a 'seamless link to elearning' (Carliner, 2005) offers an inclusive approach to defining the system. It positions the purpose within education. As a web-based training platform (Clark, 1996), it is largely described as a constructivist and collaborative knowledge environment on the World Wide Web (Relthe and Gillami, 1997) to advance guided independent learning (Rich, et al.,

1999). Note the alignment of LMSs in much of the literature with constructivist learning! It is said to enable 'flexible', 'participative' and 'contribution oriented' learning (Collis and Moonen, 2001). It can be used to incorporate multiple media elements (Henke, 1997; McManus, 1995) that further enable effective and flexible interaction. These perspectives reflect various understandings of what elearning does, rather than how and why it happens.

The following section discusses insights on elearning technologies in a higher education context, from the perspective of academic and IT practitioner interviews.

Practitioner and policy conceptions of elearning

In a recent investigation of conceptions and meanings of ICT, education and change in higher education among academics, policy makers, and IT practitioners across South African universities, one interviewee described elearning as the process where a lecturer with and sometimes without students creates a learning environment on the World Wide Web (www) and where learning in collaboration takes place (Czerniewicz, et al., 2005). Central to this definition is not only the presence, but also the significance of a network which requires access to computers and the skill to use these tools.

The University of Pretoria Strategic Plan, 2002-2005 (2002) describes elearning as the process where education technology is used in a virtual campus to enhance both distance and residential education processes. In this case the purpose of elearning is strictly to enhance the quality of teaching and learning. Special mention of a virtual campus and related implications is noted. Universal access to elearning including adequate literacy is an obvious prerequisite. The quality enhancement aspect however, suggests that the availability should be supplemented by purposeful and effective usage (Broere, et al., 2002). Purposeful usage implies a process where technology is specifically applied to achieve predefined human goals.

In the quest for a useful contextual framework, and in acknowledging dominant arguments for appropriate application/usage, the author applies the activity theory (AT) approach to technology-usability case studies by Bjoko (2006); Sheng-Cheng Huang (2006); and Kreitzeberg (2006) to explore the appropriateness of AT and usability arguments in the understanding of elearning and LMSs.

Activity theory and technology usability

Activity Theory (AT) can best be explained in terms of its key terms: internalization, mediation, subject, object, tool, transformation (process), rules, community, division of labour, and outcome (Engestrom, 1987). The subject is an individual, the object is the motive for action, the tool is an artefact while the community represents social groups, as well as rules and arrangements such as the division of labour. All these factors are jointly called the activity system (Rajkumar, 2005; Miettinen, 1997). AT originates from Vygotsky's concepts of mediated action, where he argued that human action is more than a function of internal biological processes. It is also mediated by culture and artefacts (including signs and tools). Leont'ev (1978) added that human activity is also socially mediated. Too often though, focus is placed on human action: hence the activity theory (and system). Activity theory is a concept and a theoretical approach or perspective (Sandars, 2005) that has been used and interpreted by many theorists and researchers across disciplines. It is used in most cases, to analyse the actual conditions of human activity from a means-ends, user-needs perspective (Rajkumar, 2005; Miettinen, 1997; 2002). Since the purpose of this paper is to improve the analytical framework for goal-specific uses of technology in social settings, the author finds AT useful.

The relationship between subjects (humans) and objects (motives) is mediated by the rest of the factors: tools, rules, community and the division of labour, among others. The mediation process is regarded as transformation that results into the outcome or motive (Miettinen, 1997). While a list of artefacts may be indefinite, the relationship between them and humans is purely that of a tool that merely serves to advance activities for the purpose of furthering motives. Subjects (humans) are mediated by culture, tools, rules and contexts (Rajkumar, 2005; Miettinen, 1997). They create artefacts on a continuous basis in the activity system to better enable transformation processes towards outcomes. An equivalent version of this perspective with a similar line of argument to describe the use of ICTs for local benefits (Erwin and Taylor, 2004), is made in Community Informatics (CI) literature.

This paper presents the use of an LMS within elearning as an activity system in AT. The activity systems recognize interactions between subjects (humans) – mediated by artefacts, tools, symbols, rules, cultures, communities, among other non-human things (Miettinen, 1997; Rajkumar, 2005). The relationship is that of a human and tool, with other influences. This relationship within the activity system is compatible with the instrumentalist view of technology, where the neutral tool only serves to achieve human goals or to mediate between humans and their objectives. This is how the theory has been used in recent projects. Miettinen et al. (2002) used AT to articulate the needs of the user of a high technology product. Similarly, Rajkumar (2005) cites and supports this work.

The objective of the analysis is to explore the clarity of the key terms used in technology-usability research, as well as related implications.

Usability case studies

In order to contextualise what researchers and technology users consider as important for technology usability I have highlighted key terms and attributed meanings in table 1. This will be used to establish the meaning of 'technology-usability' as implied by researchers, and to develop an AT based analytical framework that supports arguments for the usability (user-friendly) of LMSs.

In the first case study Bjoko (2006) used an eye-tracking method to compare the user-friendliness of the American Society of Oncology's two web designs in 2005. The Clinical Oncology Society had initiated a new improved website, and the objective of Bjoko's study was to test and compare the usability of the original against the usability enhanced website. The study findings confirm the usability of the new website as superior to the original website (in terms of the given criteria in table 1).

Table 1: *Selected Technology Usability Studies*

Author	Case Study + Technology Type	Purpose of Case Study	Criteria per Case Study	Meanings/Implications
Bojko, 2006	Using eye-tracking to compare web page designs	Comparing user-friendliness of two web designs	enable goal achievement enable efficiency - ease of use - meet user needs/ expectations	- Determinant of success or failure - Improves processes to the final goal - Does not add unnecessary physical strain - Does not force unnecessary user-adjustments
Sheng-Cheng Huang, 2006	Empirical evaluation of a popular cellular phone's menu system: theory meets practice	Determine effectiveness, efficiency, & user satisfaction of a cell-phone's menu system	- effectiveness - efficiency - user satisfaction - accuracy -clear labelling & descriptions -meet user expectations -compatible with intended task	- Enable successful goal achievement - Saves time, works fast, reliable - Users say it satisfy needs (user choices show) - Do only what it is intended to do, reliably - Should not be confusing - Relevant. No unnecessary user-adjustments
Kreitzberg, 2006	Can collaboration help redefine usability?	Opening debate for platforms that combine related information with easy access, reference & use	-collaborated knowledge bases -single entry-points to knowledge	- Info. fragmentation complicates usability - Info. Collaboration improves cross-discipline interaction

Reconstructed to reflect the findings of the case studies: Bjoko (2006); Sheng-Cheng Huang (2006); and Kreitzberg (2006).

In the second case study, Sheng-Cheng Huang (2006) evaluated a Nokia Cell-phone menu system to compare the convergence between the theoretical and practical aspects of cell-phone menu usability in 2005. The findings offer an insight into what should be more usable cell-phone menu functionalities. Though a cell phone is not exactly the same thing as a website, usability criteria do support those of Sheng-Cheng. From a slightly different angle, Kreitzberg (2006) introduces content provision as a significant aspect of website usability. The focus of this paper is not on the details of methodologies and findings of respective studies, but to draw lessons concerning the objectives and the key terms used for inferences into the usability of LMSs. The AT framework can also be used to analyse the terms and emergent meanings attributed to technology usability in three case studies. For example, the central AT term: subject (which implies the individual), is central to technology usability considerations in all three case studies. Evident in all three case studies is that good (highly usable) technology applications should enable the 'satisfaction of the subject (the individual user) interests, goals, and meet their expectations – with ease'.

Just as Bjoko (2006) is concerned with the user friendliness of the webpage, Sheng-Cheng Huang (2006) is concerned with the user-satisfaction of cell-phone menu systems. Kreitzberg (2006) is also concerned with the improvement of information provision methods in websites, thus suggesting a collaboration of different information platforms and sources to improve user access.

Terms used in all case studies tend to present an instrumentalist perspective of technology as a somewhat neutral tool (Feenberg, 2003) whose purpose is to adequately satisfy user-ends. Technology usability in the case of web pages for example, is high if technology functionalities enable goal achievement, enable efficiency, ease of use, and meet user needs/expectations (Bjoko, 2006). Sheng-Cheng Huang (2006) uses the terms of effectiveness, efficiency, user satisfaction, accuracy, clear labelling and descriptions, meet user expectations, and compatibility with intended tasks to make a similar point about the usability of cell-phone screen menus.
Keitzberg (2006) discusses the content delivery aspect of information technologies. The argument is strictly that of enhancing usability by improving the process towards access to information (motive for using a web-page). Collaboration rather than disintegration of information sources according to Keitzberg (2006) enhances information access processes.

By technology usability therefore, the case studies suggest the capacity of a technology to improve processes towards achieving the final goal of the user (in respective contexts and purposes). It should not be confusing. It should meet user needs, expectations, and should be easy to use (Bjoko, 2006). Keitzberg (2006) adds efficiency, effectiveness, and accuracy to concur with other two studies. The focus is clearly on subject activities and processes towards the outcome.

The reasoning in the three case studies supports the activity system paradigm of AT. Human-technology interaction according to this model of thinking is equivalent to a social network joined together by the use of tools where a negotiated relationship is limited to subjects (humans) who interact by manipulating artefacts. Following this thinking, a framework for understanding the LMS within AT paradigm is constructed in Figure 1.

An LMS in this framework would represent the activity system where learners are the subjects with activity taking place in their interaction with the hardware, software, content, and other learning applications. It is the usability of the LMS applications and the entire learning environment that mediates and transforms the object (learning) through the activity of learning – into the final outcome: enhanced learning and learning experiences. While this thinking seems fairly logical in many instances, it tends to carry simplistic implications that leave numerous questions unanswered. When technology is highly usable then the individual user will simply apply the rules in the activity system to easily achieve intended goals. In practice, the relationship between technology use and outcomes may be far more problematic since socio-technical interactions are not simply determined by the technology. Given the AT bias towards technology-neutrality perspectives, the question arises whether this framework is adequate to contextualise elearning through LMSs. The application of the neutral technology thesis in elearning processes is critiqued in the following section.

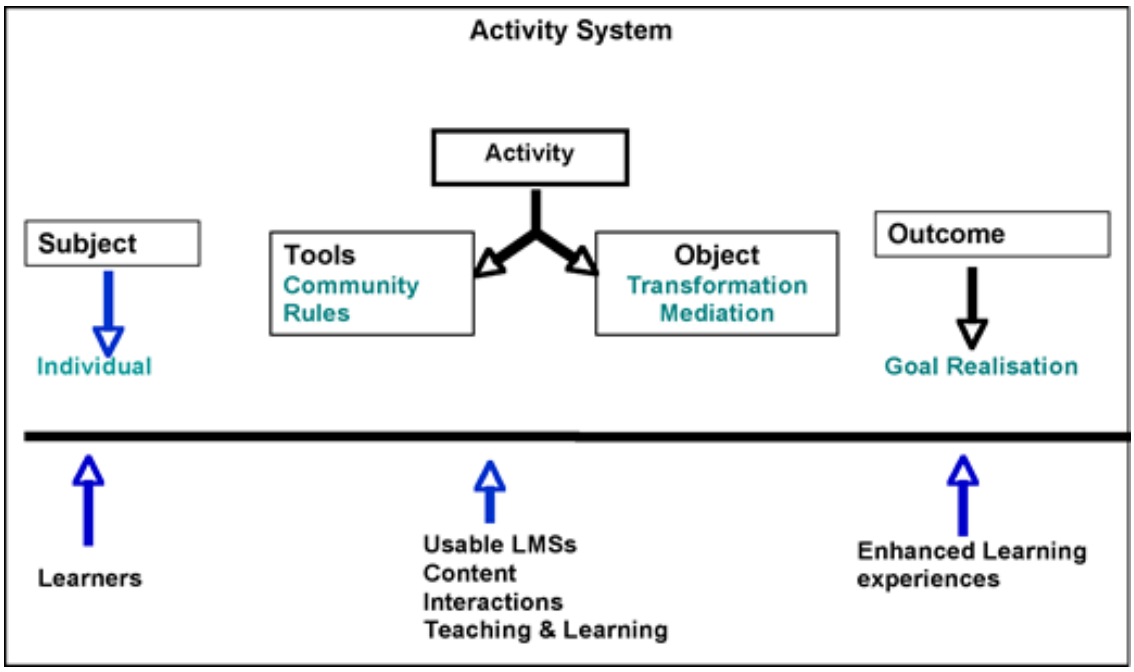

Figure 1: *AT, Technology Usability Studies & LMS*

Elearning and the neutral technology thesis

The neutral technology thesis is common in instrumentalist vocabularies that tend to see technology as the indifferent tool that merely stands to serve user purposes (Henrickson, 2000; Feenberg, 2003). This thinking is based on assumptions of essentialism and the social abstraction (Kellner, 1998) of technology as a means to the end. The neutral-technology thesis tends to limit the socio-technical interaction debate to issues of resistance or adoption, reducing the problem into a mere technical literacy challenge where all that matters is for humans to know how to use a technology for goal realisation. Our identities according to this perspective are uniquely pre-given, fixed, and rationally independent (Henrickson, 2000). The role of technology in shaping human action (and identities) is non-existent (or rather, neutral) in instrumentalist accounts. So, we shape technology for our purposes and not the other-way round.

In AT's own terminology however, the activity system emphasises the process of mediation and transformation of activities into end goals. Where the end-goal is learning which includes cognitive, cultural and shaping, assumptions of technology-impact neutrality on the 'learning outcome' becomes questionable.

Czerniewicz, et al., (2005) reports numerous interview statements that subscribe to this thesis. Most respondents presented teaching and learning ICT (including the web) as the neutral means to furthering user-ends. Instructivists claim that technology is merely a tool for use by teachers to instruct (transfer knowledge). In this case, elearning is successfully or unsuccessfully used to transfer content. Because technology is seen as neutral, instructivists would focus attention on how it is used (Czerniewicz, et al., 2005). The limitations in the instuctivist focus on tools, uses, resistances to use, and adoptions, tend to overlook the interaction of technology with cognitive

processes (as propagated by Vygotsky, 1978), failing to take account of the socio-technical discourse.

The determinists on the other hand see technology as both neutral and autonomous. Determinism is aligned with descriptions of technology as a determinant of progress and change (Feenberg, 2003) in higher education (Czerniewicz, et al., 2005). A number of uncritical constructivists who accept technology at face value as the agent for change also fall into this trap. In this view technology automatically enhances education. This is related to claims that ICT enables 'independent learning, it influences or drives the theory of learning, it breaches many walls created by distance and times zones; it unites people and creates powerful and synergistic partnerships at local, regional and global scales; it motivates students and energises classrooms' (Czerniewicz, et al., 2005; Mlitwa, 2005). Most constructivist commentators interviewed by Czerniewicz, et al., (2005) however, saw the impact of elearning as the enabling of user engagement with learning, where a learner becomes the active participant in the construction of knowledge.

Collaborative learning was also emphasized. One interviewee even explained why the term eLearning is written with a small 'e' – followed by a capital 'L': 'I think the whole issue is clearer when I write it, I always try to be consistent and make the 'e' small and the 'L' large to emphasize the learning and the 'e' as the small or abbreviation type of thing but the learning is the most important thing … (II)' (Czerniewicz, et al., 2005). Implications were however, largely aligned to the neutral thesis that as long as elearning is designed as a user-friendly tool for the learner, and is applied to further constructivist principles, it should enable the unproblematic construction of knowledge. The reader should note that divergent understanding of technology is evident even within a single 'neutral thesis' school of thought, which in turn opposes the value-laden perspective of technology.

Technology as value-laden

At the other extreme, technology can be autonomous and value laden, but not human controlled. Feenberg (2003) calls this view the 'substantivist' perspective of technology. In other words both the means and ends are linked in a system. Technology therefore, influence academic processes and change, but is also influenced by those processes. It can also be human controlled and value-laden. Feenberg (2003) calls this perspective, the critical theory of technology. In this case technology is used as a value-laden tool that carries with it the context of its design, the language and cultural connotations of its location, to influence its destinations (Vygotsky, 1978). It is never neutral but value-laden (Feenberg, 2003) and has a potential to shape (transform) social inter/action and social identities. The embedding of American English in most computer applications for example, means that the Mongolians, the Chinese, and the Russians should now adopt the foreign language in order to effectively interact with the Western technology. Therefore, it is because of this value-laden nature of technology that critical theorists interrogate the possible connotations of its use.

In summary, the focus of the neutral technology thesis is clearly on human activity where the interaction of human and technology is that of improving user-interests. Actor Network Theory (ANT) offers an alternative value-laden perspective of technology which gives more credit to the social and contextual embedded aspects of technology. Technology is seen as a tool that interacts, shapes, and is in turn shaped by contexts. ANT and elearning contextual framework is discussed in the following section.

ANT AND eLEARNING

Actor network theory places a semiotic emphasis on the human and the technical agents (Latour 1987; 1992 and Callon 1991) and enables specificity about the technology (Hanseth and Monteiro, 1998). It further suggests the elimination of all a priori distinctions between the technical and the social (Callon 1986) actants in what Law (1987) refers to as a heterogeneous network. Unlike the implications of activity theory where the activity system represents human actions that are mediated by neutral artefacts, ANT presents a network as a sum of interrelated and causal connectedness of all factors on any socio-technical account. The significance of a network is in its 'continually negotiated processes' where both human and artefact actors have a mutual and causal influence in network processes (Tuomi, 2001). There is no network without actors, and actors cannot act outside of a network. Each actor can only be viewed in relation to, and not separate from other actors or parts of the network (Tuomi, 2001). While a social network is merely a set of people, organizations, and perhaps their structures that are connected by a set of social relationships, a socio-technical network includes technologies that people construct and use in collaboration (Lamb and Davidson, 2002).

This paper takes the perspective that elearning is a socio-technical network that comprises of humans (educators, students, administrators), structures (learning groups, educator groups, institutions, policies), technology (a LMS), environments (contexts), resultant learning processes, wanted and unwanted outcomes.

Technology in a network

ANT is built on the arguments that knowledge is embedded in social processes, conceptual systems, and material artefacts that are used in social practices (Callon, 1991; Latour, 1992). From an ANT perspective elearning involves a negotiating interplay between the human and machines. Through a LMS, elearning qualifies as a socio-technical network that incorporates a computer, network, applications, learning material, learners, educators and/or mediators. Just as human and non-human actors assume identities according to prevailing strategies of interaction in ANT (Hanseth, and Monteiro, 1998), the parties to the elearning network should be mutually engaging, but also supportive. This view tends to streamline the arguments of this paper into the constructivist rather that instructivist pedagogical stream. As opposed to the ‘instructional’ view, constructivists describe learning as the innovative and participative process that can be enhanced through elearning platforms. The question though, is whether ICT assumes such a meaningful role in technology assisted education practices and whether it is engaged as the active actor in the elearning network.

The author of this paper shares the mutual shaping view of actors in a network, and that a network constitutes both human and material actors. This paper however, does not subscribe to the symmetrical notion of humans and non-human actors. Human actors have higher order cognitive capabilities (Vygotsky, 1983) and intentional action that are lacking in artefacts. Artefacts (and animals) also have other characteristics that humans lack. So, as much as the mutual shaping argument is accepted, it is not accepted that it follows a linear and equal negotiation pattern.

CONCLUSION

Literature about existing conceptions of ICT and education has shown that the meanings and perceptions of ICT in educational technologies are divergent. A recent investigation of the thoughts of academics, practitioners and managers have also shown that conceptual

disagreement is not only limited to the literature, but also to perceptions of practitioners in the field.

This paper opened with the argument that all higher academic institutions are either adopting open source software (OSS) or proprietary learning management system. In the midst of the existing conceptual stampede however, studies show discrepancies between the adoption of a technology in higher education by institutions and usage patterns by academic staff. In a quest to find a useful framework for understanding teaching and learning ICT, dominant calls for effective or appropriate usages of technology were acknowledged by a synopsis of the technology usability studies. An AT framework has been applied. It adopts the neutral instrumentalist view of technology as a means to achieving ends. This makes it useful only to analyzing better uses of technology to improve the satisfaction of human needs. Unfortunately AT neglects issues of power relations that stem from the social embedded nature of technology. This is where ANT comes in. ANT has been used to reconcile conflicting perspectives on the position of learning technologies in social processes. It supports the critical view of technology as a social and culturally embedded actor in a socio-technical network. It supports the view that technology shapes, and is shaped by contexts and environments.

ANT offers a helpful approach in encouraging the critical engagement of a technology in social environments such as elearning, but it is not without shortcomings. The notion of a symmetrical relationship between technical and human actors just pushes the role of technology a bit too far. The problem as Vygotsky (1978) would put, it is that humans are graced with cognitive mental capacities which artefacts and animals do not have, and as such the symmetrical argument remains questionable. The final argument therefore, is that an AT's socio-technical activity system should be extended into a socio-technical network without the symmetry implications. The LMSs should not only be seen, but also conceptualized and treated as socio-technical networks. This will enable coherent engagements between humans (educators, students, administrators), structures (learning groups, educator groups, institutions, policies), technology (a LMS), and resultant learning processes in the network. In turn, it will contribute to the realization of intended benefits of elearning – within varying contexts in which it is engaged.

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Assessment of the effectiveness of the CAD elearning Certificate at the University of Botswana

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ABSTRACT

The introduction of eLearning in higher education has brought a challenge for higher education institutions to train their faculty to equip them with the necessary skills needed to embark on eLearning activities. The University of Botswana (UB) is no exception. The UB first introduced eLearning in 2002 to enhance instruction and students' learning. eLearning at the University of Botswana has been defined as the 'appropriate organisation of Information and Communication Technologies (ICTs) for advancing student-oriented, active, open, collaborative and life-long teaching-learning processes' (Educational Technology Unit, n.d.a)

The Centre for Academic Development (CAD) eLearning Certificate, introduced in 2003, a workshop series on eLearning related topics, has been designed to cater for the needs of academic staff embarking on eLearning at UB.

The purpose of this study was to evaluate the effectiveness of the Centre for Academic Development (CAD) eLearning Certificate and its individual workshops. The study employed both qualitative and quantitative data collection strategies.

By August 2006 more than 800 academics and support staff had attended one or more workshops, which were in general very well received. Main reasons for attending the workshops were the acquisition of technical skills, the use of eLearning and the wish to obtain the Certificate. Preferred workshops were a very general workshop on course design, an introduction to PowerPoint and, only in third place, an introduction to eLearning. The majority (74%) of respondents claimed to have applied skills and knowledge acquired in the workshops, mainly technical skills, such as the use of PowerPoint, online information skills and information management techniques. A minority of 17 % of the participants had developed online courses. Alarmingly, about a quarter of the respondents (23%) claimed not to have applied any of the skills and knowledge covered in the trainings. Furthermore, only 16% of respondents managed to complete the Certificate. Respondents indicated that non-application of skills and non-completion of the Certificate was mainly due to time constraints lecturers are facing when balancing demands of teaching, research and administration.

The study provides recommendations on ways to improve the CAD eLearning Certificate. The combination of skill-based workshops with online learning seems to be the preferred option in international literature for eLearning staff development, to expose participants to the world of online learning. The participants indicated that parallel development of an online course could facilitate the immediate application of knowledge and skills acquired. A more structured programme approach would help in developing a community of practice between staff active in eLearning at UB. Issues of recognition and reward for lecturers embarking on eLearning also need to be addressed.

INTRODUCTION

Following the international trend to introduce more technology into teaching and learning, the University of Botswana (UB) launched its eLearning initiative in 2002. To support lecturers in this endeavour the Centre for Academic Development (CAD) has offered the CAD eLearning Certificate since 2003. The Certificate has been highly welcomed by both academic and support staff and by August 2006 more than 800 staff have participated in these workshops. After a first review in July 2004 it became evident, however, that although a great number of lecturers were attending the workshops, comparatively few were using eLearning in their teaching and learning. This paper explores the effectiveness of the Certificate and its individual workshops in relation to the objective, to promote more learner-centred, active, collaborative and lifelong teaching and learning based on international research in this field. The results of an in-depth evaluation of the Certificate carried out in 2005 are included in this paper.
The authors will first introduce some concepts and examples of innovative staff development for eLearning with a focus on the Southern African region, then give an overview of eLearning at the University of Botswana and the eLearning Certificate and present the main findings of the study carried out. This paper concludes with some recommendations for the future of the Certificate and staff development at the University.

eLEARNING STAFF DEVELOPMENT

While their value is still heavily debated (see Saunders & Klemming, 2003; Shephard, 2004), the use of Information and Communication Technologies (ICTs) for teaching and learning in higher education (HE) has become a reality both in the developed and the developing world. In Australia and the UK, eLearning has become an increasingly significant part of the student learning experience, with substantial growth of around 60% since 2001 (averaged across all faculties). This pattern of ICT adoption in teaching and learning is similar to patterns described elsewhere in other countries and universities (Applebee, Ellis & Sheely, 2004).

The use of eLearning draws from two distinctive areas of expertise: technical skills and a pedagogical understanding of how to use technology to support teaching and learning. Academic staff must not only learn how to operate within a learning management system (LMS) but also develop an informed critical perspective of their use of the LMS in their teaching (Weaver, 2003). They need an understanding of how eLearning can be meaningfully integrated in teaching and learning to fully exploit its potential to enhance a student's learning experience (Kent, 2003). ICTs have only a positive effect on learning, when used in an 'appropriate way and in the right circumstances' (Saunders & Klemmings, 2003: 75). The current underlying assumptions in the literature of 'meaningful' or 'appropriate' are based on the concepts of learner-centredness, Vygotsky's and Jonassen's social constructivism, Wenger's community of practice (COP) and the importance of collaboration, self-directed learning and a focus on Knowles' adult learning principles (see Kent, 2003; Carr et al., 2005; Sharples, 2000; Klopfenstein, 2003).

As with any other innovations, eLearning innovators and early adopters are driven by intrinsic instinct and seldom need external motivation or support to gather first experiences with the technology (Zemsky & Massy, 2004). But how can we support the roll-out of eLearning in an institution, especially an institution of higher learning, whose members, academics, are, as Salmon (2005: 205) points out, 'naturally reluctant to change their methods of teaching and learning … without a deep understanding of why and how and what the impact will be in terms of quality and resultant benefits'? What kind of staff development and staff support initiatives are needed to reach the late majority or non-transferers (Shephard, 2004)?

In this context the hybrid role of learning technologists, also called educational technologists, eLearning advisors or instructional designers (Shephard, 2004; Carr et al. 2005) has become crucial in supporting academics in the pedagogically meaningful uptake of technology to 'encourage innovation and change in teaching and learning' (Gosling, cited in Shephard, 2004: 74). A learning technologist advises the academic in a close dialogue on the best use of technology in his/her individual context (Ellaway et al., 2006). Learning technologists most often also provide the professional development needed for academic staff (Shephard, 2004), ideally in cooperation with a wider pool of experts, such as from teaching and learning Units, multimedia production teams or the library (Carr et al., 2005).

Ownership, buy-in and engagement seem to be keywords in the debate on staff development. Collis and Moonen point to the 'important level of commitment and buy-in involved' (cited in Carr et al., 2005) and Salmon (2005) argues that to engage larger numbers of academics, it is important to transfer ownership to the involved staff, but also provide the supportive mechanisms that underpin the continued developments. Supportive mechanisms should include elements of reward and recognition; accreditation of professional staff development programmes and the opportunity for academic research on the use of new technology in teaching and learning (Shephard, 2004).

Conventional training activities most often take the form of once-off workshops, focusing on the transfer of technical skills, and fall short in providing the pedagogical linkages needed in eLearning. This results in a didactic, teacher-centred use of technology (Littlejohn & Sclater, 1999). This 'new way of doing something familiar' (Salmon, 2005: 201) does not challenge underlying assumptions about learning and knowledge sharing. This type of training also does not support the transfer of new practices into the lecturers' day-to-day work, which is, in most cases, not conducive to educational innovation (Carr et al., 2005).

The literature reveals a number of examples of how to offer innovative staff development on eLearning.

At the most basic level, Monash University offers a training programme on its LMS WebCT combining workshops and online resources, and a set of accessible, easy to read manuals (Weaver, 2003).

The University of Birmingham developed a 10-week e-Learning in Higher Education module including online discussion and conferences, collaborative learning, open learning materials and learning journals for reflective practices. Assessment is done by portfolio. This module gives staff a unique opportunity to develop online skills while participating in an eLearning environment and helps participants understand and sympathise fully with the students' potential online environment. Participants receive credits towards a degree in Higher Education Development (Kent, 2003).

As an African example, the Centre for Higher Education Development at the Durban Institute of Technology (DIT), most recently the Durban University of Technology (DUT), offers staff development on eLearning, based on the principles of skills, pedagogy, research and community. This intensive one-year training programme for a small group of educators combines workshops with online activities and individual consultancy sessions with instructional designers. In the process of collaboration, a communal resource base (comprising journals, papers, online classrooms, discussions) is built. The outcomes of one year participation are for a member to participate in an online class as a learner; design an online course; manage a class online; facilitate online learning for students; conduct action research into online learning; and interact with other online practitioners in a community of practice. This programme will be linked to a

degree in Higher Education Development through Recognition of Prior Learning (Pete & Fregona, 2004).

The University of Cape Town Centre for Educational Technology is following a multi-faceted staff development approach to integrating technology into University courses. Their focus is very much like DIT's on the development of a Community of Practice (COP), promoting the importance of mentorship, reflection, self-directed online learning in combination with workshops, regular seminars, bi-annual show and tell sessions and teaching and research partnerships (Cox & Carr, 2006).

Through the Partners@Work Programme at Tshwane University of Technology, lecturers are seconded for one semester to Telematic Education to develop an online course and conduct research in the field of eLearning. The Partners@Work programme proposes to focus on the development and consequent implementation of well-rounded technology-enhanced courses that address specific challenges such as low pass rates, geographically dispersed learners and large groups. This extensive capacity-building strategy involves block face-to-face session, weekly contact sessions, and a variety of online training courses. (Tshwane University, n.d.)

Looking at these examples the authors identified key elements of successful implementation of staff development in eLearning: the provision of a structured training programme, with a clear time frame/duration as opposed to once-off workshops; the combination of skill workshops with online learning; the promotion of collaboration to develop a community of practice; the importance of peer support and mentoring; the opportunity for research as an incentive to staff investing their time in eLearning; and the possibility of accreditation of the staff development programme and recognition of prior learning.

eLEARNING AT THE UNIVERSITY OF BOTSWANA

The University of Botswana (UB) realizes the need and urgency to empower their academic staff with the information, communication and technological skills that contribute to quality education. Based on UB's vision of 'developing a student-centred, intellectually stimulating and technologically-advanced teaching, learning and research environment' (University of Botswana, n.d.b), the Educational Technology Unit (EduTech) in the Centre for Academic Development (CAD) has been mandated to infuse ICTs into teaching and learning. Hence, eLearning at the UB has been defined as the 'appropriate organisation of ICTs for advancing student-oriented, active, open, collaborative and life-long teaching-learning processes' (Educational Technology Unit, n.d.a). After a slow start in 2002, the university has seen a rapid increase in the development of eLearning courses.

The focus of eLearning at UB is on a blended approach in which various modes, methods and media – traditional and innovative - are integrated and organised for appropriate learning. Lecturers embarking on eLearning are guided by the eLearning support team offering services in Instructional Design, Online Media Development and Graphic Design. To overcome resistance to technology by academic staff an extensive amount of support and coaching is required. This is especially crucial during the early stages of venturing into the unknown eLearning environment.

To make sure that teaching staff have opportunities to build and develop necessary pedagogical and technological skills to implement eLearning, the Education Technology Unit (EduTech) at UB has offered a wide range of training, from novice to advanced skills levels since 2002.

The CAD eLearning Certificate

The CAD eLearning Certificate, introduced in 2003, has been designed to cater for the needs of academic staff embarking on eLearning at UB. The contents of the workshops have been carefully selected to guide, support and prepare for planning, development and implementing eLearning.

Workshops offered in the CAD eLearning Certificate cover four areas: eLearning, Information and Computer Skills, Multimedia Production and WebCT training. When the Certificate was introduced, little additional training was available for lecturers at UB. Therefore, EduTech offered some topics that would normally belong to the IT department or the Teaching and Learning Unit, such as MS PowerPoint or training in Course Design and Innovative Teaching and Learning Methods.

The Certificate is based on attendance and application and is awarded when eight out of the currently offered 17 workshops have been completed and the participant can provide adequate evidence of the application of eLearning in his/her work. Adequate evidence refers to the use of eLearning in the context of the UB eLearning definition (see above). For a detailed description of the workshops see Appendix 1, CAD eLearning Certificate brochure.

The following table (Table 1) shows the number of workshops and attendances from 2002 – August 2006. As of August 2006, approximately 800 lecturers and support staff from UB and affiliated institutions attended 312 workshops. By December 2006, 107 participants had completed the Certificate (13.4%).

Table 1: *Workshops and Attendance 2003-2006 (August)*

Total number of workshops	312
Number of years workshops have been offered (2002-2006)	5
Average workshops/year	62
Total number of workshop attendances	4074
Total number of participants	802
Average participant/workshop	13
Average workshops/participant	5
Number of participants with completed certificates (by December 2006)	107

(Source: EduTech's internal statistics)

All the workshops of the CAD eLearning Certificate are held in one of the eLearning SMART classrooms, collaborative computer labs, to provide the possibility for hands-on work. Facilitators try to balance theoretical input and activities, with an emphasis on practical work. Ample time for discussion and group activities is given. Part of the completion requirement, the evidence of application of eLearning, ensures that participants practice what they learn during the workshop. Most of the workshops are half-day, offered both during the semester and during the long semester break (May-July).

PURPOSE OF THE STUDY

The purpose of this study was to evaluate the effectiveness of the CAD eLearning Certificate in relation to its objective, which was to transform teaching and learning at UB using ICTs for more learner-centred teaching and learning. The Certificate was reviewed for the first time in July 2004. At that time 23 participants had completed the eLearning Certificate, but only 7 (30%) of those were running online courses.

It became evident that although many lecturers were attending the workshops, only a few lecturers were using eLearning in their teaching and learning. Therefore, the completion requirements for the Certificate were changed in 2005 to include evidence of application of technology in teaching and learning; for example, the presence of an online course or a PowerPoint presentation used in class. Nevertheless, it was felt that a more detailed study had to be carried out to investigate the usefulness and effectiveness of individual workshops and also the usefulness of the CAD eLearning Certificate as a whole for preparing lecturers to integrate eLearning in their teaching and learning.

The following research questions guided this study:

Why do staff members attend the eLearning Certificate workshops?
How well do participants apply knowledge and skills from the eLearning Certificate workshops?
To what extent is the way the Certificate is currently offered conducive to changing lecturers' way of teaching and learning to reach EduTech's goal – to make teaching and learning more learner-centred, collaborative, active and lifelong?

METHODOLOGY

Instruments

This study was quantitative and qualitative in nature and was carried out between May and July 2005. It was funded by the Office for Research and Development at UB. To assess the individual workshops of the CAD eLearning Certificate, questionnaires handed out to participants after every workshop were evaluated. This instrument is a short questionnaire containing 11 closed-ended statements using a five point Likert-type scale and two open-ended questions. Participants were asked to indicate whether they agree or disagree with the 11 closed-ended statements using the scale: 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5= strongly agree. The evaluation instruments were handed out to participants at the end of each workshop. The participants were requested to complete the questionnaire and leave it with the workshop facilitator(s). (See questionnaire in Appendix 2).

To assess the CAD eLearning Certificate an electronic eLearning Certificate Modules Effectiveness Questionnaire was developed by the research team and was sent out to approximately 500 UB academic and support staff by e-mail (including academic staff at the affiliated institutions who participated in eLearning Certificate workshops). Staff members were asked to fill in the questionnaire and send it electronically to one of the research team members. The questionnaire contained a total of 12 questions, divided into three sections: Section A – demographic data, Section B – respondents' reaction to statements and Section C - respondents' comments. The questionnaire sought to obtain information on the demographic profile of the participants, their participation in and opinions on the effectiveness of the programme, as well as their suggestions for improvements (See questionnaire in Appendix 3).

Data analysis procedure

A total of 82 (16.4%) eLearning Certificate Modules Effectiveness Questionnaires and 771 eLearning Certificate Module Evaluation Questionnaires were used for data analysis. Quantitative data were coded and entered into SPSS v 12.0 for Windows. The data were analysed using appropriate statistical procedures like frequency counts and percentages for applicable categorical and nominal variables. Statements from open-ended responses were grouped following content analysis to determine specific categories. These categories were used to confirm and/or explain findings from the quantitative data.

FINDINGS

eLearning Effectiveness Questionnaire

In this section, specific findings from the eLearning Certificate Modules Effectiveness Questionnaire are presented. A total of 82 eLearning Certificate Modules Effectiveness Questionnaires were returned and used for data analysis. The response rate of 16.4% is quite low and limits generalisation of the findings.

The respondents included 48 (58.5%) males and 33 (40.2%) females (one respondent [1.3%] did not respond to this question). The survey notes a high number of young staff with the majority of the respondents (79%) aged between 31-55 years, with one-third of these being in the age group of 36-40 years. Analysis of respondents according to faculty revealed that the Faculty of Science had the highest numbers of respondents (18.2%; n = 16), followed by the Faculty of Education with 15.9% (n = 14). The others faculties included: Social Science 12.5% (n = 11), Engineering and Technology 11.4% (n = 10) and Humanities10.2% (n = 9), while Business had the lowest participation rate with only 4.5% (n = 4) of the respondents coming from this faculty.

The support staff comprised 18.2% (n = 16) of the participants while 9% (n = 8) were from the 15 affiliated institutions. Lecturers and senior lecturers formed the bulk of the participants accounting for 58.5% (n = 48) of the respondents. Over 40% (n = 33) of the participants had been employed by UB for four years or less. Only five respondents (6%) had been employed by UB for more than 15 years with two of these having worked at UB for more than 25 years.

The majority (63.4%, n = 52) of the participants had no training in eLearning prior to attending the eLearning Certificate workshops, while 36.6% (n = 30) had some sort of training. Asked to indicate the number of modules they participated in, the following responses were given: Over 40 percent (42.7%; n = 35) participated in four or less modules. Twenty eight percent (n = 23) had participated in five to eight modules while 19.5% (n = 16) had participated in nine or more modules (Table 2). However, only 13 (15.9%) of the total participants had completed the eLearning Certificate requirements. This corresponds with the general figure of around 13% of participating lecturers completing the Certificate.

***Table 2**: Number of modules participated in by respondents (n = 74)*

	n	%
1-4	35	42.7
5-8	23	28.0
9-12	12	14.6
13-above	4	4.9

Participants were asked to indicate their reason for attending the eLearning Certificate modules. The predominant reason for attending was to 'acquire technological skills' with 95.1% (n = 78) of the participants making this selection. However, 81.7% (n = 67) of the respondents indicated 'the use of eLearning for teaching' as the reason why they participated in the workshops while 63.4% (n = 52) indicated that they wished 'to obtain the Certificate' and 59.8% (n = 49) said it was just 'general interest'. The other reasons advanced for participating in the modules were personal development and advancement; to be up to date with technological innovations; innovative teaching and technology-driven job descriptions.

An instrument with a list of the 17 workshops that were offered by CAD was provided and participants were asked to select the three workshops they considered most useful by ranking them from 1 to 3. The analysis of ranking per module was done to give an overall total score (Table 3). Workshop 01 - Principles of Course Design, emerged as the highest ranked module with 59 points in total, while workshop 11 - Power Point Presentations ranked second with 58 points in total. Third ranked was workshop 2 - Introduction to eLearning (50 points). Fourth ranked was workshop 6 - Management Information Techniques (49 points), closely followed by workshop 7 - Online Information Gathering (46 points). The least popular module was workshop 15 - WebCT Training getting a total of only two points, followed by workshop 03 - eModeration, receiving only four points in total. (eModeration has since been offered in a modified way, while the WebCT Training is still being offered but under review).

Table 3: *Ranking of eLearning Workshops*

Position	Code	Title	Points
#1	WS1	Course Design	59
#2	WS11a	PowerPoint (beginners)	58
#3	WS2	Introduction to eLearning	50
#4	WS6	Management Information Techniques	49
#5	WS7	Online Information Gathering	46
#6	WS4	Teaching in SMART classroom	33
#7	WS13	Initial WebCT Training (replaced by WS15)	32
#8	WS11b	PowerPoint (beginners)	32
#9	WS9a	Web Design (Beginners)	25
#10	WS12	Initial WebCT Training (replaced by WS15)	14
#11	WS9b	Web Design (Advanced)	11
#12	WS8	Copyright and the Internet	10
#13	WS14	Initial WebCT Training (replaced by WS15)	8
#14	WS10	Scanning	8
#15	WS5	Video Conferencing	8
#16	WS3	eModeration	4
#17	WS15	WebCT Trainings	2

The participants were asked to indicate whether the module(s) they had attended had met their needs; 53.7% (n = 44) indicated 'yes, very much', 34.1% (n = 28) said 'yes' and only 4.9% (n = 4) said 'no'. These responses indicated that over 88% (n = 72) of the respondents felt that the eLearning Certificate Modules met their needs. Some of the benefits cited by those who felt their

needs were met included personal and professional development, such as better computer skills, proficiency in presentations and in online information gathering, improved effectiveness in teaching and learning and improved management of large classes (by using online communication and course management tools, such as electronic submission of assignments).

In addition, 74.4% (n = 61) of the respondents indicated that they had put into practice at least some of the training they received from the eLearning Certificate Modules. Of these, 46.4% (n = 32) had used PowerPoint presentations in class, conferences and elsewhere, while 18.8% (n = 13) had used various search engines to gather information from the Web. Information management was also mentioned by 13.0% (n = 9) of the respondents while at least 12 respondents (17.4%) had already put courses online, (i.e., using WebCT for teaching).

Other ways in which the training has been put into practice that were mentioned are: designing a website for a course, scanning, use of the smart classroom, instructional design and passing on knowledge about copyright use. However, it is notable that 23.2% (n = 19) of the respondents indicated that they had not put into practice any training they had received from the workshops. The main reason given for not practicing these skills was time constraints (over 90%). Other reasons were a personal reference of traditional teaching/learning method, limited facilities at faculty level and limited accessibility to Internet for students.

As mentioned before, only 13 (15.9%) of the total participants had completed the eLearning Certificate requirements. For those who had not completed the CAD eLearning attendance Certificate, 37.9% (n = 22) had not been able to attend the minimum number of workshops required to obtain the Certificate. Of these, 36.2% (n = 21) cited time constraints as the reason for not completing. The comments raised were that the timing/scheduling of the workshops clashed with other assignments and commitments, or their official workload was too heavy to make time to attend the workshops. Only one person (1.7%) complained that the workshops are always fully booked and one respondent (1.7%) felt the eLearning Certificate was not necessary.

Individual eLearning Certificate Module evaluation

Analysis of the individual eLearning module evaluation responses revealed that participants were generally happy with the structure and format of the workshops. A general analysis of the statements across all the workshops, facilitators and workshop groups yielded highly similar results. The majority of the participants (over 85%; n = 656) agreed that the topics of the workshops were relevant to them and that they had interest in the topics prior to attending the workshops. These respondents also agreed that the pace of the workshops was good for them, that the facilitators did a good job in the presentation and that they would recommend these workshops to others. In addition, the majority of respondents felt that the workshops were well done and valuable and that they felt confident about using the technology and techniques on their own. Most participants thought they would use whatever they learnt from the workshops in their own classes/work. More than 87% (n = 671) on average thought that the material covered during the workshops was not difficult for them, though they had not been familiar with the topics before attending the workshops.

Participants were asked to suggest ways to improve the eLearning Certificate modules. Though a majority of the participants felt that the workshops/modules were satisfactory, some very useful suggestions were made.

These suggestions focused on the workshop organisation (not during semester, the importance of time for practical activities during workshops, a demand for more support during workshops by increasing the number of facilitators/demonstrators or by pairing experts and novices); the target group for these workshops (such as running workshops for departments and for students); the

importance of additional online resources for preparation, follow-up and self-study; and technical issues, such as upgrading the workshop labs.

Additionally, the participants suggested other types of training that they felt would be useful to their careers. Some of the modules they suggested have already been implemented such as SPSS and MS Excel. Others modules suggested were Access, Office Planner, production of teaching aids, GIS, desktop publishing, and document formatting.

Generally, there was an overwhelming consensus that the modules were very effective and beneficial to the participants. The participants felt that these workshops have helped improve their general technological skill and hence, have developed confidence in technology (dispelled their techno-phobia). The majority of respondents agreed that these workshops have helped them to become more innovative and improved the quality of their teaching which will improve the standards of the university as a whole. The participants also commended the facilitators for being very resourceful, helpful, organised and consistent. Almost all the participants (99.9%) felt that the workshops were/ are 'a job worth doing and well done'.

DISCUSSION AND CONCLUSION

This research indicates that after the first three years of providing the CAD eLearning Certificate, the workshops have been highly successful, and the number of lecturers putting their courses online is growing rapidly. Most of the academic staff members have found these workshops rewarding and have reported they are now able to integrate some form of eLearning to enhance their teaching and their students' learning experience.

One of the main reasons this study was carried out was to analyse the gap between lecturers participating in the workshops and lecturers using eLearning. UB's eLearning definition is wide, encompassing all use of ICTs, such as the use of a MS PowerPoint presentation during a lecture. Therefore, it is not surprising that many lecturers participating in the eLearning Certificate might not engage strictly in online learning, but are using some of the skills acquired in the workshops, such as finding information on the Internet, using PowerPoint in teaching and at conferences or managing their information better.

These skills are also reflected in the most preferred workshops by participants, showing an equally preference for pedagogical and technical issues: course design, a very general introduction into how to design a course effectively, and the use of PowerPoint. Introduction to eLearning only ranks in position number three, followed by Management Information Techniques (a workshop on how to create files and folders) and Online Information Gathering (a workshop on how to use search engines effectively). These findings show that there is a high demand for pedagogical and ICT related workshops, but not necessarily eLearning specific ones. Since this is the reality on the ground, we need to cater for this demand. It is speculated that once the basic training needs have been covered, participants will be ready for advanced eLearning training, including new online communication and collaboration tools, like blogging or wikis.

Nearly a quarter (23.2%; n = 19) of participants deny that they have put anything learnt through the workshops into practice. Even if lecturers blame time constraints and limited access to the Internet by students as main stumbling blocks to using technology, the content and delivery of the workshops need to be re-evaluated in this light.

As an immediate action, workshops high in demand will be offered on a more frequent basis and new workshops have already been added, such as SPSS and MS Excel, in collaboration with

colleagues from the IT Department. Furthermore, WS3 eModeration has been slightly changed to an Advanced eLearning workshop, for lecturers who are already engaged in eLearning, to share experiences and good practices. Still, individual workshops need to be looked at very carefully to make sure they are hands-on and content is immediately applicable to participants' context.

What is surprising is the lack of interest in the WebCT Refresher training. These training modules are offered as a week-long training course twice or three times a year, just before the start of a new semester. The poor rating of these modules could be explained by the nature of the skills acquired in the course. If participants do not apply these skills immediately, they will soon be lost. This is in line with international research, which states that conventional one-off workshops are not ideal for this sort of training (Littlejohn & Sclater, 1999, Carr et al., 2005). We often see lecturers coming back to us when actually preparing an online course, with very little recall of these workshops, and therefore needing intensive individual WebCT refresher sessions.

One recommendation to address this problem is to link the attendance in face-to-face workshops to the participation in an online course. This will allow lecturers to gather first-hand experience as online learners. This follows the trend in international research to offer eLearning training as a combination of hands-on skill-based workshops and online learning (see Weaver 2003; Kent, 2003; Littlejohn & Sclater, 1999; Carr et al. 2005). This initiative is also reflected in some of the recommendations of participants, who call for more independent practice material and additional resources on the Web for preparation and follow-up. This strategy will also expose lecturers to good practices and examples of blended learning and might increase their appreciation of these methods. Ideally, participants should also in parallel develop their own online course, to immediately apply what they learn in the workshop to their work. This strategy might take care of 63.4% of participants, who stated the wish to obtain the Certificate as reason why they participated in the workshops and encourage them to re-think their position.

Lecturers at UB are not unique in their complaints about time constraints as the main reason for not completing the Certificate and not using innovative techniques. Carr et al. (2005), report that without proper incentives already overworked staff members who are negotiating 'complex balances between teaching, administration and research activities', tend to attend few workshops or even drop out of workshops for which they have registered. Through the provision of a more structured workshop programme other potential participants might be convinced to participate in more workshops (the majority of respondents had participated in 1-4 workshops only). This strategy could also lead to the development of a community of practice of lecturers with a shared interest and a common goal – promoting eLearning at UB.

Another incentive for lectures to invest their time in eLearning could be the offering the workshops at the departmental level, inviting the Head of Department to ensure managerial support. By raising awareness of the work involved in eLearning, management might ease the work load of lecturers embarking on eLearning and/or offer other kinds of rewards.

Clearly, there is much work ahead if the University is to fulfil its vision of developing a student-centred, intellectually stimulating and technologically-advanced teaching, learning and research environment (UB website, n.d.b). But with the continuous, collaborative efforts of all stakeholders involved, spearheaded by the Educational Technology Unit, this goal could certainly be achieved. The need for staff development is clearly seen through constantly increasing participant numbers. Now it is up to EduTech and other involved parties to ensure that the content and the format of the training is delivered in order to facilitate the UB to achieve its vision.

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APPENDIX 1: DESCRIPTION OF WORKSHOPS

WS01 Instructional Design Principles
Provide basic educational theories, skills and attitudes to design instruction. Objectives include: Understand the relationship between curriculum and instruction, distinguish between instructor-centred and learner-centred learning, write clear, learner-centred learning objectives, select and implement appropriate strategies for instruction and evaluate instruction.

WS2 Introduction to eLearning
Provide guidance in planning, developing and implementing eLearning at UB. Objectives include: Define eLearning in UB context, know benefits and challenges of eLearning, understand important eLearning terms, list examples of integrating eLearning in course delivery and understand the process of eLearning course development.

WS3 Advanced eLearning (former eModeration)
This workshop aims to develop and share best practice models in eLearning at UB. What is best practice in eLearning at UB? How can students' participation in courses be improved using online communication tools like e-mail, discussion forums, chat, group presentations and student homepages? What challenges are encountered in eLearning and how could we overcome these challenges?

WS4 Teaching in the SMART Classroom
Provide participants with knowledge and skills required to teach in UBs SMART classrooms. Tools used include PowerPoint and data projector, computer with Internet access and special software, e-mail, www, WebCT, Mimio and MS Netmeeting, audio, VCR, TV, digital still camera, digital video camera, video conferencing, document camera.

WS5 Video Conferencing
Provide participants with the knowledge and skills required to conduct a lesson using video conferencing.

WS6 Information Management Techniques
Provide participants with skills necessary to manage increased information flow. Objectives include: Manage information overflow by organizing files and folders, searching for files and folders, cutting and pasting between applications, managing your mailbox and using filters.

WS7 Online Information Gathering
Provide participants with the knowledge and skills required to conduct academic research using online resources like search engines, information gateways, directory portals, databases. Objectives include: Understand more about the World Wide Web as an environment for finding information, explore strengths and weaknesses of different search tools, learn to use tools properly and evaluate information found.

WS8 Copyright and the World Wide Web
Provide participants with the knowledge required to use resources from the World Wide Web for teaching and learning in a legal, ethical and moral fashion. Objectives include: Have an understanding & appreciation of Copyright and its application to the World Wide Web; relate the Copyright law to the academic environment.

WS9 Creating a Website (I and II)
Provide participants with knowledge and skills required to create a basic instructional website using MS FrontPage. Objectives include: To distinguish website terminologies, to design a web

page using MS FrontPage, to add graphics and other multimedia material, to link web pages and to publish a website on the Internet.

WS10 Scanning (Digital Imaging)
Provide participants with knowledge and skills required to create and formatting digital images and editable text.

WS11 PowerPoint Presentation (I and II)
Provide participants with knowledge and skills required to develop a multimedia presentation. (WS11a: animating text, objects and adding transitions, WS11b: adding sound and video clips, creating a self-run kiosk presentation and converting a presentation into a web page).

WS15 WebCT Trainings (a - e)
Provide participants with skills required to publish online course information, use online communication tools, upload online content, create self-tests and quizzes and manage online courses using UB's eLearning platform WebCT.

WS16 SPSS Basics (NEW)
Provide participants/researchers with the knowledge and skills required to code variables, enter and analyze data and how to import data from WebCT to SPSS.

WS17 MS Excel (NEW)
Provide participants with the knowledge and skills to use a spreadsheet to perform simple calculations and analysis of data. Particularly the participants will learn how to enter data on the spreadsheet, perform calculations, format data, create charts and print information.

APPENDIX 2: WORKSHOP EVALUATION

Topic: WS 15c: Self Tests and Quizzes

Presenter:
Date:
Name: ……

Please indicate your ranking for each statement below. Circle the number corresponding to the following scale to indicate your opinion. (1 strongly disagree – 5 strongly agree)

	Statement	Scale
1.	I was interested in this topic prior to attending the workshop.	1 -- 2 -- 3 -- 4 --5
2.	I was familiar with this topic before attending the workshop.	1 -- 2 -- 3 -- 4 --5
3.	The topic of this workshop was relevant to me.	1 -- 2 -- 3 -- 4 --5
4.	The pace of the workshop was good for me.	1 -- 2 -- 3 -- 4 --5
5.	The material covered in the workshop was too difficult for me	1 -- 2 -- 3 -- 4 --5
6.	The workshop facilitator did a good job	1 -- 2 -- 3 -- 4 --5
7.	I will use something from this workshop in my own classes/work.	1 -- 2 -- 3 -- 4 --5
8.	I feel confident I could use the technology or techniques covered in this workshop on my own	1 -- 2 -- 3 -- 4 --5
9.	I still need more help and pratice to be able to use the technology or techniques covered.	1 -- 2 -- 3 -- 4 --5
10.	Overall, this workshop was well done.	1 -- 2 -- 3 -- 4 --5
11.	Overall, this workshop was valuable to me.	1 -- 2 -- 3 -- 4 --5
12	I would recommend this workshop to others.	1 -- 2 -- 3 -- 4 --5

One aspect that I would like to try in my teaching / work is

Please take a moment to suggest how we might improve this workshop or offer any additional comments or concerns you might have.

APPENDIX 3: eLEARNING CERTIFICATE QUESTIONNAIRE

Evaluation of the CAD eLearning Attendance Certificate

SECTION A: Biographical Data

Male: ☐ Female: ☐

Age: click here

Department: APRU (A-L) Other (M-Z) Specify

Faculty/Centre

Job Title:

SECTION B: Statements

1. How long have you worked at the University of Botswana?

2. Have you had any training on eLearning before attending the CAD eLearning Attendance Certificate? YES: ☐ NO: ☐

3. In how many modules of the CAD eLearning Attendance Certificate have you participated at UB? click here

4. What are your reasons for attending the CAD eLearning Attendance Certificate modules? (Tick as many as are applicable)
Acquire technological skills:☐
Use eLearning in teaching:☐
Wish to obtain the Certificate: ☐
General Interest: ☐
Other, please specify:

5. Among the 17 workshops listed on the dropdown menus below, select the three workshops you consider most useful, and rank them in the following way:

Place 1 (most useful) click here
Place 2 (very useful) click here
Place 3 (useful) click here

6. Have you completed the CAD eLearning Attendance Certificate?
Yes:☐ No:☐.

7. If your answer to question 4 is NO, please state the reason(s)

8. Have you put any of the training from the CAD eLearning Attendance Certificate modules into practice? YES: ☐ NO: ☐

9. Please, explain question # 8: If YES, which modules and explain how. If NO give (a) reason(s)

10. Have the eLearning modules that you have attended met your needs?
click here
Please explain your response to question 10:

11. Suggest way(s) of improving the effectiveness of the CAD eLearning Attendance Certificate modules at UB:

12. Which other types of training in Educational Technology Unit would you find helpful?

SECTION C: FEW PARAGRAPHS

Instruction: In the space provided below, briefly tell us how effective you found the CAD eLearning Attendance Certificate modules at UB.

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Costs of information and communication technology in developing country school systems: The experience of Botswana, Namibia and Seychelles

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ABSTRACT

Despite the steady decline in the relative cost of acquiring information and communication technology (ICT), the cost of owning and maintaining sustainable computer systems in schools is rising. Simultaneously, Ministries of Education (MoE) in sub-Saharan Africa are under pressure to invest in ICT. However, there is very little evidence upon which decision makers can base their decisions to allocate finances to ICT. This article is based on a survey of total costs of owning computer rooms in 62 schools across Botswana, Namibia and the Seychelles. It reveals that in Botswana and Seychelles, where government provided computer facilities to all post-primary schools, ICT expenditure per school is much higher than in Namibia where school computer facilities are funded from several sources including government, NGO and the community. It is argued that high expenditure is not necessarily associated with efficiency of resource usage, and that internationally benchmarked research is needed in order to support optimal MoE and school level decision making.

Keywords: *Cost, total cost of ownership (TCO), information and communication technology (ICT), financing, schools, developing country, Africa*

INTRODUCTION

Among the technologies strongly associated with education, paper and book printing significantly pre-date the advent of mass education systems in Europe (1780-1870), while chalkboards (circa1800) and modern graphite pencils (circa 1795) are technologies that have long been applied in education settings. In contrast, information and communication technologies (ICTs) are historically recent additions to the basket of discretionary (non-teacher salary) expenditure options that are available to those tasked with apportioning the education budget. The potential for ICT to be applied in schools has radically increased from the mid 1990s. This is on account of the combination of massive improvements in computer processor power, information storage capacity and software utility; rising ubiquity of telecommunications services; the explosion of the Internet; and steadily declining relative costs of acquiring hardware, software and telecommunications services.

In many, though not all, developed countries, these technological and cost advantages have accounted for mass access and use of computers in education.[1] The same is not evident in developing countries, largely because the cost barriers to supplying ICT hardware, software and connectivity in these education environments are significant. In developed countries there is a growing realisation of what in 1996 Oberlin called the 'financial mythology of information technology' which he described as follows: 'While the per unit price of information technology is declining rapidly … the total cost of owning and maintaining systems is steadily rising …the falling prices mislead many to expect cost savings that will never materialise' (Oberlin, 1996:21). This was largely because of consistent underestimation of the management, technical support, curriculum development and training expenditure that is essential to ensure sustainable ICT access and use in education. Given global enthusiasm for applying ICT in schools, higher

education institutions and in national education systems, it is essential to put in place appropriate costing, financing and planning processes to aid budget allocation decisions.

In developing countries that have to deal with constrained budgets, financial allocations to ICT must properly take into account the full costs of sustainable ICT systems as well as address the challenge of providing ICT on an equitable basis. Education planners must investigate costs related to ICT so that key strategic questions around effectiveness, efficiency and sustainability can be better understood. Such an understanding is particularly important, given that sometimes wildly extravagant claims are made for ICT and its impact on education processes.

This article seeks to address the matter of ICT financing by examining the financing patterns of ICT in schools of three SADC countries. The aims are to present and discuss the full costs of running computer rooms in these countries, and then to compare cost profiles with reference to the different conditions in each country that influence spending patterns.

This article develops findings drawn from 'An analysis of ICT costs in three SADC countries: Botswana, Namibia and Seychelles' (Paterson, 2004) which forms part of a larger project, commissioned by the Southern African Development Community (SADC), that focused on the conditions necessary for effective implementation of ICTs in Botswana, Namibia and Seychelles (Chisholm, Dhunpath & Paterson, 2004).

This article first provides a brief literature review, followed by an account of the methodology and sampling approach. Second, the cost calculation model standardised across each country is explained. The third section constitutes an analysis of the ICT cost data. Finally, the relevance of the analysis to ICT financing challenges is sub-Saharan Africa is considered.

LITERATURE ON FINANCING ICT IN DEVELOPING COUNTRY SCHOOLS

There is limited information on how schools in developing countries finance their ICT resources. Available work refers to Belize (Rock, Glick and Sprout, 1991), to Belize, Chile, Costa Rica, Jamaica and Mexico (Potashnik and Adkins, 1996), to extrapolations for LDCs based on data from Israel (Osin, 1998), to Costa Rica (Wolff, 1999), to Barbados, Turkey, Chile and Egypt (Bakia, 2000), to Zimbabwe and South Africa (Cawthera, 2001) and to the Phillipines (Roderigo, 2005). Ottwanger, (2003:37) collected country level ICT costs for six nations in sub-Saharan Africa but the data was not obtained in a way that enabled systematic and comparative analysis. Within this small collection, work on the SADC region is limited to only two countries. [2]

The literature on developing countries tends to focus on costing the technological elements of hardware, software and telecoms to the relative neglect of a range of cost elements such as training, technical support, curriculum development and planning. In this article, 'total cost of ownership' (TCO) a methodology that derives from management of computers in business environments, is used as a framework to identify costs. TCO draws attention to the importance of obtaining an appropriate combination of purchases, inputs and activities in order to operate a sustainable ICT environment. This implies that failing to fund key elements may fatally undermine the success of the whole ICT financing programme (McKenzie, 2003: 1). In this way costs must be related to financing within a time-based budget allocation framework that in turn is informed by policy. There is evidence of schools and school districts in a number of developed countries applying TCO methods in financial planning and management of ICT facilities. [3] In this article the concept of TCO is applied in three developing countries, in order to better understand the financial challenges facing developing country school communities and MoEs that aim to finance ICT on any scale. Using a TCO approach and method can contribute to understanding and achieving an appropriate balance between the strategic inputs required to sustain ICT facilities in

individual schools or in groups or systems of schools. If applied to a national sample the process can reveal differences between countries in expenditure patterns, which can be explained with reference to policy and conditions in schools.

METHODOLOGY

Botswana, Namibia and the Seychelles elected to be the countries in which this research was conducted. In-country researchers from each MoE were involved in the project to facilitate interaction with role players in each country. Meetings were held with SADC Permanent Secretaries to ensure that there was a shared understanding of the aims, objectives and methodology and to ensure that countries took ownership of the research project. The draft results were presented to SADC Permanent Secretaries at a regional conference in August 2003.

Data was obtained by means of a survey of schools in each country. The aim was to audit ICT equipment in each school and to capture all the fixed and recurrent costs of ICT provisioning (such as telecommunications costs) and services (e.g. computer repairs and network maintenance) as well as other human resource costs such as training. The instrument was based on key cost categories that were identified from the TCO literature. These main categories/themes were developed in a workshop attended by the in-country researchers. The instrument, after piloting, included 117 questions covering the cost categories given above.

In-country researchers delivered and collected the instruments and followed up on queries from respondents. The returns were captured, spot checked for accuracy and cleaned. The data was loaded into and queried in SPSS. The analysis refers only to computers used for classroom teaching and learning.

CALCULATION OF COSTS

As indicated, the aim of this study was to consider the costs associated with installing software, hardware and peripherals in school computer rooms, as well as recurrent expenses, human resources, training and management and administration costs.[4] The cost model was built using the average in-country cost for each item. There was some missing data from the returns because certain costs associated with the implementation of ICT in schools were not incurred at the school level but rather at the level of the MoE. For example, Botswana and Seychelles MoEs budgeted for and provided technical support to schools and as a consequence schools did not know the cost of these services. This information was obtained through further interaction with the Ministries concerned. Some values, such as recorded expenditure amounts, required confirmation or explanation where they appeared to be disproportionately large or small by comparison to the mean distribution of values. They were checked with in-country researchers to ensure the highest possible levels of accuracy.

Expenditure on certain high value items (computer room, hardware and peripherals, software and training contracts with external providers), was annualised over the estimated life of the item in question so that an annual cost could be derived. On this basis it was possible to populate Table 2 (discussed below) so as to compare costs across the three countries.

SAMPLING STRATEGY

On account of time and budget constraints, only schools that had a computer room and used computers for teaching and learning were sampled, except in the case of the Seychelles, where that country's small population of Secondary Schools – all with computer rooms – was surveyed. Fieldworkers aimed to achieve a balance between primary and secondary, rural and urban, and public and private schools proportionate to the occurrence of these school types (with computers) in each national school system. Private or NGO-established computer centres or tele-centres operating independent of schools were not surveyed.

In Namibia, a reasonable spread of urban and rural schools was obtained, whereas in the case of Botswana, the sample was restricted to a radius of 50km from the capital city, Gaborone. Assuming that ICT costs will tend to increase with distance from an urban centre, the Botswana cost data is likely to slightly underestimate school ICT costs in that country.

THE SAMPLE AND THE NATIONAL POPULATIONS OF SCHOOLS WITH ICT

In all, a total sample of 62 schools was obtained (Table 1). The low number of primary schools included from Botswana and Seychelles in the sample is simply reflective of the low numbers of primary level schools with a computer room in those countries. When the fieldwork was undertaken in 2003, Botswana and Seychelles had already supplied a computer room to every school offering post-primary education. The few primary schools in Botswana and Seychelles that do have computer rooms own these facilities because they were specifically established for pilot purposes, or they owe their existence to school community initiatives.

Table 1: *Sample of Schools*

	Country			
School phase	**Botswana**	**Namibia**	**Seychelles**	**Total**
Primary	1	9	1	11
Middle/Junior Secondary	19	2	-	21
Senior Secondary	9	9	121	30
Total	29	20	13	62

1. The 12 schools surveyed in this category represent the entire population of public secondary schools (10) and private secondary schools (2) in the Seychelles

In Botswana and Seychelles, the distribution of computer rooms is driven by a policy that follows a phased approach to implementation, starting with secondary schools, and this is reflected in the sample. In Namibia, there is a more or less even balance in the distribution of computer rooms between Primary and Secondary schools that is the outcome of an 'organic' growth in the number of schools with computer facilities. This is partly because the Namibian government, though supportive of ICT in schools, had not yet made the strategic decision that all schools in a particular phase or grade range should provide learners with access to ICT. Under these circumstances school-based and NGO-based initiatives to set up, facilitate and operate computer facilities in schools in that country are important. Circumstantial evidence suggests that there is significantly greater NGO activity in the field of ICT education in Namibia than in Botswana and Seychelles. The existence of ICT education-based NGOs across the school spectrum in Namibia largely explains why the number of primary and secondary schools in the sample for that country is almost equal in number – there being no policy directing ICT provision in any particular phase.

In that country, NGOs and school communities acquire ICT for schools in terms of their own programmes and objectives and the cumulative impact does not appear to favour primary or secondary schools.

Reliance on NGO initiatives appears to be a fairly typical situation across a number of sub-Saharan African countries where, according to Ottwanger (2003: 29) the 'most successful in the implementation of ICT in practice are a few, often donor-funded projects'. A concomitant characteristic across many countries is that, even where they have developed ICT curricula and materials and provided teacher training in some way, 'most of the countries lack national umbrella organisations watching over a co-ordinated implementation' (Ottwanger, 2003: 29-30).

In the sample the numbers of schools in each phase (Primary, Junior Secondary and Senior Secondary) were not consistent across each country. There were very low numbers of accessible primary schools with computer rooms in Botswana and Seychelles, where the policy emphasis was on equipping junior and senior secondary schools. Only 11 (<20%) of the sample of 62 were primary schools. It was therefore decided not to separately analyse ICT costs for each school phase. The main focus of the analysis was therefore on costs per school in each country rather than on differences in costs per school phase.

DISCUSSION

Firstly, the overall pattern of ICT expenditure is described and related to MoE policy on ICT access in the three countries. Then the allocation of funds within each country's expenditure envelope is discussed to show differing allocations of value to elements of the ICT package found between the school systems. This is followed by discussion of the main findings.

ICT Costs

Table 2 provides a summary of ICT costs based on the TCO approach. The Botswana and Seychelles MoEs set out to systematically provide access and support ICT in their secondary schools and were primary funders of human resource, training and technical support costs. Unfortunately, expenditure data in these categories was not available from the Botswana MoE.

Table 2: *Annual costs of ownership in US$ per school in Botswana, Namibia and Seychelles, 2003*

	Category	Second level description	Botswana	Namibia	Seychelles
1	Building*	Build from scratch	7 241	3 342	5 790
2	Hardware and peripherals**	Workstations, peripherals, network and internet facilities	11 384	7 602	15 742
3	Software***	Systems software and applications	443	275	761
4	Curriculum and subject-specific software****	Subject specific software	1 570	2 473	1 522
5	Recurrent	Software licensing and upgrading	171	208	570
		Maintenance	1 041	1 116	4 000
		Insurance	1 979	834	0
6	Internet connectivity (recurrent)	Leased Line rental/ ISDN line rental	100	170	192
		Internet Service Provider fees	864	936	996
		Call charges	2 484	1 416	648
7	Consumables		3 719	573	963
	School level technology costs		31176	18945	31184
8	Human resources for technology management	Computer technician, user support, and computer room manager	n.d.	2184	12115
9	Personnel training and professional development*****	Technical support training, computer room manager	n.d.	314	238
10	MoE management and administration	Planning and administration costs	n.d.	754	2473
	Support costs		n.d.	3252	14826
	Total cost of ownership (TCO)			22197	46010

* *Annualised over 20 years*
** *Annualised over 4 years*
*** *Annualised over 4 years*
**** *Annualised over 4 years*
***** *Annualised over 3 years*

School Level Technology Costs

The distribution of school level technology costs (Table 3) by category, calculated as a percentage, reveals a broadly similar pattern between countries, where in each case, hardware, software and peripherals constituted the single biggest expenditure followed by recurrent expenditure, the computer room and lastly consumables. Within this pattern, the higher levels of expenditure on hardware software and peripherals in the Seychelles were on account of higher costs of supply and installation on the relatively isolated island archipelago. The lower costs of the computer rooms in Namibia were attributable to lower labour-construction costs. The high share of costs allocated to consumables in Botswana (printer cartridges, paper and stiffy disks) was based on supply of these items to schools at the beginning of the computer room building and equipment programme, which may have been adjusted over time. The 'retro-fitting' of electricity and other installations to existing classrooms, which is less costly than special rooms purpose-built for computers, was quite common in Namibia.

Table 3: *Comparison of school level technology costs in percent**

		Botswana	**Namibia**	**Seychelles**
1	Computer room	23.2	17.6	18.6
2,3,4	Hardware software peripherals	43.2	54.6	57.8
5,6	Recurrent (incl. connectivity)	21.3	24.7	20.5
7	Consumables	11.9	3.0	3.1
		99.6	99.9	100

** Percentages may not add up to 100 on account of rounding*

Influences on Total Costs of Ownership

Total annual total cost of ownership (TCO) per school can only be analysed for Namibia and Seychelles because this data was not available for Botswana (Table 2). It is striking that in US$ terms, expenditure on ICT in Namibia was less than half that of the Seychelles. Moreover, Seychelles expenditure on computers was higher for both (a) school level technology costs and (b) support costs which were supplied centrally from the MoE. This indicates the extent to which the Seychelles MoE has committed itself to ICT as an important element in its national curriculum strategy.

In contrast, the greater overall share of costs is borne at the school level in Namibia, which suggests that in that country government depends on school communities and NGOs to sustain computer activity at schools. The shape of expenditure in Namibia is consistent with a country that is in the process of developing policy but where the MoE does not yet have the budget to underwrite the expansion of computers into schools on a large scale. The Namibia education system consists of a highly dispersed population of 1545 schools, while the Seychelles MoE is responsible for 50 schools with a more dense population, so putting in place computer rooms in the latter country will be a more financially-onerous undertaking. The first step on this path will be for the MoE in Namibia to formulate and implement policy regarding national aims for computer rooms in schools, including norms and standards for such learning environments, and where such a roll-out should start. Until this happens, the distribution of schools with computer rooms in Namibia will be driven by local initiative and will reveal a variety of approaches to the challenge of providing ICT access to learners.

It is important to observe that in the case of both Botswana and the Seychelles, where investment in computer infrastructure in schools was driven by government, the average expenditure per school was almost double the expenditure in Namibia, where support for such expenditure came from NGOs and the community (Table 3). A key question is whether a model of ICT provision in which MoE and NGOs share funding and roll-out – as appears to be the case in Namibia – could provide more efficient access to computer rooms of equivalent quality than facilities in countries that are (almost) entirely driven by government funds.

This question becomes more complex when we compare the proportionate allocation of funds to all cost categories within a TCO framework (See Table 5). The most important difference between the two countries is that the proportional allocation of expenses in categories 8-10, all of which refer to human resources and planning, were much higher in the Seychelles – with a combined percentage of 33.25% – than in Namibia, with a combined percentage of 14.2%. Support costs were mostly absorbed by the individual schools in the case of Namibia and funded by the MoE in Seychelles.

Table 5: *Comparison of Total Costs of Ownership (TCO) in percentages: Namibia and Seychelles**

		Namibia	**Seychelles**
1	Computer room	15.1	12.6
2,3,4	Hardware software peripherals	46.6	39.2
5,6	Recurrent (incl. connectivity)	21.1	13.9
7	Consumables	2.6	2.1
8	Human resources for technology management	9.8	26.3
9	Personnel training and professional development	1.4	0.5
10	MoE management and administration	3.4	5.4
		100	100

** Computer costs are affected by the standards for provision set by a MoE (such as performance benchmarks set for computers, number of computers per computer room, etc.)*

Could it be that the Seychelles approach – though more expensive – is more sustainable, given their emphasis on human resources costs to support the operations of the computer room?

These questions are raised deliberately because the cost data collected, though describing what current costs are, cannot assist in establishing which allocation patterns are more efficient or produces better quality of service than others. For example, the 9.8% allocation to school-based technology management in Namibia may seem to be cost efficient in comparison to the Seychelles value of 26.3%. But a lower allocation to technology management may buy less qualified user support, or user support that is not available on call, leading to extended down-time of the school computer network. This wasted time erodes the value of all investment inputs into the installation. More research needs to be done on hidden costs and opportunity costs of ICT investment in order to make the TCO model more sophisticated so that the impact of different expenditure patterns on efficiency and quality of ICT access can be understood.

Cost Indicators and International Comparisons

A simple and useful cost indicator is derived by calculating the cost of computers per learner or per computer. In Seychelles schools, the expenditure on computers was three times that of

Namibian expenditure per learner and four times that of Namibian expenditure per computer (Table 6).

Table 6: *Cost indicators for Botswana, Namibia and Seychelles in US$, 2003*

Category		**Botswana**	**Namibia**	**Seychelles**
School level technology costs		31 176	18 945	31 184
Support costs		n.d.	3 252	14 826
Total Cost of Ownership (TCO) per school		n.d.	22 197	46 010
Annual cost per learner	Average n of learners per school	873	842	594
		n.d.	26.36	77.46
Annual cost per computer	Average n of computers per school	29	27	13
		n.d.	822	3 539

FURTHER DEVELOPMENT OF COSTING MODELS FOR AFRICAN COUNTRIES

The cost analysis applied in this study was deliberately restricted to a simple set of parameters that afforded relatively easy data access and which could be replicated. Consequently, there were relevant cost elements and influences on costs that were not incorporated, but which deserve noting in the interest of developing a more nuanced cost analysis.

In the first instance there is the matter of whether to use refurbished (or reconditioned) computers rather than new computers. There are conflicting views on whether refurbished PCs are a more viable technology option than buying new computers in terms of cost-effectiveness (See: Open Research, 2004; InfoDev, 2005: 3). For example, one argument is that opting for refurbished computers may reduce costs of acquisition of the hardware, but that the overall costs of maintaining older machines will outweigh the initial cost saving. A decision on this matter could appreciably affect ICT costs over a lengthy period of time.

Second, there is the option of 'cost recovery' in respect of ICT fees that could be levied at school level, in order to subvent MoE expenditure. But there are also equity, administrative, legal-regulatory and cultural aspects that must be satisfactorily addressed (InfoDev, 2005: 3).

Third, the dominant language of software and of the Internet is English. In linguistically diverse African countries, MoEs will come under pressure to support the development of content, materials and software that can add considerably to government's financial burden (See: Gyamfi, 2005; Dalvit et al., 2005).

Fourth, costs of hardware and software are dictated largely by technology cycles where each generation becomes progressively cheaper to purchase as it is superseded by new models/versions with higher performance. The MoE can control expenditure through defining the

economic life-cycle – or the useful financial life – of an item, and also through timing of its purchases to maximise the efficiency of its systems.

All of the above aspects have the potential to impact significantly on ICT costs, but are difficult to introduce into a model that must be used for comparative purposes.

CONCLUSION

This article observes that in developing countries that have to deal with constrained budgets, financial allocations to ICT must properly take into account the full costs of sustainable ICT systems. However, there is a dearth of information about ICT costs that can assist MoE decision makers to apportion their budgets between competing demands between the four 'T's' - teachers, textbooks, time and technology.

This is because a body of work that upholds systematic study of ICT costs in African schools has not yet emerged. The task of generating a coherent understanding of ICT costs through research is complex because investment in ICT in African schools is mainly dispersed in resource centres or in small networks of pilot schools (Ottwanger, 2003:29) which operate under different conditions with widely varying technology configurations. A shared approach to collecting data on ICT costs is essential to raise the comparability of research studies.

The analysis of cost data suggests that very few countries in sub-Saharan Africa will be able to contemplate the aggressive implementation of computer rooms in all high schools, as was achieved in Botswana and the Seychelles. Most will find themselves in a situation analogous to Namibia's. In that country, government depends on school communities and NGOs to sustain computer activity at schools. A key question is whether such a model of ICT provision in which MoE, NGOs and communities share the financial burden can be as sustainable, equitable and provide equivalent quality of access as facilities in other countries that are (almost) entirely driven by government funds.

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ENDNOTES

[1] The potential benefits of using of ICTs in educational administration at the school level (School Management Systems) and at the systemic level (Education Management Information Systems) are noted but not addressed in this paper.

[2] There is a body of publications that deal specifically with the financing of distance education – in higher education and adult education – that will not be addressed here (eg: Butcher, 2003).

[3] The following are examples of TCO-based tools giving the sponsoring organisation acronym and URL: IAET at AEL <http://129.71.174.252/tcov2/bkgnd.cfm> (Date accessed: 31 January 2006); BECTA at <http://schools.becta.org.uk/index.php?section=pr&catcode=ss_to_pr_su_03&rid=9650> (Date accessed: 31 January 2006); ISTE at <http://tsi.iste.org> (Date accessed: 31 January 2006); CoSN & Gartner at <http://classroomtco.cosn.org/gartner_intro.html> (Date accessed: 16 September 2003).

[4] A detailed account of how these values were calculated is available in Paterson (2004).

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Social presence awareness for knowledge transformation in a mobile learning environment

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ABSTRACT

Knowledge sharing occurs between humans, rather than being a human-computer process. Knowledge transformation is an outcome of individuals' knowledge-sharing experiences. Social interaction is central to both knowledge transformation and to learning. When learners intermingle, there may be a shift in knowledge due to the social interaction. Consequently, knowledge transformation is a social process that occurs when there is an interaction among learners. In a contact university, learners perform tasks in three locations: formal contexts, semi-formal contexts and informal contexts. Learning tasks are presumed to be constant but a mobile learner carries the tasks across different environments. However, as learners move across different contexts, they do not have access to the same social networks for sharing knowledge and learning experiences. The paper conceptualises a mobile learning environment that provides social presence awareness as a learner traverses different learning contexts. It highlights how through synchronous mobile instant messaging, social presence provides learners with continuous awareness of available social support, thus facilitating the on-demand and opportunistic sharing of knowledge.

Keywords: *Knowledge transformation, social presence, social interaction, instant messaging, learning contexts*

INTRODUCTION

Learners in South African universities come from diverse social backgrounds, with different languages and cultures. Some learners come from previously disadvantaged schooling systems where direct interaction or one-on-one contact with an instructor is quite unusual because of large classes. Assuming that the instructor is the only expert available to draw on, these learners tend to be unaware of other available social resources they can draw upon for knowledge consultation. The resources may take the form of lecturers, tutors, knowledgeable peers and other expert personnel. Additionally, learners often encounter problems that may need immediate attention or are time-driven; and generally they feel the lack of context-sensitive and anywhere, any time academic support as they traverse various learning locations. Limited support is normally only available at fixed times (i.e., during instructor office hours) or seminar slots, and the opportunity for engagement in large lecture theatres is limited, if not almost impossible.

For these higher-education learners, a viable alternative – one that complements existing opportunities – is to engage in a mobile learning activity through social interaction with knowledgeable peers who share a background. Sharing learning experiences could provide useful academic support. This paper grapples with the ways that social awareness of knowledgeable peers with shared background, languages and cultures, regardless of a learning location, could be leveraged to enrich the learning and knowledge transformation experience. Specifically, the contribution of this paper is an exploration of the possibilities that social presence awareness, in ways that are sensitive to the background and context of a learner, provides propinquity of available social resources regardless of location of the learner and task at hand.

How can social presence awareness be used to support a learner moving across different locations? My conceptual model is a learning environment that facilitates on-demand 'anywhere, any time' consultation and continuously assures a learner of the availability of a social support network. To this end, ubiquitous communication and social interaction is exploited to support learner mobility across varied learning contexts. As learners move between contexts, a knowledge sharing environment moves with them, hence maintaining access to available social resources regardless of context.

The conceptual model described in this paper underpins empirical work described elsewhere (Kekwaletswe, 2007; Kekwaletswe & Ng'ambi, 2006a; 2006b). These works show how learners merge context and social presence awareness for purposes of mentoring and sharing learning experiences. The empirical research was carried out over a period of 18 months on the University of Cape Town's upper campus and in the residences using a Contextual Inquiry methodology. About 70 mobile learners and tutors participated with and without mobile devices. Contextual Inquiry is a research framework that depends on interactions with actors in the context of their work. Hence, the empirical work was done with participants engaged in authentic learning tasks. The general finding was that learning actions are influenced by changes in the environment and in social awareness. Learners in mobile learning environments use social awareness to model their actions for the provision of personalised academic support. Social awareness is found to be synonymous with awareness of context and social presence. The studies concluded that context and social presence awareness is of vital significance to how learners share learning experiences.

The purpose of this paper is to focus on one element of the empirical work: the potential of the mobile instant message to contribute to mobile learners' interaction through its social presence indicator. A mobile learner refers to a learner who is not fixed to specific learning locations. The paper identifies the various elements of the model, drawing on the limited related literature available and showing how learners' engagement can be enhanced through mobile technologies. In particular, the potential of mobile social presence indicators to contribute to learners' interaction is emphasised.

CONCEPTUALISED MODEL

The conceptual model assumes a contact university where learners attend formal lectures and laboratory sessions. In a contact university, there tends to be disproportionate access to available social resources between the times when learners are attending scheduled or formal classes and when they are away from scheduled classes. It is therefore useful to distinguish between the learning contexts in which a learner's experience takes place. These are: formal contexts such as scheduled classes and laboratory sessions (where a learner's behaviour is modelled according to the university class timetable); semi-formal contexts such as libraries, walk-in laboratories, cafeteria and mingling areas (these contexts may represent informal spaces on campus used by learners while waiting for the next lecture to start); and lastly, informal contexts (the characteristics of an informal learning context are not explicit; however, these contexts include working after-hours, weekends or in university residences and private homes).

These different contexts are generally not permeable. However, since acquiring, sharing, or transferring knowledge is a location-independent learning activity, the available resources for social support ought to move with a learner. In this regard, the problem is that of ensuring that the resources remain socially present and consistent for supporting a learning task regardless of the location of a learner. Providing personalised academic support to learners includes recognising the huge and sometimes complex volumes of information a learner deals with. To alleviate this challenge, I sought a model that helps reduce cognitive loads by providing on-demand

information in smaller chunks and at the right time, regardless of a location. This model provides ubiquitous knowledge sharing and learning support to a learner as he or she traverses the varied contexts. The goal is to create a presence and context-aware consultation system that provides a knowledge-sharing space and supports a learner in the various contexts through the use of context-aware social presence mechanisms. In the model, the mobile learner has access to the same social network or resources regardless of his or her location and learning context.

Figure 1: *A model for ubiquitous social presence awareness in an IM-learning environment*

The conceptual model (Figure 1) depicts social presence awareness in a mobile learning environment. Social awareness is a mental concept where a learner becomes aware of the social network that follows him or her while moving across the different learning contexts. In the figure, a learner is consciously aware of available tutors, lecturers and knowledgeable peers should they encounter a learning problem for which they need to consult. By the same token, a peer is consciously aware of other mobile learners as well as available experts (lecturers or tutors) should they not be able to address the learning problem encountered. They both access a consistent social network and resources even as they move away from formal learning contexts. The social network provides a necessary social interaction whose outcome may contribute to knowledge transformation in the mind of a learner.

The context-independent social presence awareness is achieved via mobile instant messaging (IM). The mobile instant messaging client is installed on Wi-Fi enabled PDAs. IM interactive space is used to exchange and transfer knowledge in a textual form. That is, mobile learners share what they know through instant textual messages. The mobile IM environment, through its social presence awareness feature, shows a learner who among his or her peers, lecturers and tutors (social network) is available for a potential immediate and impromptu face-to-face consultation. The next section briefly describes the concept of social presence and its role in facilitating knowledge transformation.

SOCIAL PRESENCE

Social presence gives a sense of the extent to which a communication medium facilitates awareness of the other. It is a measure of the feeling of community the learner experiences (Tu & McIsaac, 2002) in a mobile learning environment. It is also the degree to which a person is perceived as a 'real person' in a mediated communication (Gunawardena, 1995). To examine social presence, the relationship between media and socio-cultural construction of knowledge should be explored (McIsaac & Gunawardena, 1996). The role of social presence (Short et al., 1976) has been explored in online collaborative learning situations (Gunawardena, 1995) and distance class environments (Tu & McIsaac, 2002) but its application in a mobile learning environment has not been addressed. This paper suggests that it is equally pertinent in a mobile learning environment.

Social presence theory is defined as the 'degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships…' (Short et al., 1976:65). They define social presence as a quality of the medium itself and theorise that communication media differ in their degree of social presence, and that the differences are key in determining the way individuals interact. The argument that the quality of the communication media determines its social presence or richness is contradicted by Ngwenyama & Lee (1997) who envisage that the communication richness of a media is dependent on who and how you use it. Rafaeli (1990) argues that social presence is a subjective measure of the presence of others, while 'interactivity' is the actual quality of a communication sequence or context. I am in agreement with Rafaeli,

Ngwenyama and Lee in that the context in which an interaction takes place determines social presence. For example, the determining factor may be how fast a learner or tutor in a remote location needs a response or it may be how much they need to be aware of another's emotional involvement.

Mediated social presence involves social interaction using a communication medium, such as instant messaging, to come to know the meanings, cognitions, emotions and behaviours of another mind (Sallnas et al., 2000). Since social presence refers to the feeling of being socially present with another person at a different or remote location, it can be 'cultured' among participants (Walther, 1994). For instance, people interacting in a text-based IM environment tend to develop an ability to express emotions through the use of 'relational icons' or 'emoticons'. This 'socially cultured' argument, yet again, diverges from the Short et al (1976) argument that social presence is mostly an attribute of the communication medium.

Although social presence theory has not been explored in mobile learning environments, research to date has shown that social presence can be strongly felt by participants in computer-mediated communication (Walther, 1994; Tu & McIsaac, 2002) and that students' perceptions of social presence have a strong influence on their satisfaction with online courses (Richardson & Swan, 2003; Tu, 2000; Gunawardena et al., 1997). Researchers have demonstrated both that students perceive the presence of others and that they socially present themselves (Gunawardena, 1995; Picciano, 2002).

My argument is that learners use awareness of a social presence to engage in a social interaction whose outcome is knowledge transformation. Thus, social presence is redefined and understood to be the mobile IM mediated presence of another learner, tutor or lecturer who could provide personalised on-demand social support for a learning problem as the learner traverses varied learning contexts.

The following section discusses how IM offers both the interactive space and the much needed social presence as the learner finds himself in varied learning contexts and locations.

KNOWLEDGE-SHARING SPACE

Social presence provides learners with the indications of the possibility of a supportive learning community. The role of such a community (social network) in a higher education context can, amongst other things, be that of an enabling knowledge-sharing space. This paper suggests that such a knowledge-sharing and interactive space can be afforded through mobile instant messaging (IM). IM is a tool that successfully supports formal and informal communication (Grinter & Palen, 2002; Grinter & Eldridge, 2001) and hence offers the potential to facilitate knowledge transfer instantly. Cases have been reported where instant messaging was preferred to informal face-to-face conversation because it is less intrusive and allows multi-tasking (Nardi et al., 2000). According to studies by Grinter & Palen (2002) and by Nardi et al. (2000), IM has been adopted by teenagers for socialising, and by adults for both social and work purposes. It seems that the possibilities of IM for learning have not been exploited or researched. Yet indications are that the social presence indicators afforded by instant messaging enable and support informal social interaction and communication, and contribute to its value in knowledge transfer and education.

The literature on instant messaging suggests that conversations have a specific character: they tend to be brief (but could also be used for longer, discontinuous interactions among peers or learners) and mostly cover a single topic, and both media switching and multi-tasking are prevalent. Despite the IM social presence, learners can still engage in other activities while

maintaining the presence. Secondly, IM is used for the following general functions: quick questions and clarifications, coordinating learner-tutor meetings, coordinating impromptu social meetings, and keeping in touch.

In a mobile learning environment, mobility and social presence of both the learner and the social support network are no longer limited, unlike in wired communication spaces or environments. Since a mobile IM client is installed on a mobile device (PDA) that can be carried everywhere, the learner is ensured of the opportunistic and on-demand social interaction with the social network in their contact list, regardless of time and their location. Serendipitous learning and knowledge transformation may be realised in this mobile learning environment. Knowledge, and its transformation, is discussed in the following section.

KNOWLEDGE TRANSFORMATION

Acquiring, sharing, and processing knowledge are all essential activities of learning. Knowledge is an ambiguous, unspecific and dynamic phenomenon, intrinsically related to meaning, understanding and process (Alvesson & Karreman, 2001). Knowledge is fundamentally intertwined with the social settings in which it is encountered. Schutz (1997) views knowledge as possessing radically different meanings for different individuals, based on their biography and positions in the social setting. It involves the mental processes of comprehension, understanding and learning that go on in the mind and only in the mind, however much they involve interaction with the world outside the mind, and interaction with others (Wilson, 2002).

Knowledge transfer and sharing is ultimately a human-to-human process. Since this process is inherently interactive and dynamic, the knowledge, in essence, transforms while or during the very process of its transfer (Shariq, 1999). Knowledge transformation is thus a social process that occurs when there is a shift in knowledge, perspective or thought process due to the social interaction.

Social interaction and knowledge transformation can be mediated by technology. In a mobile context, interactive and dynamic knowledge transfer process is realised through mobile instant messaging as learners communicate by writing text and sending graphic messages. However, such messages are unlikely to carry 'knowledge' but rather constitute 'information', which a knowing mind may assimilate, understand, comprehend and incorporate into its own knowledge structures (Wilson, 2002). These structures are different for the person writing the message and the receiver, because each person's knowledge structures are biographically determined (Schutz, 1997). Therefore, the knowledge built from the messages can never be exactly the same as the knowledge base from which the messages were uttered. In a mobile IM environment, the volume of information exchanged via text instant messaging is relatively small. That is, learners' cognitive load is also reduced, since sharing of information is in small chunks. The meaning of the text in IM interaction is understood from a learning context (Ricoeur, 1991). In other words, knowledge is constructed when an IM text message is socially and contextually interpreted by the learner. The learner's perspective or thought process may be adjusted as an outcome of IM social interaction. This shift in knowledge, perspective and thought process constitutes knowledge transformation.

CONCLUSION

Given that knowledge sharing is a location and time-independent human-to-human process, mobile instant messaging allows learners the awareness of available social resources that they may draw upon for consultation. In this paper I have suggested how social presence awareness could be used to support a mobile learner. The conceptual model is a knowledge transformation

environment that supports learners, continuously assuring them of consistent access to social networks and resources. I have also argued how ubiquitous social interaction through the use of a context-aware social presence mechanism could be employed to support a learner as he or she traverses learning contexts.

The social presence afforded by synchronous mobile instant messaging could successfully maintain social networks constituted for ubiquitous mobile learning and enable the kinds of interaction whose outcome is knowledge transformation. Thus, the model supports synchronous collaboration between geographically dispersed learners. The conceptual model also provides learners with reduced cognitive load. That is, learners do not have to remember or memorise volumes of information, since they are consciously aware of available social networks that could provide an on-demand small chunk of information for a specific learning task.

I approached mobile instant messaging in the context of a South African higher education environment, where personalised academic support is a growing need but delivery is fraught with challenges. Subsequently, mobile IM allows me to determine the local value it may bring to learning and knowledge sharing as well as its place among other forms of social and educational communication. A mobile IM environment may provide personalised academic support to disadvantaged or under-prepared learners in different ways. Its social presence indicator is relevant to selecting who among the peers (based on a shared background) is available for an opportunistic and on-demand social interaction. And finally, such learners are afforded access to knowledge resources and peer networks, regardless of time and their location.

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Making sense of the meaning maker: tracking the object of activity in a computer-based mathematics lesson using activity theory

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ABSTRACT

This paper outlines how one can use activity theory (AT) as an analytical framework to understand tool use and its attendant developmental impact in context by selecting object-oriented activity as the unit of analysis. While an understanding of object-oriented activity is central to activity theory, the notion of object is a frequently debated and often misunderstood one. The conceptual confusion surrounding the object arises both from difficulties related to translating the original Russian conceptualisation of object-oriented activity into English as well as from the different interpretations of the object currently in use within two contemporary approaches in activity theory. Further compounding the understanding of this notion as it relates to pedagogical practices within schools is its use as a predominantly interventionist tool in work settings to understand transformation rather than as a theory to explain activity in classroom settings. This paper sets out to develop a methodology for studying the object of mathematics lessons by exploring notions of object-oriented activity, before discussing the conceptual challenges arising from its use in two contemporary versions of activity theory. To this end, the paper traces the historical development of the object through Leontiev (1975/78; 1981) and Engeström's (1987) expansion of Vygotsky's original triadic understanding of object-oriented activity. The paper goes on to elaborate a methodology for using AT to analyse observational data by developing the notion of evaluative episodes as pedagogical events in which the pedagogical object is made visible in computer-based mathematics classrooms. Findings indicate that an evaluative episode can serve as a moment in which the dynamism of an activity system is momentarily frozen, enabling one to model human activity in the system under investigation and, hence, in this study, to understand learning in context.

Keywords: *activity theory; learning with computers; evaluative episodes; object-oriented activity.*

INTRODUCTION

Computer-assisted teaching and learning has come to occupy a significant role in classrooms around the world, with positive learning outcomes being reported by various researchers (Sivin-Kachala, 1998; Holmes, Savage &Tangney, 2000). This is especially true in relation to the use of this technology to teach mathematics (Papert, 1980; 1990; Campbell et al, 1991). Research into mathematics classrooms shows that computer technology can support problem solving skills (Fey, 1992); decrease the amount of time required to master skills, allowing for more time to be spent on developing conceptual understanding (Wagner & Parcker, 1993) and facilitate the development of deeper understanding of algebraic ideas (Kaput, 1992). As South Africa currently faces a crisis in mathematics education, which has seen it placed last[1] in the Third International Mathematics and Science Study (Martin et al, 2000), if computers are indeed able to impact positively on mathematical performance then placing this new technology into schools could help alleviate the deepening crisis. The assumption underlying the implementation of computer-based technology into schools in South Africa is that the technology will help to develop autonomous learners, who are both mathematically and technologically literate (DoE, 1996; 2000). And indeed it would appear, given the right circumstances, that the computer can facilitate the development of autonomous learners capable of exploring their world and constructing knowledge (Wegerif,

Mercer, & Dawes, 1999; Wegerif, & Scrimshaw, 1997; Mercer, & Wegerif, 1998). While policy documents (DoE, 2002) point to the desired outcomes of the current curriculum (such as 'qualified, competent, dedicated and caring' teachers and 'confident and independent, literate, numerate, multi-skilled, compassionate…' lifelong learners who are active citizens (DoE, 2002:3), there is little indication about what must be transformed in order to meet these outcomes. One thing, however, seems clear and that is the need to develop mathematically literate students who are capable of engaging in the global marketplace. The use of computers as teaching/learning tools offers at least the hope of meeting this outcome (Hardman, 2004).

This paper emerges out of a wider investigation aimed at understanding how teachers use computers to teach mathematics at a primary school level in four previously disadvantaged schools in the Western Cape, South Africa. Much research conducted in the past in information and communication technology (ICT) and teaching/learning focused on the interaction between an individual child (or in some cases a group of children) and the computer; the underlying assumption is that learning emerges only out of this interaction. However, present research (see for example Nardi, 1996) indicates that learning with ICTs needs to be understood in relation to broader social relationships and structures that afford and constrain the interaction between the student and the computer. For those researchers working to understand how computers potentially impact on or mediate learning, activity theory (AT) provides a powerful analytical framework for situating learning in context (Hardman, 2005c; Lim & Hang, 2003; Lim, 2002; Lim & Chai, 2004; Nardi, 1996; Kuutti, 1996; Bottino et al, 1999). Figure 1 represents a contemporary view of an activity system, which activity theorists take as the prime unit of analysis (Engeström, Miettinen & Punamaki, 1999; Engeström, 1987). This unit of analysis allows one to situate developmental processes in context. What one can see from figure 1 is that the subject acts on the object in order to transform it using mediating artefacts in order to arrive at an outcome. In turn, the subject's position and engagement with the activity is influenced by the rules of the context, his/her community and division of labour.

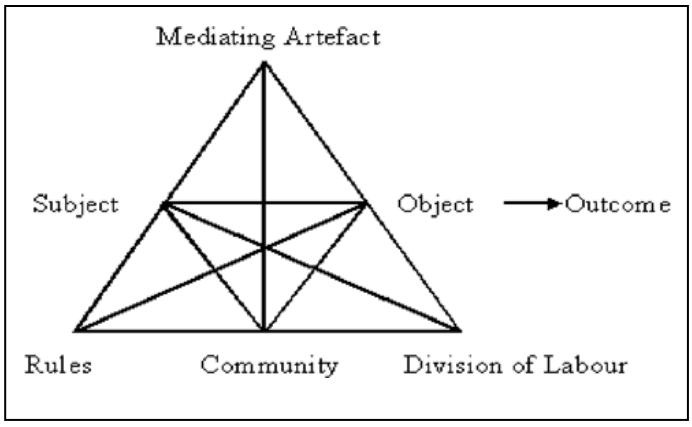

Figure 1: *An activity system* (Engeström, 1987: 75)

A key characteristic of an activity system is its object orientedness (Leontiev, 1981; Engeström, 1987; Hardman, 2007a; Foot, 2002). Objects define activities and, hence, identification of the object of the activity enables one to map the different nodes of the activity system. However, tracking the object of an activity is a problematic endeavour due in part to the different views on how the object can be defined. This paper seeks to illustrate a method for investigating the object

of mathematics lessons using activity theory by focusing on analytical events that I call evaluative episodes as spaces in the data that surface the object of an activity.

What is activity theory?

Activity Theory provides the researcher with a heuristic device, formulated as an activity system in Figure 1 above, for identifying, examining and aiming to answer research questions related to human activity. Researchers working within the wide AT field share certain concepts and accept certain principles. I draw primarily from Cole (1996) and Russell (2002) in order to elaborate on these principles:

- Human activity is collective and human behaviour originates within the social realm (Cole & Engeström, 1993).
- Mind is social, growing out of joint activity.
- Tools, which carry socio-historical meanings, mediate our psychology.
- Activity theory studies development and change, which is understood to include historical change, individual development and moment-to-moment change (Russell, 2002).
- Activity theory assumes that people are active cognising agents but that they act in sites that are not necessarily of their choosing with tools that constrain and afford their actions.
- Methodologically, activity theory rejects cause and effect explanatory science in favour of 'a science that emphasises the emergent nature of mind in activity and acknowledges a central role for interpretation in its explanatory framework' (Cole, 1996:104). Consequently, activity theorists make use of a contextualist methodology.
- Activity systems are constantly subject to change and activity theory sees these changes as driven by contradictions (Engeström, 1987; Russell, 2002).

While providing a rich framework for investigating the subject-in-action, activity theory is not particularly well developed when it comes to studying the complexities of classroom interaction. Further, the theory is hampered in part because the notion of 'object' is not sufficiently well operationalised to investigate its emergence at the level of the classroom. While there are numerous examples of the application of activity theory in interventionist research to analyse work (Engeström, 2001); product design (Hyysalo, 2005); collaborative activity (Nardi, 2005); studies in creativity (Daniels & Ledbetter, 2005); drama games with children (Brostrom, 1999); educational interventions (Lim & Hang, 2003; Seitamaa-Hakkarainen, Hakkarainen, Bollstrom-Huttunen, Engeström, 2005) and even the workings of a law court (Engeström, 1997), there are surprisingly few analyses dealing with the use of activity theory in exploratory studies at the level of the primary school classroom (see Lim & Hang, (2003) for a notable exception) [2]. Further, as it is used primarily as an interventionist tool, AT struggles to track the emerging object of complex activity systems observationally. There is nothing, however, in the AT literature to suggest that it is problematic to rely on observations to uncover the object of an activity. In fact Engeström & Escalante (1996) suggest that the objects of manual labour, for example, are relatively easily discerned due to their observable materiality. The point, however, is that it becomes increasingly difficult to track an object in a complex activity system, such as a school, unless one intervenes to disrupt practice, thereby forcibly making visible the previously invisible object. In this paper I argue that AT can be used as a framework to study the object of classroom activity observationally in the absence of an intervention. My argument hinges on the notion of what I will call evaluative episodes, analytical spaces that surface the previously invisible pedagogical object.

One of the challenges facing AT as a framework for understanding the activity system of the classroom is the sometimes opaque use of the term 'object' by activity theorists. While most researchers who work in activity theory indicate that one of the central concepts of the theory is its understanding of activity as object oriented, the notion of 'object' remains conceptually slippery (Kaptelinin, 2005; Miettinin, 2005, 1999; Foot, 2002; Lim & Hang, 2003). This 'slipperiness' makes it very difficult for researchers to 'capture' the object as it emerges within the research site unless one actively intervenes in order to surface it. For theorists such as Engeström (1999) the object of an activity system directs the activity and 'determines the horizon of possible actions' (Engeström, 1999b: 381). Being able to 'capture' this elusive object, then, is of primary importance to researchers who wish to develop an understanding of the activity system they are investigating (Foot, 2002). As this study is concerned with mapping the activity systems of classrooms in order to track pedagogical practice in context, it is essential to this endeavour that the object can be identified in classroom observation data. Below I track the emergence of the conceptual confusion surrounding the notion of object in AT before demonstrating how an activity system's object can be identified through observing teacher/student interactions during an evaluative episode within a classroom. The following questions drive this paper:

- In the absence of direct intervention, how can one uncover the object of activity in computer-based primary school mathematics classrooms?
- What does the activity system of a grade 6 computer-based mathematics lesson look like?
- What is object-oriented activity?

Reacting against the two dominant theoretical paradigms of his day (behaviourism and introspection), Vygotsky's general genetic[3] law of human functioning and his notion of mediation transcended the nature/nurture debate by illustrating how higher cognitive functions develop in context. His classic triadic model (figure 2) shows how higher cognitive functions are mediated by tools while elementary functioning occurs at the base of the triangle.

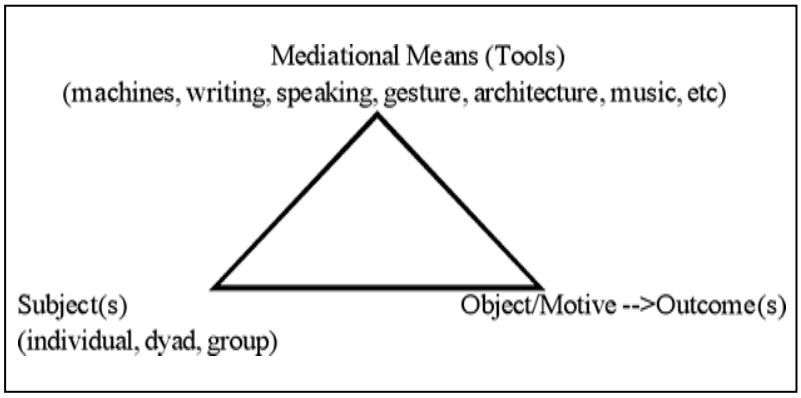

Figure 2: *First generation activity theory*

While Vygotsky's learning theory points the way towards an understanding of learning as distributed, it does not develop an analytical framework capable of situating learning within a wider context, accounting for the collective and dynamic nature of activities (Engeström, 1987). Moreover, Vygotsky's emphasis on semiotic mediation tends to condense issues of power and control into the study of language alone, without much emphasis placed on practical activity. Therefore, while the first generation of activity theory centres on Vygotsky's notion of mediation,

this notion is still located at the level of the individual's actions and does not go far enough to illustrate how cognitive change happens within a collective context. The distinction between individual action and collective activity implied, but not articulated in Vygotsky's theory, was elaborated by one of his colleagues, Alexei Leontiev, whose famous example of the 'primeval collective hunt' clarified the distinction between individual action and collective activity (1981: 210-213).

A.N. Leontiev (1975/78; 1981) built on Vygotsky's original thesis, extending his theory to develop the notion of hierarchical levels of human functioning, accounting for individual actions within social activities[4]. Leontiev's hierarchical model of functioning (see Figure 3) conceives of activity as driven by the object, while individual actions are directed at goals (Engeström, 1987; Leontiev, 1981).

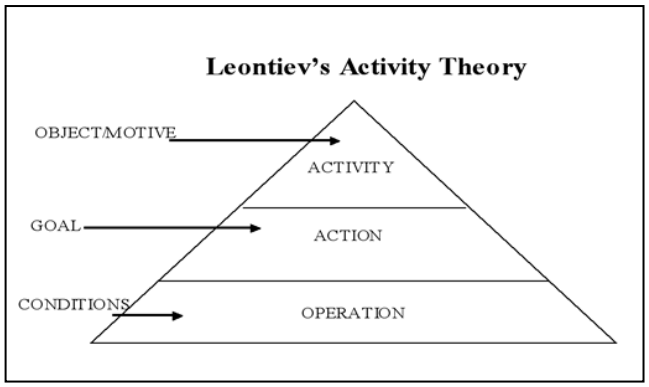

Figure 3: *Second generation activity theory*

In this formulation, Leontiev is able to illustrate how motives, emotions and creativity are social endeavours, something that is quite tricky to do with Vygotsky's triadic model. In his example of the primeval hunt, Leontiev demonstrates the weaknesses inherent in focusing only on tool-mediated, individual actions as a unit of analysis.

> *'When a member of a group performs his labour activity he also does it to satisfy one of his needs. A beater, for example, taking part in a primeval collective hunt, was stimulated by a need for food or, perhaps, by a need for clothing, which the skin of the dead animal would meet for him. At what, however, was his activity directly aimed? It may have been directed, for example, at frightening a herd of animals and sending them toward other hunters, hiding in ambush. That, properly speaking, is what should be the result of the activity of this man. And the activity of this individual member of the hunt ends with that. The rest is completed by the other members. … What the processes of his activity were directed to did not, consequently, coincide with what stimulated them, i.e., did not coincide with the motive of his activity; the two were divided from one another in this instance. Processes, the object and motive of which do not coincide with one another, we shall call "actions". We can say, for example, that the beater's activity is the hunt and the frightening of game his action.' (Leontiev, 1981: 210.)*

This example of the primeval hunt has been used by theorists, such as Engeström (1987) to suggest that Leontiev draws a distinction between individual actions and collective activities.

Kaptelinin (2005), however, argues that it is probably more in keeping with Leontiev's notion of activity to view this as an example that illustrates ' that dissociation between individual's activities and actions, that is, between motives and goals, initially emerges as a result of division of labour in collective activities' [5] (12). And indeed, in the above quotation it is clear that the 'individual's activity' is always social, although not necessarily collective. The object of activity for Leontiev, then, is not collectively shared; the object of activity is individual and it is '[the] true motive. It is understood that the motive may be either material or ideal, either present in perception or existing only in the imagination or thought' (1975/78: 62). For Leontiev studying the object of an activity, then, is primarily about understanding what motivates the actors.

While accounting for hierarchical levels of human functioning, Leontiev's theory does not go far enough to situate human functioning in context, illustrating how individual actions are transformed into shared, collective objects through interactions with community members or indeed how division of labour impacts on individual actions in a collective activity. This is where Engeström's (1987) conceptualisation of an activity system (see figure 1) as the basic unit of analysis serves as a useful heuristic for situating cognition in context. While accepting Leontiev's hierarchical levels of human functioning, Engeström moves the theory forward by situating it more fully in context and focusing on the collective nature of all activity. However, while doing this, Engeström shifts the understanding of 'object' to encompass more than mere motive (Kaptelinin, 2005). And it is in this move that confusion surrounding the notion of object begins to rear its head.

True motive, raw material, or both?

Time and space constraints militate against an in-depth comparison between Engeström and Leontiev's respective theories. Suffice to say that there is much in their work that is similar, and yet, some crucial elements, such as their understanding of the notion of object, differ. I do not propose to engage in an exhaustive discussion regarding the roots of the differences in these theorists' understanding of the object; this paper seeks merely to highlight the different understandings both theorists have towards the object before arguing for which theorists' articulation might work best in an educational setting.

In a well-argued article uncovering the conceptual gaps in understandings of the notion of object, Kaptelinin (2005) illustrates that for Leontiev (1978), the object of activity is predominantly the 'object of individual activity' (9). Leontiev's psychological framework suggests that:

> *'Human psychology is concerned with the activity of concrete individuals that takes place either in conditions of open association, in the midst of people, or eye-to-eye with the surrounding object world – before the potter's wheel or behind the writing desk. Under whatever kind of conditions and forms human activity takes place, whatever kind of structure it assumes, it must not be considered as isolated from social relations, from the life of society' (1978: 51).*

For Leontiev then, all activities are social, even those carried out in apparent isolation; however, the focus is on 'concrete individuals' engaged in individual activity. Leontiev's work does not discount the possibility of collective activity; indeed, Engeström (1987) makes a good case for reading his work as a move towards collective activity. It appears, however, that his framework was designed for explicating individuals' activities. Given the profoundly psychological focus of Leontiev's concept of activity as essentially individually motivated, this understanding of activity could not easily be applied to fields outside of psychology that deal with supra-individual activities (Kaptelinin, 2005). Education is a field that deals very much with collective rather than individual activity. As a field of study, education requires that one is able to situate the subject of study within a wider context[6], highlighting community membership, rules of interaction and issues related to division of labour in order to more fully understand the complexities of learning and

teaching. Consequently, in an attempt to understand the object of this complex activity, I rely on Engeström's elaboration of the activity system as the basic unit of analysis (see figure 1) and it is his understanding of the collective nature of the object that informs my work.

For Engeström (1987), activities are collective phenomena that unfold over time. Individuals can carry out actions oriented towards goals only within the wider arena of a collective, object-oriented activity. For him, the object is more than merely the motive driving the activity. The object is 'the raw material or problem space at which the activity is directed and which is moulded and transformed into outcomes' (Centre for activity theory and Developmental Work Research, n.d.). Moreover, resonating with Cole's (1996) articulation of artefacts, Engeström and Escalante suggest that:

> 'Objects do not exist for us in themselves, directly and without mediation. We relate to objects by means of other objects … this means that objects appear in two fundamentally different roles: as objects (Gegenstand) and as mediating artefacts or tools. There is nothing in the material makeup of an object as such that would determine which one it is: object or tool. The constellation of the activity determines the place and meaning of the object' (1996: 361-362).

This understanding of the object draws heavily on the Marxian notion that the object of thought (Gegenstand) cannot be understood independently from object oriented practical activity (Objekt) (Marx & Engels, 1970; Roth, 2004). Whereas for Leontiev the object of activity is related to motive, the object of activity, for Engeström, is related to production. However, while focusing on the collectively shared object, Engeström does not dismiss the notion of the object as related to motive but, rather, illustrates the complexities involved in the motivational aspects of collective activity (Hyysalo, 2005). By highlighting the dual[7] nature of the object as both material and ideal, what emerges is a notion of the object as containing within it both the 'what' and the 'why' of the activity. It is Engeström's notion of the object as raw material that is acted on during an activity that informs this study. Below, I outline a methodology for investigating the object of an activity as it emerges during an activity.

THE STUDY

The study underpinning this article investigated how teachers use computers to mediate mathematics and whether the introduction of this novel technology impacts on their pedagogical practices. The focus of the study, then, is on teachers rather than on students. Through detailed analyses of teachers teaching, interviews with teachers and students, classroom observations and analysis of students' productions (such as workbook or board work), the study set out to investigate the potential developmental impact of novel technology by focusing specifically on teachers' pedagogical practices. An exploratory case study design was employed in order to best investigate how teachers appropriate novel technology. The sample comprised four previously disadvantaged primary schools in the Western Cape region of South Africa. In total 153 Grade Six students and four Grade Six mathematics teachers participated in the study. The decision to focus the analytical lens on mathematics classrooms was driven both by the crisis faced in mathematics education in South Africa as well as by the more pragmatic concern with situating the study within a context where computers were used with some frequency (at least once a week for at least one hour). Two schools were located in urban areas and two were located in rural farming districts. All schools can best be described as previously disadvantaged schools that have benefited from a government initiative to bridge the digital divide by providing schools with a fully-equipped computer laboratory (Hardman, 2004). Sixteen lessons differing in length from one hour to one hour and 45 minutes were video recorded and serve as the primary observational data set. The video data were examined for evidence of evaluative episodes, disruptions in the

pedagogical script where the teacher makes visible the evaluative criteria required for students to produce a legitimate text.

TRACKING THE OBJECT OBSERVATIONALLY

Drawing on Engeström's work (1987), the unit of analysis employed in the study upon which this paper draws is the activity system of the lesson. As noted, a substantial amount of research using AT in educational settings is driven by interventionist concerns. For Daniels (2005) three steps are necessary in the interventionist use of activity theory [8] in order to understand the object of the activity system. First, one interviews the participants [9] (in this study, the teachers) in order to elicit motives; second, one uses observations to study what is really being worked on and thirdly, one takes the data back to the teachers in order to surface contradictions between the intended and actual practice. These contradictions in turn drive transformation. As the nature of my own work is located in an exploratory case study rather than in an interventionist mould, I have not used activity theory in order to intervene and transform practice. Rather, for my purposes, the theory serves as a useful framework for situating practice in context and for interrogating how teachers appropriate a novel tool. To this end I have developed a method capable of tracking the emergence of the object by focusing on moments in the pedagogical script where the student productions challenge the invisible boundaries in the script forcing the teacher to restate the criteria for successful production of a legitimate text. It is in the restatement of these criteria that the object, that problem space that the teacher and students work on together, becomes visible.

ANALYSING THE DATA

Definition of evaluative episodes

An evaluative episode is a coherent classroom activity in which the teacher elaborates the evaluative criteria required to produce a legitimate script. These episodes are marked out because they represent disruptions in the pedagogical script; that is, they indicate a break in the flow of the script where the teacher is called on to restate the requisite evaluative criteria in response to student productions. Essentially, these are spaces in which the teacher realises that the students' have not yet acquired the requisite rules for the production of a legitimate text and, consequently, the teacher restates these rules; these are spaces, then, of clarification and illustration arising out of students' mis/lack of understanding[10].

The notion of an evaluative episode draws on the body of knowledge that has developed out of Flanagan's (1954) definition of critical incidents as 'a classroom episode or event which causes a teacher to stop short and think' (33) as well as Wragg's (2001) description of a critical incident as an event that appears to 'help or impede children's understanding' (11) and Goodwin's (2001) understanding of these events as turning points in the lesson 'where the teacher's utterances influence the shape and tone of the subsequent interaction' (11). An evaluative episode then, is an event in the lesson in which the teacher stops the flow of the lesson in order to restate what he/she has already covered. Essentially, what the teacher does in these episodes is elaborate what Bernstein (1996) calls 'evaluative criteria'. For Bernstein (1996) evaluative rules are those rules that transmit the criteria for the production of legitimate texts, behaviour and relations. In a sense, these rules are psychological tools that the students acquire through schooling (Karpov, 2003). These rules are 'framed'[11] to greater or lesser degrees depending on the amount of control exercised by the teacher. Framing refers then to relations within boundaries. When the student oversteps or challenges these invisible boundaries the teacher is forced to re-assert the boundary, making visible the previously invisible rules of engagement. In short, then, evaluative criteria communicate the object to be constructed by illuminating how one arrives at a legitimate

mathematical text. In these episodes my reading of the object can be likened to Engeströms (1987) notion of the object unit as that

> *'chunk of the object handled and moulded by the subject at a time…Once identified the object-unit thus provides a strategic lens or magnifying glass through which the inner movement of the activity system becomes visible'.*

While pointing to the importance of being able to identify the object, Engeström does not, as far as I can determine, provide a methodology for achieving this in relation to observational data. It is this gap in AT's current methodological tool box that I seek to engage with in this paper.

Coding

The data were analysed at two stages. In the first stage, evaluative episodes were identified. That is, transcribed lessons were analysed with the purpose of identifying disruptions in the pedagogical script that led teachers to restate the criteria for producing a valid text. The episodes were then coded using categories suggested by AT: viz, object, subject, community, division of labour, rules and tools. For the purpose of analysing classroom discourse, this discourse was broken up into teacher and student utterances. As the focus of this study is on teachers' pedagogic practice, I focus here primarily on teachers' utterances. Utterances were divided into two groups: questions and statements. Some questions were difficult to categorise as such as they did not elicit answers nor were intended to do so (such as a rhetorical question that the teacher might answer him/herself). These questions where no responses were elicited were categorised as statements (Myhill & Duncan, 2005). Statements were categorised as those utterances that did not elicit a response.

Tables 1.1 and 1.2. elaborate the utterances categorised in this study.

Table 1.1: *Categorisation of the form of questions used in evaluative episodes*

Form	Definition	Code	Example
Factual	Factual questions to which the teacher knows the answer: single response items	Q1	Teacher: What is 3 x 1?
Probe	Probes (teacher stays with same child asking further questions; invites child to articulate their understanding/explain their thinking)	Q2	Teacher: How did you work that out?
Procedural	Procedural: questions related to the organisation and management of the lesson	Q3	Teacher: Can you all hear?

Table 1.2. *Categorisation of the form of statements used in evaluative episodes*

Form	Definition	Code	Example
Instruction: maths	Maths subject matter concepts.	I1	Teacher: My denominator tells me how many parts I have divided my whole into.
Instruction: task	Instruction regarding skills required to complete task.	I2	Teacher: You fold the paper into four. In the top corner you put mixed numbers.
Instruction computer	Instruction regarding how to use a computer-technical skill.	I3	Teacher: I click here and then text wrap.
Evaluation	Teacher assesses students' productions – usually verbal responses to his/her question	E	Teacher: Now, what is this? Students: Whole. Teacher: Whole.
Time	Teacher controls time in which tasks are carried out – overt verbal instructions to hurry up.	R1	Teacher: Hurry up! Time is short.
Discipline	Teacher verbally instructs students in how to behave appropriately.	R2	Teacher: Don't shout out! You put up your hand [if you want to answer a question]!

LEVEL 1: IDENTIFYING EVALUATIVE EPISODES

Evaluative episodes represent disruptions in the pedagogic script where the teacher restates the evaluative criteria required to produce a legitimate text. By focusing on developing students' understanding of these evaluative rules, evaluative episodes make visible the object of the lesson because they capture both what the teacher is working on (the problem space being acted on in the lesson) as well as capturing the teacher's motive for acting. These are spaces where the teacher, realising that the students have not yet understood the thrust of the lesson, changes the flow of the lesson in order to restate what the object of the lesson is. A total of 29 evaluative episodes were identified and analysed; 12 of which were computer-based episodes.

Table 2: *Evaluative episodes across schools*

School	Number of episodes face-to-face	Number of episodes computer lab
Merryvale[12]	6	4
Newtown	4	4
Siyazama	1	1
Thandokulu	6	3
Total per context	17	12
Total		29

In table 2 above, one can see that for Merryvale[13] and Thandokulu primary schools, six evaluative episodes were recorded in the face-to-face lessons. Both these schools are located in a farming district. In Newtown and Siyazama, two urban primary schools, the picture alters with four

episodes recorded in Newtown and only 1 episode recorded in Siyazama. The number of episodes collected in the computer laboratory is slightly lower than those collected in the face-to-face lessons, with four episodes being identified in Merryvale and Newtown and three in Thandokulu. I remind readers here that these episodes provide insight into the object, and hence the activity system, of the overarching lesson. Using the conceptual tools drawn from AT, below I present an analysis of a representative evaluative episode identified in this study.

AN EVALUATIVE EPISODE

Merryvale Primary: Computer-based mathematics lesson

The teacher has been explaining how the students are to proceed with a computer task; he has been elaborating the skills they need in order to accomplish the task. They have spent the lesson drawing shapes such as squares and 'guessing' what half of the square is, drawing a line to represent that half, colouring in the half and then typing in ½ next to the coloured-in square. While a few students seem to have grasped the task it is apparent that most are struggling as they do not have the requisite computer skills. This episode happens 30 minutes into an hour-long lesson. Recognising that the children are not engaging with the task, the teacher is now compelled to restate the criteria.

Table 3: *An evaluative episode*

Teacher/student talk	**Actions**	**Activity theory elements**
		Tools; object; rules; division of labour
Pre-focus segment Click on it,	The teacher is standing behind a student, telling her how to manipulate the mouse in order to engage with the task. At one point (line 5) he actually takes the mouse himself and demonstrates how to 'click and drag'.	
then put in one and then two,		
now click here,		
and then you go to text wrapping and then come down and go to (inaudible),		
and now I can take him		
and drag till here.		
Episode 1: Skills required for manipulating computer programme. Right?		Q3
Students: No answer, look at teacher		

Teacher/student talk	**Actions**	**Activity theory elements** Tools; object; rules; division of labour
Teacher (Mr. M): Come, let me show you again.	The students do not appear able to engage in the task. The teacher sits at a computer and the students (about 15 of them) stand behind him while he manipulates the mouse. He talks as he is manipulating the mouse. After showing the students how to do the task, the teacher checks their understanding before showing them the steps again. The teacher demonstrates how to proceed as he is talking	
I click here, then here,		I3
click on it,		I3 Object: technical skills
right click,		I3
programmes,		I3
word processors,		I3
paint,		I3
paint.		I3
Look. Raises voice slightly		R2 Rules: Look when teacher talks.
Look what I am doing.		R2
Are you following?		Q3
Students: No answer		
Come,		
look here,		R2
look carefully		R2
once again.		
We go to?		Q1
Students: New		R

Teacher/student talk	**Actions**	**Activity theory elements**
		Tools; object; rules; division of labour
New blank documents.		E
We go to auto shapes; auto shapes.		I3
Click on it,		I3
click on it.		I3
Listen.		R2 Rule: Listen when teacher talks
Listen!	Raises voice	R2
Now you go to 'equation editor',		I3
go to 'fractions and templates',		I3
and click on it.		I3
Go to 'draw'.		I3
Go to 'text wrap'(inaudible).		I3
Do you want to see again? Silence		Q3
come …	Shows them again for a further five minutes before moving on to another task.	

This episode begins with the teacher asking a procedural question (line 7) that functions to check whether students have understood the process he has spent eight minutes elaborating on. When the students do not answer him but look at him instead, he takes this as an opportunity to restate the criteria for successful completion of this task. Now, rather than explaining the process to them only verbally, as he has just done, he sits at a computer surrounded by those children (about half the class; 15 students) who have not understood the instructions and visually and verbally illustrates the process that he has verbally outlined.

Tools: The use of the computer and language as a tool to guide interaction

The teacher uses both talk and the computer to develop students' computer skills in this episode. Most of the teacher's talk (70%[14] of the teacher's coded talk) is used to instruct students in how to use the computer. Note that he instructs the children verbally while demonstrating how to do it on the computer (12, 14, 15, 16, 17, 29, 30, 34, 35, 36, 37, 38). That is, the teacher does not merely use talk as a tool to develop students' computer skills, he also uses the computer as a tool for this purpose. Students use talk (3% of all coded talk) to respond to the teacher's questions. The teacher also uses talk (18% of all coded talk) to manage the classroom through setting behavioural rules and managing the pace and which work is covered.

Object: focusing on technical skills

The object of an activity is that collectively shared problem space that community members act on and transform during the unfolding activity. What is it that the teacher and students are working on in this episode? It is clear that in this episode the teacher is focused on developing students' computer skills. The group of students standing behind him watching him appear to share in this object, as they have self-selected to watch him perform the task (he has not told

them to do so, but has merely offered to demonstrate the skills again). However, the relative silence of the students makes it difficult to infer students' motives for sharing this object; it could just be that they want to please the teacher in this instance. I do, however, think that their self-selection says something about their desire to develop their skills in this area. There is no test on this, nor are they going to be graded on their output. Hence, selecting to watch the teacher restate the skills says something, perhaps, about their desire to develop their computer skills. It is also clear that the teacher's focus is on covering the content in a timeous manner; hence the high degree of control over the pace of this interaction.

Division of labour

Division of labour is both vertical and horizontal and refers to the negotiation of responsibilities, tasks and power relations within a classroom. The teacher completely dominates talk time with students only verbally interacting with him once (line 26). There is thus a clear asymmetrical power relation set up between teacher and students in this episode. The teacher demonstrates the computer skills needed to engage with the task. He uses language to instruct students regarding these skills, which are technical in nature. He directs their potential actions by explicitly illustrating and verbalising what they will be required to do. He is, in a sense, the instructor in this episode and the students are the listeners, who must model their behaviour on his if they want to accomplish the task. There is a sense in which this role differs from one of expert and novice in that the type of knowledge being imparted is basic skills and competency, rather than expertise, which requires giving the novice access to tacit rules of engagement. An expert on this understanding is someone who is able to elaborate the evaluative criteria or rules for the production of a legitimate text, in such a way that the student is able to access and use these rules in future problem-solving activities. No fundamental rules of computer usage are being imparted; rather, the skills are based entirely in this one task. That is, these skills are context dependent and not transcendent. There is little in this episode to suggest that the skills he illustrates will ultimately become tools for the students to use in solving similar problems. The teacher is perceived as a didactic instructor. This role is characterised by almost no student interaction, evaluation of students' productions that is not explicit, and a focus on the transmission rather than the acquisition of knowledge. There is actually very little interaction between the teacher and the students: the teacher instructs; the students follow. A central feature of the teacher's role as instructor is that the teacher sets the rules and the students follow them. No students set any rules in this episode.

Rules

Rules may be either behavioural prescriptions or mathematical in nature. Behavioural rules, such as keeping silent when the teacher talks, may be either explicitly stated or implicitly followed in a classroom context, depending on the extent to which students have internalised behavioural norms. Where behavioural rules are explicit, the control over behaviour lies with the teacher. In this episode, the teacher explicitly states rules, rather than assuming an implicit understanding on the students' behalf. Students are required to watch the teacher carefully (19, 20, 23, 24) as well as to listen to him (32, 33). It is the teacher who exercises control over pace, sequence and selection of content during this episode with students not intervening to question him.

Community

The community in this activity system is that group of people who share an object, in this instance, the development of children's technical skills. In this episode, the community comprises

the students and the teacher. While a wider community exists outside of the school (such as the Western Cape Education Department, who will also share this object to a greater or lesser degree) I have chosen to focus my analytical lens on only those participants who are obviously involved in this episode. As the teacher makes no use of textbooks or worksheets in this episode, I have also excluded curriculum specialists from the community of this particular episode. This is not to ignore the obvious impact the wider community has on the teacher's decisions regarding what object is to be worked on. However, this influence cannot be garnered from this episode.

Analysis of this evaluative episode enables us to graphically represent the activity system of the episode, as in figure 4.

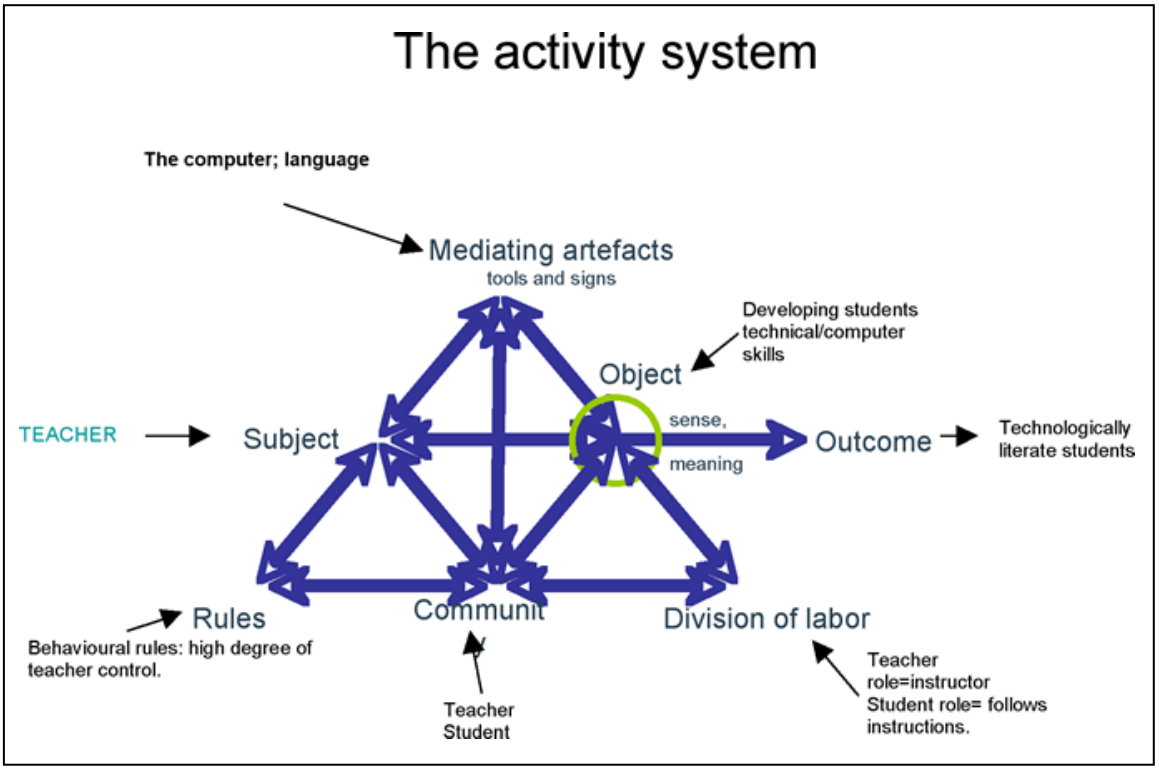

Figure 4: *The activity system of a primary school computer based mathematics lesson*

In figure 4, we can see that the teacher, acting in the role of instructor, uses various tools to develop students' technical skills (object), producing technologically literate students (outcome) in a context in which the teacher exercises a high degree of control over behavioural rules. The production of 'technologically literate students' is the actual outcome of this episode, rather than the intended outcome. As this is a computer-based mathematics episode, the teacher's intended[15] object of the episode is the development of students' mathematical understanding and, hence the production of mathematically literate students.

CONCLUSION: MAKING SENSE OF THE OBJECT OF ACTIVITY USING EVALUATIVE EPISODES

This paper began with two questions: one relates to how a researcher can methodologically track the object of classroom activity and the second, related question, was whether this methodology would enable one to construct a model of the activity system of a computer -based mathematics lesson. Activity theory is a developing body of knowledge, in which ideas and concepts continue to be debated and empirically tested. One of the most conceptually contested areas of AT is its notion of the 'object' of activity. The interventionist use of AT as a theory capable of articulating and driving change currently dominates the literature. In this paper, I have argued for the use of AT as a tool for analysing observational data at the level of the classroom by elaborating the notion of evaluative episodes as those pedagogical moments in which the previously invisible rules of engagement are made visible, which in turn, surfaces the object of acquisition. Findings indicate that evaluative episodes provide a window into the unfolding activity system of the classroom, a microcosm if you will, of the overall system. By enabling the researcher to temporarily freeze the unfolding system, evaluative episodes allow us to construct a model of activity in the computer-based mathematics lesson, illustrating how a tightening of the rules in the computer lesson mediates the teacher's selection of tools (in this case a reliance on talk and the computer) which in turn impacts on the kind of object the teacher acts on in this lesson (children's technical skills).

The rather rigid role of instructor, characterised by asymmetrical power relations, played out by the teacher in turn mediates the students' and teacher's interaction with the object of the activity.

Endnotes

[1] The international average score for 38 countries was 487 points; South Africa achieved a total of 275 points.

[2] An extensive, although arguably not exhaustive, search of the ERIC database, a broad journal search as well as a Google Scholar search uncovered Lim's (2001; 2003) work where he explicitly uses AT to analyse classroom observations as part of a wider project. This is the only study I have found that makes explicit use of AT to analyse observational data at the level of the classroom.

[3] "Every function in the child's cultural development appears twice: first, on the social level, and later on the individual level; first, between people (interpsychological), and then inside the child (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formulation of concepts. All the higher functions originate as actual relations between human individuals (Vygotsky, 1978:57). This law famously overcomes the nature/nurture debate by situating mind in society.

[4] While Leontiev did indeed extend a portion of Vygotsky's theory, his endeavours differed in significant ways from Vygotsky's project. This is especially so in relation to the notion of semiotic mediation. For Leontiev, semiotic mediation is not central to development; practical activity rather than signs and symbols mediate cognitive development (Kozulin, 1986).

[5] I recognise that the primeval hunt can indeed be interpreted as Engeström does, i.e. as an indication that actions are individual while activities are collective. However, on my reading of Leontiev's (1981) work I am inclined to agree with Kaptelinin that his psychological bias seems always to point to the individual. Activities are carried out by individuals, either

individually or collectively, who are animated in the activity by the object (the motive that drives them to act). For a well-argued but different view, I refer readers to Engeström (1987).

[6] There is some conceptual fuzziness surrounding the notion of 'context' as it arises out of debates that stretch across sociology, anthropology and cultural psychology (Cole, 1996). For my purposes I draw on Cole's (1996) notion of context as that which 'weaves together'. Interested readers are referred to this seminal work in cultural psychology for an in-depth discussion in which Cole illustrates how the notion of context is elegantly captured in Engeström's elaboration of an activity system.

[7] For Illyenkov, who draws on Hegel and Marx, an artefact's ideality results from the 'transforming, form-creating, activity of social beings, their aim mediated, sensuously objective activity' (Bakhurst, 1991: 182). There is, therefore, no way of telling whether something is an artefact or an object outside of the particular context of activity.

[8] The interventionist use of activity theory plays itself out in Change Laboratories or Developmental Work Research (see for example Engeström, 2005, Daniels et al, 2005).

[9] See Hardman, 2005b for a detailed discussion of the interview process.

[10] Note, however, that in severely dysfunctional classes, one may not be able to find evaluative episodes as these episodes indicate a level of teacher responsivity that would be lacking in a context where the teacher's main function was to manage behaviour and the students' main function was to rote learn (for an example of dysfunctional classrooms, see Hoadley, 2005; Jacklin, 2005).

[11] For Bernstein (1975), 'framing refers to the degree of control teacher and pupil possess over the selection, sequencing, pacing and evaluation of the knowledge transmitted and received in the pedagogical relationship' (88).

[12] Pseudonyms are used when referring to schools who participated in this study.

[13] All names, both individual and school names, are pseudonyms.

[14] Determined by coding the teachers' discourse, counting instances of a category and generating a frequency count.

[15] This is a fairly typical lesson. I want them to really understand fractions, so that's what it's about. Getting them to understand.' (Interview: Mr Botha, August, 2003).

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The role of ICTs in higher education in South Africa: One strategy for addressing teaching and learning challenges

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ABSTRACT

One of the most common problems of using Information and Communication Technologies (ICTs) in education is to base choices on technological possibilities rather than educational needs. In developing countries where higher education is fraught with serious challenges at multiple levels, there is increasing pressure to ensure that technological possibilities are viewed in the context of educational needs. This paper argues that a central role of educational technology is to provide additional strategies that can be used to address the serious environmental and educational challenges faced by educators and students in higher education. The educational needs manifest in South African universities include addressing general lack of academic preparedness, multilingual needs in English medium settings, large class sizes and inadequate curriculum design. Using case studies from one higher educational institution, this paper shows how specific and carefully considered interventions using ICTs can be used to address these teaching and learning concerns. These examples serve to demonstrate some ways in which teaching and learning may be enhanced when uses of educational technology are driven by educational needs. The paper concludes that design of educational technology interventions should be driven by educational needs within the context of a broader teaching and learning strategy which requires buy-in of both educators and learners.

Keywords:*Educational challenges, higher education, educational technology, student diversity*

INTRODUCTION

It has been suggested that information and communication technologies (ICTs) can and do play a number of roles in education. These include providing a catalyst for rethinking teaching practice (Flecknoe, 2002; McCormick & Scrimshaw, 2001); developing the kind of graduates and citizens required in an information society (Department of Education, 2001); improving educational outcomes (especially pass rates) and enhancing and improving the quality of teaching and learning (Wagner, 2001; Garrison & Anderson, 2003).

While all of these suggest the potential impact of ICTs in education in general and South Africa in particular, it is still difficult to demonstrate the potential of technologies in addressing specific teaching and learning problems faced by South African higher education institutions. The thesis of this paper is that the potential of ICTs is sandwiched between increasing pressure on higher education institutions from government to meet the social transformation and skills needs of South Africa, and the varying student academic preparedness, large class sizes and multilingualism currently experienced in these teaching and learning contexts. Our thinking aligns with others (such as Kirkup & Kirkwood, 2005; Wagner, 2001) who argue that it is the contextualised teaching and learning needs that ought to drive the ICT intervention, rather than the technology itself. In South Africa, contextualisation of teaching and learning requires a tightrope walk between higher education imperatives and social-cultural context of the educational landscape. This paper illustrates by means of examples drawn from one higher education institution how educational needs can drive design of learning environments and technological use.

The question driving this paper is: *How may educational technology interventions address the teaching and learning challenges faced by South African higher education institutions?* We discuss the general and specific educational challenges. These challenges then provide a context for an ICT intervention framework which is described and examples of the use of this framework in curriculum projects are discussed.

CHALLENGES FACING HIGHER EDUCATION IN SOUTH AFRICA

General challenges

Currently, higher education in South Africa is under increasing pressure to meet the social transformation and skills needs of the new South Africa (Kistan, 2002). At the same time it is under immense external and internal pressure to improve on its policy and delivery performance (De Clercq, 2002). One of the indicators of social transformation in education is increasing the demographic representation among graduates and reducing the demographic difference between student intake and graduate throughput. The National Higher Education Plan (2001) outlines the role of higher education institutions in the new South Africa:

> *The key challenges facing the South African higher education system remain as outlined in the White Paper: 'to redress past inequalities and to transform the higher education system to serve a new social order, to meet pressing national needs, and to respond to new realities and opportunities' (White Paper: 1.1). (Department of Education South Africa, 2001.)*

Furthermore, recent government policy has added pressure on higher education institutions by linking funding to throughput. In other words, unlike in the past when institutions were funded on the number of registered first year students, funding is now linked to graduate throughput.

Improving efficiency and addressing the equity needs of the country raises conflicting challenges for higher education institutions (Scott, 2004: 1). These challenges are exacerbated by the fact that most students enter university under-prepared and therefore require more support to bridge the gaps in the required knowledge and skills (Paras, 2001). Furthermore, in 2005 quality assurance audits[1] focusing on the institutional management of core functions of teaching and learning, research and community engagement were conducted at South African higher education institutions. The challenge for higher education institutions is therefore not only about increasing throughput in terms of numbers and the diversity of its student population but also involves ensuring quality educational provision.

The South African government has identified the use of ICTs for teaching and learning as an important priority. For example, the e-Education policy states:

> *Every South African manager, teacher and learner in the general and further education and training bands will be ICT capable (that is, use ICTs confidently and creatively to help develop the skills and knowledge they need as lifelong learners to achieve personal goals and to be full participants in the global community) by 2013. (Department of Education South Africa, 2004: 17)*

Thus, the ultimate goal of the policy is the realisation of ICT-capable managers, educators and learners by 2013. Read together with the National Higher Education Plan, these two policies have ramifications for instructional designers, educators, students and researchers. The underlying argument of this paper is that the realisation of the policy's goals largely depends on the extent to which current educational challenges are re-conceptualised in the context of the role that ICT can play in teaching and learning. The current focus on teaching and learning coupled with growth in educational technology in South African higher education institutions (Czerniewicz et al., 2005:

61) requires that we begin to ask questions about the ways in which educational technology contributes to addressing the educational challenges in the new South Africa.

Educational challenges in South African higher education

As is the case in higher education globally, South African higher education is under pressure to increase participation from diverse groups of students and to produce the skills required for a rapidly changing society. In the UK, for example, participation in higher education has increased since the 1940s but participation of higher socio-economic groups still exceeds that of lower socio-economic groups (DFES report, 2004). While similar, these challenges take particular forms given South Africa's unique history. For example, global disparities are defined in terms of class; in South Africa the educational disparities are manifested along racial lines due to the political, economic and social policies of the pre-1994 era. Redress of marginalised groups and social transformation is therefore central to the policies of post-1994. The South African government has made it clear that one of its aims is to achieve equitable access to higher education for previously disadvantaged learners, with diverse educational backgrounds (Hardman & Ng'ambi, 2003). Education is viewed as one of the key mechanisms of achieving social transformation.

It is in this educational context that new opportunities for educational technology have arisen. Although we are aware that educational challenges demand multi-pronged approaches, which may include both traditional teaching approaches and innovative non- digital instructional designs, it is the role of educational technology that is the focus of this paper.

Specific teaching and learning challenges

The major teaching and learning challenges facing higher education revolve around student diversity, which includes, amongst others, diversity in students' academic preparedness, language and schooling background. Teaching and learning in higher education in general can largely be characterised as follows:

> *[…] instruction that is too didactic, a lack of personal contact between teachers and students and among students, assessment methods that are inadequate to measure sophisticated learning goals and too little opportunity for students to integrate knowledge from different fields and apply what they learn to the solution of real-world problems. (Knapper, 2001: 94)*

Teaching and learning in South African higher education fits the above description but in addition it has to contend with deep-rooted complex issues and problems stemming primarily from a previously racially divided and unequal education system. In addition, large classes are an endemic feature of most university courses posing an additional challenge in the teaching of a diverse student population.

South African higher education institutions are faced with a myriad teaching and learning challenges. In this paper we focus on a few of these: academic preparedness, multilingulism in a first language context, large classes and inadequate curriculum design. In the next section, we look at ways in which ICTs have been used to respond to these challenges at one South African higher education institution.

Academic preparedness

Students from disadvantaged educational backgrounds as well students from privileged backgrounds generally enter higher education with gaps in the knowledge and skills required for studying particularly in key areas such as mathematics (Paras, 2001, Howie & Pietersen, 2001) and science.

Given the pressure to increase the diversity of the student population of South African higher education, assessing students' potential for success in higher education has gained increasing importance, particularly since the school-leaving certificate is currently viewed as an inadequate measure of a student's potential for success in higher education.

> *In a country such as South Africa, for instance, school-leaving certification has had a particularly unreliable relationship with higher education academic performance especially in cases where this certification intersects with factors such as mother tongue versus medium-of instruction differences, inadequate school backgrounds and demographic variables such as race and socio-economic status (Yeld, 2001; Badha, et al, 1986; Scochet, 1986; Potter & Jamotte, 1985). (Cliff et al., 2003)*

Alternative placement tests have therefore been used in conjunction with school-leaving certificates to admit students with potential into higher education studies (Cliff et al., 2003). Consequently, many of these students may be under-prepared in that they may not possess the necessary language or mathematical proficiencies required for higher education or may have gaps in the foundational disciplinary knowledge. Furthermore, university tasks present challenges for under-prepared students (Hardman & Ng'ambi, 2003). Although support programmes to address academic under-preparedness of students from both advantaged as well as disadvantaged groups are offered at many South African higher education institutions, they are resource intensive. It is therefore worth paying attention to additional resources and expertise offered by educational technology.

Multilingualism in a first language environment

South Africa is a multilingual society with 11 official languages. This diversity is reflected in the student population of South African higher education institutions. A recent study by Czerniewicz & Brown (2005) on higher education students' and academic staff's access to and use of computers in five South African universities found that 39% of respondents spoke English as a home language and 54% spoke other languages. At the University of Cape Town, on average 65% of the student population declared English as their first language while 35% have home languages in the other South African official languages and other international languages (Spiegel et al., 2003).

English is therefore a second or foreign language for many South African higher education students. In most black South African schools, English as a subject is taught as a second language. Higher education students from disadvantaged educational backgrounds therefore have to learn in their second or third language. A considerable body of research (Cummins, 1996; Gee, 1990) has shown that language and academic success are closely related and that academic language proficiency is far more difficult to acquire in a second language. Students learning in their second or third language are therefore at a disadvantage which is compounded by poor schooling background.

The relationship between language and academic success is reflected in the throughput rates of English second language students when compared to the throughput rates of English first language students. At the University of Cape Town, for example, the difference in throughput

rates between English first language and second language students in 2002 was more than 20% in several degrees/programmes (Spiegel et al., 2003).

Large classes

The growth of mass higher education has made large classes an endemic feature of several courses at higher education institutions. Large class sizes make it difficult for teachers to employ interactive teaching strategies (Nicol & Boyle, 2003) or to gain insight into the difficulties experienced by students. Large classes pose problems for all students but students who are under-prepared are particularly affected. It is these contexts that provide useful opportunities for educational technologies.

Curriculum design

Curriculum design is a relatively under–engaged area within higher education debate, policy formulation and practices (Barnett & Coate, 2005). Pressure to transform curricula at a macro-level to the needs of industry and the economy in South Africa is reflected in the National commission on higher education's policy framework (1996) for higher education transformation.

> *There is a strong inclination towards closed-system disciplinary approaches and programmes that has led to inadequately contextualised teaching and research. The content of the knowledge produced and disseminated is insufficiently responsive to the problems and needs of the African continent, the southern African region, or the vast numbers of poor and rural people in our society.*

In response to policy intentions, South African higher education has implemented a curriculum restructuring policy aimed at the development of inter- or multidisciplinary degree programmes (Moore, 2003). While policy has resulted in curriculum shifts on a macro level, curricula contents at a micro-level are driven by disciplinary specialists. Undergraduate curricula remain predominantly theoretical but require that students have some knowledge of the contexts to make sense of theory.

In this paper, we are concerned with the way in which ICTs can play a role in shaping curriculum design at the micro-level. ICTs open up new ways of accessing information thereby changing the relationships between students and between students and their teachers. Access to primary sources in the form of video, audio and photographs which may be contained in digital archives have the potential to influence the content of curricula because it makes previously inaccessible information available. In addition, ICTs enable lecturers to transform their teaching practices by facilitating student-student discussion and collaboration or by simulating 'real-world' problems thus providing students with authentic learning experiences.

In this section, we discussed some of the teaching and learning challenges experienced by educators and students in higher education. In the next section, we examine the role of educational technology in responding to these challenges and provide some examples.

RESPONDING TO THE CHALLENGES

Since the teaching and learning challenges are multi-faceted, multi-pronged approaches are needed in order to attempt to solve some of these problems. Dede (1998) postulates:

> *[…] information technology is a cost-effective investment only in the context of a systemic*

> *reform. Unless other simultaneous innovations in pedagogy, curriculum, assessment, and school organization are coupled to the usage of instructional technology, the time and effort expended on implementing these devices produces few improvements in educational outcomes – and reinforces many educators' cynicism about fads based on magical machines.*

We infer from Dede that there are several inter-related factors that influence improvements in educational outcomes. Thus together, pedagogy, curriculum, assessment and organisation contribute to bringing about improvements in the educational process.

Although educational technology is not the panacea for educational challenges, it does leverage and extend traditional teaching and learning activities in certain circumstances and hence has the potential to impact on learning outcomes. Knapper (2001) argues that:

> *[…] technology may be a good solution for some instructional problems, and in some cases it may be a partial solution. But in other instances technology does little to address the fundamental teaching and learning issue or – even worse – provides a glitzy but inappropriate solution to a problem that has simply been misconstrued. (Knapper, 2001: 94)*

The trick is to identify situations where educational technology will be appropriate and when and how to use educational technology in these situations. There are times where technology may not be useful and may indeed be counter-productive. However, there are many times when educational technology offers a solution for problems that would be difficult, cumbersome or impossible to resolve in a face-to-face environment.

Numerous manuals, websites and articles have been devoted to suggesting, explaining and modelling the ways that educational technology can be used to support teaching and learning. We agree with Laurillard (2001) that it is important that educational technology-based resources be appropriately matched to both teaching and learning activities. Table 1 adapted from Laurillard (2001) usefully explains how educational technology can be integrated into the curriculum.
Laurillard's guidelines are useful in that they provide a framework which relates ICT-based resources to particular teaching and learning activities. The guidelines therefore suggest particular uses of ICT for particular teaching and learning situations. The effectiveness of ICTs for teaching and learning, however, is largely dependent on how much the context is understood. Thus, there is a need to relate educational technology to actual challenges experienced by both students and lecturers in the South African educational context. O'Hagan (1999) suggests that educational technology can be used to present and provide content, assess students learning, provide feedback, scaffold student learning and enable peer-to-peer collaborative learning.

The choice of appropriate teaching and learning activities is dependent on a range of factors such as the curriculum or course objectives; i.e. the purpose of the teaching and learning, the educator's preferred teaching approach, the learning styles of the student and the nature of the curriculum content. Although we advocate that teachers should use the teaching approach that suits their paradigm of teaching and learning, we believe that the use of educational technology provides teachers with opportunities for traversing an entire continuum of possibilities as may be appropriate to their teaching needs. Educational technology creates affordances for a range of different teaching and learning activities which the teacher may not have used or considered.

Table 1: *Teaching and learning events and associated media forms*

Teaching & Learning Event	Teaching action or strategy	Learning action or experience	Related media form	Examples of non-computer based activity	Example of computer based activity
Acquisition	Show, demonstrate, describe, explain	Attending, apprehending, listening	**Narrative** Linear presentational. Usually same 'text' acquired simultaneously by many people	TV, video, film, lectures, books, other print publications	Lecture notes online, streaming videos of lectures, DVD, Multimedia including digital video, audio clips and animations
Discovery	Create or set up or find or guide through discovery spaces and resources	Investigating, exploring, browsing, searching	**Interactive** Non-linear presentational. Searchable, filterable etc., but no feedback	Libraries, galleries, museums	CD based, DVD, or Web resources including hypertext, enhanced hypermedia, multimedia resources. Also information gateways.
Dialogue	Set up, frame, moderate, lead, facilitate discussions	Discussing, collaborating, reflecting, arguing, analysing, sharing	**Communicative** Conversation with other students, lecturer or self	Seminar, tutorials, conferences	Email, discussion forums, blogs
Practice	Model	Experimenting, practising, repeating, feedback	**Adaptive** Feedback, learner control	Laboratory, field trip, simulation, role play	Drill and practice, tutorial programmes, simulations, virtual environments
Creation	Facilitating	Articulating, experimenting, making, synthesising	**Productive** Learner control	Essay, object, animation, model	Simple existing tools, as well as especially created programmable software

Czerniewicz & Brown (2005) adapted from Laurillard (2002)

Responding to the challenges: examples from curriculum projects

The affordances of educational technologies provide ways of being sensitive to wide-ranging and differing learning needs. In this section, we describe some curriculum projects that have attempted to respond to some of the educational challenges faced by students at the University of Cape Town (UCT). For the sake of brevity only overviews are provided.

Using interactive spreadsheets to develop mathematical literacy skills

As discussed above, many under-prepared students entering university have potential but do not possess the relevant mathematical literacy skills required for certain courses (Frith et al., 2004). These students are often expected to pursue an extended undergraduate degree programme that offers additional support to address mathematical literacy skills. In this case, the teaching challenge is that of finding ways of developing students' mathematical literacy skills. Self-contained interactive spreadsheet-based tutorials were developed for use on the mathematical literacy support courses at UCT and were used in conjunction with face-to-face lectures. A typical tutorial consisted of interactive presentation of relevant mathematics content, examples and exercises. Students were able to work at their own pace and receive immediate feedback. Frith et al. (2004: 163) found that 'while the lecture room tutorial taught students how to calculate the various statistics, the computer tutorial was more effective in giving them an understanding of the concepts and they retained better what they had learned.' This effect, they argue, is possible due to the shift in emphasis in the computer-based tutorials away from mechanical calculations to demonstrating conceptual understanding. This curriculum project illustrates how educational technology was used to complement teaching and learning and to support the development of students' mathematical literacy skills.

Using educational technology to develop academic literacy in an economics course

Economics at university level poses particular difficulties for students since lecturers assume prior knowledge of the economy. Unfortunately, many students from previously disadvantaged communities have very limited knowledge of the economy at the start of their university careers. Under-prepared first year students encounter further difficulties due to a lack of academic literacy skills. The Industry Research Project (Carr et al., 2002) was designed to address economic literacy while simultaneously dealing with language and communication skills of UCT economic students. Interactive excel spreadsheets in conjunction with short writing tasks in the form of online discussions, short essays, reports and presentations were used in academic development economics courses at UCT. These tasks or activities provided a range of opportunities for students to develop understanding of economic discourses through writing in economics. Although Carr et al. (2002: 5) found it difficult to measure the impact of these tutorials, which formed a small part of the first year economics curriculum, they observed that the interactive spreadsheets were effective teaching tools in that tutors were able to focus students' attention on economics issues rather than procedural issues and that the quality of articles produced by students improved due to the online feedback provided during the process of drafting articles online. This curriculum project demonstrates the use of educational technology in conjunction with face-to-face activities in addressing students' academic literacy skills.

Using educational technology to manage tutorials in large classes

Commercial-Off-The-Shelf (COTS) based tutorials system called MOVES were developed around Excel and Word to teach computer literacy to first year Information System students at UCT. MOVES incorporated computer-assisted marking techniques and provided feedback to lecturers and students. The significance of this project is that it typifies the problems of teaching a large and diverse class.

> *The computer literacy levels of these students are diverse, with some students not having touched a computer before to students who have had home computer and internet facilities since the age of five. The immediate challenge this diversity poses on teaching is that it is not practical to pitch the lecture at an appropriate level to meet all students at their level of knowledge. The other challenge is in providing feedback messages that are relevant and useful to individual students. (Ng'ambi & Seymour, 2004: 255).*

Ng'ambi and Seymour (2004: 257) report that the MOVES tutorials saved time for tutors since tutorials were marked and results captured electronically, lecturers had access to student performance and students found the immediate feedback useful in that misconceptions could be dealt with immediately. The significance of this project is that it illustrates how educational technology is used to facilitate teaching and learning in large classes.

Influencing curriculum design

Many university courses are theory driven and assume that students have knowledge or real world experience and can therefore make the links between theory and practice. Students often have limited experience or practical knowledge and therefore have difficulty in understanding theory. Deacon et al. (2005) report on the use of educational technology to simulate film editing. The *Director's Cut* was produced and used in a Film and Media course at UCT to provide students with insights into the practical processes involved in filmmaking without engaging in the actual process of editing. Exposing students to actual editing is expensive and impractical in a large course. The intervention provided individual students with an authentic learning environment through a simulation. Students sequenced film clips, hence simulating the role of an editor through a simplified version of the editing process. In this way, the focus is on key learning aspects of film narrative and spectatorship and linked theory to the 'practice' of film editing.

Similarly, Carr et al. (2004) report on an International Trade bargaining simulation developed for an economics course where students assumed the role of national trade negotiators representing specific countries. Lecturers and tutors assumed the role of World Trade Organisation (WTO) officials in a semi-authentic process designed to teach students negotiation and bargaining skills similar to those required by professional trade negotiators.

The two projects reported here exemplify ways in which educational technology was used to impact on the design of the respective curricula by providing students with experiences which are difficult to provide in face-to-face environments.

CONCLUSION

South African universities face increasing pressure from government to meet the needs of social transformation in education. South African government policy on social transformation in education requires increasing the representation of Black South Africans and women among students and graduates and significantly improving the graduation rates and throughput of Black South African students. Given the social-historical context of South Africa, meeting the educational challenges associated with this noble goal requires re-conceptualisation of how

educational technologies are applied so as to make an impact. The paper has proposed a model for teaching and learning activities that are associated with media forms. The model has been substantiated with examples of the application of educational technologies to teaching mathematical literacy, academic literacy, management of large classes, and ways of influencing curriculum design. Our argument is that technology alone is not a solution to the educational challenges faced in South Africa. The challenges lie in identifying and conceptualising ways that educational technology can usefully contribute to student learning experiences, curriculum and pedagogical designs. The paper demonstrates and argues that educational technology has a key role to play in South African higher education as one of the strategies for addressing teaching and learning concerns. This challenges learning designers to rethink the role of educational technology within broader educational interventions that are shaped by educational needs rather than being technologically driven.

Endnote

[1] The rationale of the quality assurance exercise as De Clercq (2002) points out, '…is that the more employees are forced to focus on their planning and performance indicators, the better they will perform and the more knowledgeable they system will be about developmental support systems needed' (p. 96).

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Institutionalising the eLearning Division at the University of the Western Cape (UWC): Lessons Learnt

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ABSTRACT

Universities need to re-align teaching and learning in response to advances in educational technology. The University of the Western Cape (UWC) established an Elearning Division (ED) in May 2005 which has experienced rapid growth. In this paper, we present the role of the eLearning Division in the institutionalisation of eLearning. We argue that a supportive leadership and effective organisational policies and strategies are key components to the success of the establishment of e-learning. Furthermore, we show that the success is also pegged to the continuous review and updating of the organisational policies in the light of new requirements.

Our strategy for staff development involves facilitating changes in the mindsets of UWC's community towards the use of Information and Communications Technology (ICT) in teaching and learning through empowering them for online course facilitation as well as enhancing their computer literacy skills. Our challenges result from resistance from some of our intended clientele, as well as the challenges of coordinating the Division's activities with well established divisions and entities within the university. The eLearning Division's success and achievements are based on continuous review and feedback as we strive to improve and enhance our service to meet the needs of UWC educators.

Keywords*: eLearning division, support structure, institutionalisation, limited resources, resistance, organisational policies.*

INTRODUCTION

The use of E-learning has grown considerably in recent years and has triggered a great deal of interest in this age of rapid technological progress, transforming the very nature of higher education (Pollock & Cornford, 2000). Higher Education Institutions (HEIs) use Information and Communications Technology (ICT) not only for their academic functions, but also for their support functions, such as administration and communication (Cronjé & Murdoch, 2001). ICT has become part of higher education not just in the daily practice of teaching and learning, but also through policy frameworks, in a way no other teaching technology has done in the past. New media technologies are replacing or supplementing conventional course delivery (Murphy, Walker & Webb, 2001). This change has urged many e-learning facilitators, who are complementing their teaching with e-learning resources, to explore the use of both commercial and Open Source Learning Management Systems (LMSs) (Newman, 2001).

The generic challenges of navigating a transition from a pioneering phase of eLearning to its effective institutionalisation are well recorded in the literature. The early hopes that eLearning would transform education have given way to a more realistic understanding of the role of eLearning in university education and the success factors for effective implementation (Zemsky and Massy 2004). While innovators and early adopters are likely to initially accept relatively high levels of risk, their continuing use of eLearning requires a multi-stakeholder, strategic commitment at the highest levels of the institution to the provision of the effective support systems (Holt, Rice,

Smissen and Bowly 2001, Zemsky and Massy 2004, Moser 2006) which may enable bottom up initiatives to succeed. Mainstreaming eLearning also requires an increase in resourcing as well as a significant shift in the balance of activity and investment from pioneering online and mixed mode teaching projects to facilitating the involvement of the more risk-averse early majority (Moser 2006:3). The implications include purposeful and concerted efforts in areas such as ongoing consultation to assess educator and student needs, enhanced usability of software, effective technical support systems, and responsive instructional design partnerships combined with staff development processes (Uys, Nleya, and Molelu 2004:72-5) which enable educators to design and manage online interactions. Such developments both give rise to and are fuelled by the growth of local networks of educators who use online learning environments in their teaching (Carr, Brown, Cox, Czerniewicz, Deacon and Morrison 2005). In the mainstreaming phase universities also need to consider how course development by lecturers is recognised and incentivised in order to maximise takeup (Uys et al 2004:73).

This paper reflects on some of the issues that Higher Education Institutions (HEIs) face in the transition between a pioneering phase when a small number of educators are introducing e-learning to practice and the institutionalisation of e-learning so that it becomes an integral part of teaching and learning throughout the university. We present the establishment of the eLearning Division at the University of the Western Cape (UWC) as an illustration of organisational change to support eLearning across a whole university in a context of limited resources and lack of human capacity.

The University of the Western Cape (UWC) uses a home-grown online learning environment which started 'as a small set of scripts for use in teaching Marine Botany' by a pioneer of eLearning within the institution, Professor Derek Keats The system has undergone several phases of open source development in order to keep abreast of what was happening in the rest of the world (Wikipedia 2007). In 2000 the LMS was implemented officially at UWC, and a Teaching and Learning Technologies Unit (TLTU) was established to harness and support the system as well as to promote E-learning. Technological development tended to outpace the development of the eLearning community of educators and support staff. This resulted in a lack of communication and integration between the work of the developers and the support division (TLTU). As a result attempts to promote the LMS were seen by many educators as a form of evangelism rather than a genuine response to teaching and learning needs. As is often the case, at the outset many lecturers used the eLearning system administration purposes only; according to some lecturers the environment failed to provide what was necessary for teaching and learning, which resulted in the system only being used for drawing class lists. On the other hand, lecturers appreciated being able to control and manage their online content.

A new version of the LMS was launched in January 2005. The system offers interactive and collaborative features that can enliven and enrich online teaching and learning including chat, discussion forums, blogs, wikis and podcasting. Its use by the institution was also part of a larger trend towards the mainstreaming of open source software at UWC which meant that the university needed a structure and processes for the effective support of users (facilitators, teaching assistants, tutors and learners) of its Learning Management System. The institution had to re-evaluate the nature and role of eLearning support structures. Thus the closure of the TLTU allowed for the rethinking of the purpose and scope of eLearning support. The Elearning Development and Support Unit (EDSU) established in 2005 was given the responsibility of 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. The division has a team of dedicated people who have developed training programmes in order to ensure the successful implementation of online courses in KNG. The observations and reflections which follow arise from the work of this unit.

INSTITUTIONALISATION ISSUES

The integration of the work of an eLearning Division into a Higher Education organisation is a task accompanied by several institutionalisation issues. All the issues outlined in the following paragraphs had to be considered to ensure successful integration.

Clear motives for going online

A HEI's decision to enter the eLearning environment ought to be an educational decision and not so much a technological one (Lujan, 2002). An institution may implement a LMS that is excellent in terms of content and technical implementation, but there are elements that must be examined if meaningful input to the system's effectiveness is going to be made (McCormack & Jones, 1998:147). An eLearning system is a progressive new tool for teaching and learning, but until eLearning facilitators realise the change required by the use of LMSs and understand the specific skills required of learners, LMSs should not be used in Higher Education (Fetherston, 2000:51).

The eLearning strategy of UWC (1999) affirms the above by stating that: 'Academic staff need to have the necessary skills, competencies and attitudes, educational and theoretical background as well as access to the technology needed to develop and manage courses that include access to and use of ICT'. This use of ICT is further improved through the practical implementation of instructional design training and support provided by the instructional design team of the eLearning division.

Gaining the support of top management

The eLearning initiative and strategy should be driven and marketed at the highest level, in UWC's case the Senate level and the different boards of an institution. Palloff and Pratt (2001) suggest that E-learning initiatives should be embarked on by a working group consisting of leaders from all academic departments. This would ensure, according to Allan (2002) that institutions communicate strategies based on the recommendations and guidance from across the institution and beyond. The Executive Director (equivalent to Chief Information Officer) of the Information and Communication Services (ICS) department is part of the institution's Senate body. This position gives him the edge to promote eLearning initiatives at this level of governance. The Executive Director is also the 'father' of the in-house Open Source Learning Management System, KNG. He is a 'hands-on' leader, developing eLearning tools for the LMS whilst also steering the strategic aim of the eLearning initiative. The Manager of the eLearning Division (which is a part of ICS) has been selected as a member of the Senate Life Long Learning Committee, also enhancing the marketing of eLearning initiatives from within.

Many departmental leaders have attended the eLearning training sessions and encouraged many of their staff members to attend as well. Some of these heads are at the forefront, including steering pilot projects. The buy-in from these departmental leaders, referred to also as 'eLearning Champions', models behaviour, making eLearning an initiative that many more would want to pursue. It also reinforces the signal that top leadership in the institution support the initiative.

Building an effective eLearning strategy

It is of utmost importance that 'organisational policies, infrastructure and resourcing be reviewed in the light of the new eLearning requirements' (Ellis & Phelps, 2000). Thus an eLearning strategy is important to realise the vision and intention of eLearning at the institution. Centralised resources, support and the specific departments within the institution need to be aligned with the eLearning strategy.

According to Clark (2002) an eLearning strategy is an important tool that provides processes of 'decision-making' concerning the activities within the leearning environment. The eLearning strategy of UWC was developed by a task team consisting of nine members, who were instrumental in the decision-making process from the seven faculties.

De Vries (2005) suggests that an eLearning strategy should proclaim the *what*, *why* and *how* about the technology chosen to deliver and enhance the traditional teaching approach. The UWC strategy states that:

- *Information and Communication Technologies will be integrated into the curriculum to promote the four digital academic literacies, including basic computer literacy, digital information literacy, digital information fluency and digital knowledge creation*.
- *Technology will facilitate the transformation of teaching and learning according to a constructivist paradigm leading to active and independent learning (information literacy)* [UWC, 1999].

The UWC eLearning strategy also affirms that a strategy should encourage users to embrace technology in order to 'provide opportunities for lifelong learning'.

Establishing an eLearning support structure

Learning Management Systems (LMSs), multimedia, and other educational technologies supplement learning experiences. To use eLearning effectively, institutions must amend pedagogy, develop and train users in order for them to become more technologically and didactically proficient, and establish a reliable and flexible support structure (Arabasz & Baker, 2003) that is maintainable, efficient and effective (Joseph, 1999). The Elearning Development and Support Unit (EDSU) at UWC is tasked with these responsibilities since it was established to provide a structure for the implementation of integrated, holistic support and development for the institution. The eLearning division has endeavoured to integrate the use of technology in education by developing a training programme that would empower the educators to take control and ownership of their eLearning initiatives. Lecturers are encouraged to use eLearning tools effectively to deliver their core functions of teaching and learning; research and community outreach. The authors acknowledge that eLearning implementation does not only encompass the delivery of training programmes; in this case it was necessary to embark on a campaign that would familiarise educators with the EDSU's mission, and bring them on board. This was necessary, as prior to 2005 lecturers who engaged with the previous LMS stated that there was insufficient eLearning support. The division reaches across faculty boundaries and focuses on matters concerning the relationship to and use of educational technologies with teaching and learning.

THE ROLE-PLAYERS WITHIN THE DIVISION

Dedicated teams were created to support both the academic and non-academic staff as well as students of the institution.

Instructional Designers (IDs)

The instructional design team has a major responsibility toward the academics who need training and support in order for them to engage effectively with the E-learning tools and enhance the teaching and learning process. The IDs ultimate responsibility is to aid the lecturers and facilitators at UWC to develop the skills, perspectives and confidence to adopt eLearning as a complimentary mode of education for the students. The ID team delivers face-to-face training on a weekly basis using the university's LMS. During these sessions the lectures are trained on how to use the core functions of the system which include; creating an online course, assessing and evaluating the progress of students and effectively communicating with students online. This training is started by a one-on-one consultation in the participant's office and sustained through ongoing e-mail and telephonic support. The Instructional Design team of the division started training academics in September 2005. Since then they have trained a number of 156 lecturers on a voluntary basis across all faculties. More lecturers have indicated that they want students trained in the use of the LMS. The design team has conducted 91 one-on-one consultations with a number of lecturers across 7 faculties.

Figure 1: *Online Course Creation Model (J. Stoltenkamp, April 2006)*: Developed from the generic Instructional Design Model -ADDIE & Salmon, G. (2003) E-Moderating

The instructional design team delivers a training programme, based on an 'Online Course Creation' model (depicted in figure 1) which was developed at UWC by the eLearning Manager. This model is adapted from the generic ADDIE instructional design model to ensure the successful implementation of online courses. The training programme also includes one-on-one office consultations, telephonic and email support. The results of this training programme has been motivating, attracting lecturers on a voluntary basis. From January to April 2007 regular scheduled face-to-face training was not conducted, yet the adoption response remained high. The persistent efforts and support offerings had spread by word of mouth, creating a curiosity around the possibilities of eLearning tools, and ultimately the creation of interactive courses.

The model is also presented at eLearning departmental visits in order to market the team as a support structure concerned with the creation of interactive online classrooms based on sound

pedagogical principles. During the visit it is highlighted that the lecturer's decision to enter the eLearning environment should be an educational decision and not so much a technological one (Lujan, 2002).

Learning Management System Student Training

Both lecturers and students are taught on how to use the system. From January 2006 to July 2007 the unit trained 2208 students from the faculties of Law, Community & Health Sciences, Science, Arts and Economic and Management Sciences. Pilot Projects have been formed with different faculties and departments. Some of the faculties offer online courses in collaboration with universities and experts from other parts of the world.

ICT Staff Training Team

The division has created the awareness that the use of technology should not demand advanced technological skills from staff and that it should be accessible and manageable. Computer literacy training and development is provided to all UWC staff members in order to empower them with relevant skills in the workplace. The team offers both proprietary and Free and Open Source software. Databases, spreadsheets and presentation software tend to attract the biggest interest amongst participants and some departments are sending their staff in groups. After attending sessions, some departmental representatives request departmental 'customised training programmes'.

Support is provided for those who want to have Open Source Software installed on their office computers and this support is also sustained through one-on-one consultation for the staff members who attend face-to-face training sessions.

The ICT team has trained 849 people since the start of the regular monthly training sessions in September 2005. The team also provides specialised department-specific training to cater for the different needs of staff. The needs are derived from analysis and assessment within the departments

Digital Academic Literacy Team: Computer Literacy Student Training

The Digital Academic Literacy course has been designed for novice computer users to become empowered within their first semester with general computer skills - mainly word-processing for academic purposes. The students also acquire search engine skills, learning how to use the Internet effectively and to distribute information according to the approved procedures at the university.

Whilst many students come to the computer skills classes, support team considered these an opportunity to introduce relevant and useful content, focusing on themes around citizenship within a national and international context and more importantly on the HIV/AIDS pandemic.

Materials Development Team (MDT)

The MDT is also currently working towards a FOSS environment, producing training and online manuals and simulations. Users need to receive documentation that enables the facilitators and administrators of the system to understand the various application tools in use. Thus the team creates suitable materials as well as working with eLearning practitioners creating manuals, simulations and other educational materials for their courses.

Digital Media Team

The digital media team highlight the need for multimedia to enhance the teaching-and-learning experience, rather than detailing the exact application of the MM within eLearning. In the African context, the main constraint on delivering digital media over the web is bandwidth. Productions with a lot of audio, video, and graphics are especially restricted because these types of media generate large files with slow download times for students with dialup Internet access. The digital media team offers CD–web hybrids which overcome this limitation by combining the media-rich capacity of CD technology with the immediacy and resources of the Internet.

The Digital Media team has also joined the Instructional Design team in their LMS training sessions. During these sessions the DM team has trained all the participants on image processing using the GIMP (Graphical Image Manipulation Programme) Editor, which is the Open Source equivalent of Photoshop. The GIMP editor enables the participants to learn how to make use or incorporate their digital media aspects within their online courses.

INTEGRATING eLEARNING WITH HUMAN RESOURCES PROCESSES

It is considered that learning will be among the most imperative developments of a Higher Education Institution's teaching and learning activities over the next few years (Clark, 2002). Indeed, eLearning should be an integral part of human resources processes and approaches, such as training, overseeing the performance of lecturers and offering incentives to them (Tucker 1997).

At UWC an action plan to achieve the link between the eLearning division and human resources department (HR), includes the process of forwarding the structured monthly eLearning training schedules to the HR department who also assesses the training evaluation forms that lecturers complete immediately after each training session. During staff induction programmes which are also steered by HR, newly appointed staff members are introduced to eLearning resources, including LMS training. Lecturers have recently been encouraged to work toward using eLearning by means of an incentive - a laptop. Their performance is measured against a rubric which depicts outcomes that they should achieve in order for them to gain access to the incentive. They are expected to meet outcomes such as participating in a face-to-face LMS training session; developing an interactive online course; presenting at an eLearning seminar; and sharing online experiences and challenges with the greater campus.

EDSU is trying to instil a cultural change by promoting what is called lunch-time seminars - referred to as 'brown bag lunches' in many countries. Since April 2006, nine academics from the seven faculties have presented at the lunch-time seminars, describing their challenges and successes using eLearning.

CONCLUSION

At UWC, eLearning is a rapidly growing option in teaching-and-learning. This paper shows how an eLearning support structure continuously drives the eLearning initiative. It also shows that for the success of eLearning initiatives, institutional leaders should be motivating, guiding and directing lecturers to use this mode of delivery. This paper also shows that considerable planning needs to be undertaken when implementing an eLearning strategy, and since educational technologies are ever-changing, strategies and institutional policies must be reviewed. The need for continuous assessment and review of institutional policies was highlighted by the Rectorate in the case of UWC, where eLearning has been identified as an important aspect of our institution's

core business. This is especially important in our context where eLearning can be used to address various issues such as access, shortages of classrooms and remedial assistance for learners.

Moreover the paper has demonstrated the shift from a pioneering phase to a mainstreaming phase where eLearning is implemented as a core strategy of the whole institution. The shift is being negotiated successfully partly because the university has created a support unit which is able to offer reliable and astute advice to clients in difficult positions, thus building a vital relationship of trust within the campus community. It has also been successful in terms of getting academics on board on a voluntary basis and supporting them timeously. The 'non-evangelist nature' of the unit has allowed the division to see the fruits of their efforts, especially when lecturers are taking lunch-times to engage in eLearning discourse. The model (Fig 1) of analysis, design, development, implementation and evaluation, aligned with access, socialisation, information, communication and knowledge building has proven a systematic indication of the unit's contribution to quality online learning at UWC.

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Learning from the rhetoric of academics using educational technology

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ABSTRACT

Seminar presentations, by academics successfully using educational technology to support their courses, form a visible part of many staff development programmes. These events contribute to developing a community of academics that use educational technology and are sharing experiences on its use in supporting teaching and learning. We draw on classic rhetorical analysis to highlight the epideictic or ceremonial form of these presentations we see as exemplary of these events. These presentations tend to be quite distinct from how educational technology research or best practice is disseminated. We argue that this epideictic form is a vital component in emerging communities of practice and, for example, communicates the value of working collaboratively. While the underlying intuition is widely acknowledged, our analysis offers a framework to view these conscious and stylistic choices across learning communities.

INTRODUCTION

Surveys and broad perspectives of how educational technology is used in practice suggest that staff development initiatives play important roles in addressing teaching and learning challenges (Harrington et al. 2005; Czerniewicz & Brown, 2005; Botha et al. 2005). Traditional educational research and policy have probably had limited roles in directly influencing how academics understand and use educational technology. At the same time, it has proven to be unrealistic to expect most lecturers to become learning designers, content developers or to engage with the research literature, if this ever was a realistic expectation (Able, 2005).

While most staff development activities develop specific skills, best practices and theoretical foundations (King, 2003; Wenger, 1998; Carr et al. 2005; Laurillard, 2002; Littlejohn, 2002), an acknowledged crucial staff development role is the enabling of sharing and the nurturing of learning among academic educators. In researching an emerging community of educators at the University of Cape Town (UCT), we have been interested in how these communities grow and can be supported (Carr et al. 2005). Communities of practice are:

> groups of people who share a concern, a set of problems, or a passion about a topic and who deepen their knowledge and expertise in this area by interacting on an ongoing basis (Wenger et al. 2002:4).

This paper analyses two academics' presentations regarding their experiences with and learning from educational technology interventions. In particular, we focus on how academics share ideas with peers in an informal and unthreatening environment. We are interested in how seminar presentations (an integral part of academic activities), delivered by academics and concerning their own use of educational technology, contribute to community building. The presentations by academics on their use of educational technology are quite distinct from those of educational technology researchers, since they understandably have few references to debates in the literature and offer mostly anecdotal evidence.

We draw on the classic rhetorical analysis in the tradition of Aristotle, looking at how the text, speaker and audience interact at a particular time and respond to a situation calling for an action. We show that these presentations aim to persuade their audiences using an epideictic form of

praise speech, and they speak about virtue, of the speaker, their collaborators and educational technology. We observe that the purpose is not primarily about presenting facts or an argument about a state of affairs, thus these speeches are not forensic or deliberative in nature. We then make connections with learning in communities of practice about community and the roles of educational technology in higher educational development initiatives.

THE CASES

The Centre for Educational Technology (CET) staff development team organised the two presentations analysed here as part of the ongoing staff development activities (Carr et al. 2005; Deacon & Brown, 2005). They were held in university seminar rooms, one at lunchtime and the other in an afternoon session, with 10 to 30 academics attending. The audience included academics interested in using educational technology across all faculties, with a few individuals from neighbouring institutions, and some of CET's staff. The brief was to present an overview of their teaching using educational technology, which in many cases involved collaboration with CET. The content of presentations was developed entirely by the academics. While only two presentations are analysed here, most of the others can be characterised similarly.

The presenters emphasised how new educational technology solutions emerged from collaborative design negotiations. In some cases they highlighted the risk factors that technology appears to introduce (Nomdo, 2004). More often they are motivated by enthusiasm to discuss what they have tried and their impressions of its value. We were interested in atypical learning designs that are more challenging and perceived as 'higher risk'. The first case was a presentation by Nic from the School of Architecture and Planning. Nic has been using educational technology in his teaching for several years. The presentation described the creation of a tutorial that established a better link between architectural theory and what students did in an introductory Photoshop editing activity. In his presentation Nic explains:

> It was agreed that …learning Photoshop should be incidental, should be a secondary outcome to the real learning which is engaging students in theoretical issues about change over time or mapping, or things like that.

Students were given two photographs of the same street taken 50 years apart and had to compose a synthesised image reflecting the architectural changes. The student chooses from one of several paradigms of possible images by making visible Photoshop layers and then orders these layers syntagmatically with layers chosen from other paradigms; for example, changes to facades, roads, wall colour and trees on a street. Not all these were architecturally significant and using opacity their significance could be adjusted. Exploiting the scripting functionality of Photoshop, the names, order and properties of layers are automatically retrieved and appropriate reflective questions generated as a MS Word document. The students' Photoshop and MS Word documents were submitted for assessment, after the students created their image and responded to the questions.

The second case is Jane from the Centre for Film and Media Studies. She, too, has been using educational technology in her teaching for many years. Students have responded very enthusiastically to her teaching style. She highlighted in her presentation a re-purposing of Photoshop and PowerPoint, an activity developed with a colleague:

> So they have to give a little explanation of how advertising works like that [gesture to screen] and then talk a bit about the particular advert jamming …just using PowerPoint they don't need Photoshop to do anything sophisticated like that … so really, students can be as high-tech or as low-tech as they want and still be applying what they learnt about critiquing the media and developing their own technical skills at the same time.

Other work involving collaboration with CET included developing new course management system tools (Horwitz & Eden, 2004) and various online facilitation strategies. She remarked:

> So they're directly speaking to each other and engaging in this text in the online environment and engaging with the course material – my learning objectives are met, I'm very happy with this.

Both lecturers emphasised that they viewed the educational technology as one of many tools they employ in their teaching. The educational purpose was more important than technical considerations.

THE ART OF RHETORIC

Classical rhetoric focuses on how persuasion is used to influence the thoughts and actions of an audience. What makes information convincing and later able to be reproduced can be understood through an analysis of the communications between the speaker and audience. Rhetorical analysis is a methodology applicable in such situations where there is a lack of common focus and the speakers try to promote, as in our case, new ways of teaching with technology that they valued. The art of rhetoric used here, and associated with Aristotle and in more recent refinements (Perelman, 1969), captures the relationship between the speaker, the text and the audience and is concerned with the interaction between these at a particular time, responding to a particular situation and calling for a particular type of action. We believe that these circumstances need to be identified in order to perform a rhetorical analysis. Other situations in which this particular form of rhetorical analysis is used include the rhetoric of political speeches, advertisements, and funeral orations.

We are not concerned with popular notions of rhetoric as devious attempts to mislead the public or texts associated with force, propaganda or demagoguery. Nor do we draw on recent developments in the application of the art of rhetoric to communication not through speech, but using other modes, as in digital rhetoric (Zappen, 2005). Several more recent contributions to rhetoric are concerned with issues of 'identification', particularly unconscious factors in appeal (Corbett, 1990:573). Other distinct types of rhetorical analysis have also been developed and applied to texts that have been created largely in a vacuum and which are not specifically designed to persuade an audience.

In this paper the speakers are successful educators, the text is their presentation, and the audience is the community of practice; all of which is a response to the paradox where educational technology on a broad level seems to involve careful consideration before adoption in courses, but on a micro level is clearly shown to be a persuasive success. Any rhetoric analysis must thus begin by identifying the response, sometimes referred to as 'the crisis' (Gitay, 1981:42). Broadly, the response of our speakers concerns how educational technology can address teaching and learning challenges faced both locally and across higher education.

Rhetorical theory identifies three modes of persuasion (ethos, pathos and logos), three types of speech (deliberative, forensic and epideictic), special and common topics, ways to arrange a speech (disposition, meaning 'arrangement'), figures of speech and metaphor (elocution, meaning 'style'), and inventio (meaning 'discovery') which helps us to identify the broader configuration of the presentation. In addition, rhetoric theory illuminates the means of persuasion by providing definitions for terms such as 'presence' and 'adherence' which can be used to show how we can persuade and create academic communities of practice. In this paper we show that the presentations analysed are epideictic, that is to say, they are ceremonial, praise speeches elucidating issues around the virtue of educational technology and collaboration. This paper then aims to show how new research rhetoric develops and gives an analysis of how a new academic discourse comes into being.

As Perelman (1969) argues, rhetoric allows us to analyse, at an appropriately high level of abstraction, the communications between (in our case) the educator (the speaker), the educational technology (the projects discussed in the presentation) and the community of educators (the audience). The feature of such presentations is not arguments drawing on theory or factual evidence that can be analysed with logic, but a description of thoughts, feelings, and experiences. The way in which we approach the problem means that we first rhetorically analyse the presentations and then link the analysis with the communities of practice framework in order to shed light on kinds of activity we observe.

Analysis of epideictic rhetoric offers insights into the ceremonial style of the academics' seminar presentations. We also ask questions about each seminar presentations' rhetorical situation that includes the audience, purpose and context. A rhetorical analysis scrutinises the techniques of communication and persuasion to put across both technical and education messages to the various audiences that the presentation is designed to address.

ANALYSIS

The rhetorical analysis begins with a description of the rhetorical situation, a summary of the presentation and then analyses the speeches drawing on the five canons of classical rhetoric (*inventio, dispositio, elocutio, pronuntiatio and memoria*). Each presentation has a theme, an organisation and a style reflecting its response to its rhetorical situation. While it might be straightforward for an educational technologist to distinguish 'description' from 'approach' in a presentation, we must identify how the clues about such differences are provided to the general audience. Drawing on the rhetorical analysis of epideictic speech we will show how the presentations support and build the community of practice.

Rhetorical situation

Both presenters are course conveners, respected in their community of educators. The rhetorical situation of Nic's presentation involves a tutorial exercise introducing Photoshop to architecture students. The rhetorical situation of Jane's presentation is a reflection at the end of her stay at UCT, where she gives an overview of the use and evolution of educational technology in the undergraduate media programme. The descriptions below draw on the words of the presenters.
Nic's presentation starts with his context and 'the general themes that this project was located in.' The context is the History and Theory course in the Bachelor of Architectural Studies. The particular tutorial described in this course has the aim to introduce visual representations of change over time to students. The project began with the lecturer and CET negotiating how to assist students to understand change over time. The tutorial helps students to engage in 'serious questions about what makes a streetscape and that kind of visual, of that kind of streetscape.'

Jane's presentation starts with her talking about the Media and Society course, which she has 'been involved with longest, and it's probably the course that's had the most diverse involvement from staff members from the Centre for Educational Technology.' She shows a screen shot illustrative of the look and feel of the Connect course site and describes how, together with Andrea Ressell and David Horwitz, they had 'wanted to … build a sense of being, a media community, future media practitioners, and a community of media students and media teachers, liaising with one another, discussing ideas outside the classroom' using the web.

Inventio: Formulation of the thesis

Inventio is generally understood to be the macro structure of the presentation. When speakers prepare a presentation they use *inventio* as a means of discussing ways of organising the subject matter. In turn, when we rhetorically analyse we should always try to identify this 'guideline' to help us analyse the speech. These are the two opposite ends – aspects of *inventio*. Any speech needs to have a central thesis, and a speech needs to have clearly defined points where the messages are apparent.

Both presentations have a central thesis which can be encapsulated as follows: 'My experience of educational technology has been that it has improved my teaching, my students' learning and the curriculum'. Both presentations have this statement embedded in personal testimony and the higher educational development themes, while they avoid academic discussions of the merits of the specific technologies, teaching strategies, learning outcomes or curriculum designs. Generally both speakers highlight the management of their teaching (e.g., assessment, class size, colleagues, lecture format, macro curriculum), tools (e.g., software applications, hardware, tutorial learning designs, facilitation) and the fact that collaborative design achieves more than if they been working in isolation.

These points of discovery serve to bring about three types of appeal: *logos*, the appeal to reason; *ethos*, which focuses on the personality and character of the speaker as it comes across in the presentation; and *pathos*, the emotional appeal that brings about a consensus on what is acceptable as good and what is to be denounced as harmful.

Aristotle distinguished between artistic and non-artistic arguments or proofs. The non-artistic include, for example, laws, witnesses and contracts. The artistic include *logos, pathos* and *ethos* that appeals to the reasonableness of the audience, appeals to their emotions, or the speaker's reliance on his own *ethos* to bring about persuasion, respectively (Aristotle, *Rhetoric*, Book 1, 2, 1356a). The presentations include both types of 'arguments', since the functioning software and hardware tool are referred to (the non-artistic proofs) and the designs for learning are discussed (the artistic proofs).

Dispositio: arrangement

In order to put their message across effectively, speakers have to arrange their material 'with the keenest discretion' in order to strategically strengthen their material (Corbett, 1990:278). *Dispositio* is typically concerned with questions about the introduction, the statement of facts, the proof of our case, discrediting the opposition, and the conclusion. This is a classical way to structure a speech, although many will have very different structures, which include all or some of these types. Other considerations include how to appeal to the audience showing the *ethos* of the speaker, moving from readily acceptable arguments, and what sort of evidence to use and when (Corbett 1990:281).

Introduction narrative: Generally, introductions aim to capture the audience's attention and set the scene by asking a question, setting up a paradox, demanding change, identifying problems or telling a story. Of the five types of introductions, Nic and Jane's presentations use introduction narrative, which generally 'rouses interest in our subject by adopting the anecdotal lead-in' (Corbertt, 1990:296). Prior to these introductions, the audience is settling in and listening to the welcoming remarks by the chair, while others are still arriving. Neither introduction is especially controversial; both are significant scene-setting points of the respective presentations where the speakers are trying to grab the audience's attention and establishing their *ethos*.

Nic introduces his presentation by displaying what a group of his students produced towards the end of the course. He says, with an educator's perspective and modest pride:

> [Gesturing towards an image on the screen] Just to give you a quick intro into the what the project was, on the top is a photograph from 1958, and on the bottom is one from 2003, the same street, so clearly there's been quite a major change between these two time periods. The photo in the middle is a student interpretation of that change. This is part of the conclusion of what we did. Just to give you an idea of where the project landed up.

The audience is intrigued and predisposed towards Nic as an educator. Nic sets himself apart from others who might be talking about specific details, such as programmers, policy maker, or students. It is important for the audience to know who he represents and what his point of departure is.

Even through Jane starts speaking by responding to welcoming remarks, the introduction to her presentation actually starts with the following narrative:

> When I first started, there weren't any courses in film and media studies that were using a web-based platform or encouraging online learning at all. And we also have a lot of students and in fact staff members who are quite uncomfortable in the online environment so we wanted to overcome that. Because we're trying to train people to go into the communications industry, it's very, very important that they know how to use technology in lots of different ways.

From the beginning Jane makes a personal statement, describing her views of the importance of educational technology to her work. The audience understands that what will follow is more than a bland description of gimcrack software solutions, it is in fact a sequence of events, understandings and learning that are particular to her professional development.

Statements of facts: We find in the presentations that there are statements of fact, which are not forensic in nature, but consist of a narrative exposition relating experiences, incidences, thoughts, feelings, ideas, pros and cons. It is more a representation of a 'flow of thought' as the presenters talk using their slides at points where illustration is needed. They engage their audience with free-flowing descriptions, anecdotes and explanations.

Refutation: Particularly in Nic's presentation we find a mild refutation which involves appeals to reason and wit (Corbertt, 1990:302-307).

> I just want to talk quickly about the problems and difficulties, perhaps we over determined change… It was also difficult to know before hand how the use of layers and opacity would generate appropriate questions. … So there were a few technical difficulties… those are just technical things that can be streamlined…

This refutation appeals to reason, because in the audience Nic anticipates that there might be people who are sceptical that software can mimic human judgment and are eager to challenge him for not acknowledging artificial intelligence's inherent limitations. The wit comes in when he tells two humorous anecdotes about the artificial intelligence misinterpreting what a few students had done and secondly how a student erasing other students' work and how it was recovered. With this refutation Nic acknowledges the limitations of automated software. He responds to possible critics in the audience thus building his *ethos* as a pragmatic and informed educator.

Confirmatio (of temporal sequence): Throughout Jane's presentation we find evidence for a confirmation of a temporal sequence. The presentation described how from first to third year, educational technology is employed in the curriculum. For each project she makes reference to its origins, before she was involved, her initial involvement and the present state of the project. These quotes exemplify the descriptive timeline Jane uses:

> And the NewsFrames exercise itself is also followed on in second year and third year by two more advanced programs... The in their third year they get to edit news footage as well…

> Back in 2002, the student intake was much less computer literate than I think they are now. We had to give lectures and run lab session with small groups of students to familiarise them with the website, show them how to navigate, show them how to access lecture notes, actually physically teach them how to post their own little discussion pieces online and so on. The next year we moved the course to second semester, I think which meant that they already had a first semester course which gave them some online learning and so we didn't need to do that, we just had a lecture introduction where we put the website up and gave them a little bit of a tour of it. Andrea did that for us, the lecture time that worked well. By 2004, the students we were getting in were much more familiar with computers in general. The tutors we had working with us were much more confident in working in the online environment and the whole situation was generally improving, not because we'd taught them so well but because time was moving and things were changing.

Jane is chronologically systematic; she goes to great lengths to explain how various collaborators (some of whom are in the audience) fitted in to the greater pedagogical design. She shows that she understands the macro curriculum structures; she impresses upon the audience that educational technology has contributed to developing her graduates, and demonstrates her consciousness of what and how she teaches. The community of educators present are given a comprehensive view of the undergraduate programme. This builds her credibility with the audience: by praising each collaborator, their projects and how they fit together, Jane allows the epideictic nature of her presentation to come into full view.

Conclusions: The conclusions are distinctive in that they end off with remarks of gratitude and leaving the audience with a positive message. Nic's presentation ends with:

> More projects of a similar nature need to be planned, but unfortunately that has to happen now and, you know, obviously we don't have part-time staff, we don't know who is teaching next year, so it's really important to get ahead now for next year. And, yeah, the project was a success from our side, thanks to you.

This communicates that Nic, like most other educators is under time and resource pressures, remains a creative educator. This helps the audience to identify with Nic possibly even emulating him in future.

In contrast Jane's presentation ends with a personal thank you:

> Okay, I hope that gives you sense of how our programme has developed and how it fits together and what our objectives are. And I'd like to end by saying thank you very much to everyone that I worked with in this centre over the past several years, you really have been brilliant and you really have been the most important part of my professional development and given me such satisfaction working with you. Thank you so much and I hope that we continue to have a connection when I move to Queensland.

This symbolic conclusion develops a favourable outlook on both the speaker and collaborative work with CET. Again we see the *ethos* of the educator shining though, someone that places a high value on collaborative work.

Even though the arrangement of the presentations is not clearly delineated, as the presentation unfolds, the cycle of topics we recognise (in both presentations) consists of introducing themselves as creative educators, working as a collaborative designer of learning activities, assessing what students produce, evaluating the learning activities and concluding with crediting those who contributed to the success of the project. This *dispositio* builds the authority of the speaker and develops credibility, while at the same time aiming to reassure the audience, trying to produce a positive judgment in favour of educational technology projects.

Elocutio: style

Style is not simply ornamentation, but is an integral part of the thought processes of the speaker and the way that the audience will perceive the arguments presented to them:

> Style does provide a vehicle for thought, and style can be ornamental; but style is something more than that. It is another of the 'available means of persuasion', another of the means of arousing the appropriate emotional response in the audience, and of the means of establishing the proper ethical image (Corbett, 1990: 381).

Therefore, we can define *elocutio* as the means of persuasion through the use of style, the level at which the language used makes a difference. In rhetoric we identify three types of style: plain, forcible, and florid (Corbett, 1990: 26). The other important facets of style are the arrangement of sentences and the use of figures of speech (tropes and schemes), metaphor and analogy. In both presentations a plain style is used. The language is clear and straightforward, easy to understand and engaging.

Nic uses discipline-specific phrases from architecture like 'place over time' and 'change over time'. He explains what he expects his students to understand about architectural 'space' and 'change':

> ... for an architecture student it is important towards the end of first year to talk about space and special issues and rather than looking at this [gestures to the screen] and saying the colour, it's a beautiful street, not actually getting to grips with the spatial condition, the change that has happened.

Nic uses words like 'synthesise' and 'synthesis' to refer to both students' understanding of spatial conditions as well as what they have produced. He repeats this because it is important for him that his students have grasped the concept and that the audience understand his concerns. Nic emphasises that Photoshop's ability to change the opacity of layers in an image was important for students to develop in order to 'see through layers' of history so that they would be able to communicate in informed ways about change over time. Nic uses everyday language most of the time, with 'space' requiring a more technical definition. This kind of clarity easily carries his message across to the audience.

Jane also uses a plain style even though she peppers her presentation with technical film and media terms. Jane uses a technique of padding her descriptions in order to display her technical knowledge, for example:

> But the film course is very different. It aims to develop a technical and analytical vocabulary for talking about what's happening on the screen, it will be a vocabulary for cinematography, including things like tracking shots, dollies, zooms, close-ups, wide-angle lenses, and so forth. There'll be a vocabulary for editing jump-cuts, axis-of-action, graphic matches, and so on. They need to be able to use that terminology in order to express their ideas about film.
>
> It's a media writing task, it's tied to the section of the course where we first began to look at things like ideal of journalistic objectivity and the conventions of journalistic writing, the inverted pyramid, how to write a headline, how to write sentences for a news report, how to structure a news report, and so on.

Jane uses a rhythmical recitation of these technical terms and types that changes the pace of the presentation at certain points. Within a few seconds, she covers the topics from her lectures, which creates a sense of presence and reality for the audience.

Pronuntiatio and memoria: delivery and memorisation

The *pronuntiatio* of both presentations suggest that the speakers are comfortable in front of an audience. Usually rhetorical analysis neglects these two canons, but it is important to draw attention to the delivery and the *memoria* required of the speakers. For example, even when Nic

makes a mistake, the resulting humour only serves to endear him to the audience. Similarly when Jane speaks passionately, but off topic and asks if the tape could be rewound in order to tape over what she had said, the audience is both enthralled and amused. Neither speaker uses a prepared speech, but speaks to *PowerPoint* slides, from personal experience, and often from the heart. This is consistent with the *ethos* they have created, displaying their confidence working with educational technology in a high risk environment.

Ethos: appeal of personality

Arguably the most important and possibly the most powerful type of appeal in the presentations is *ethos*. The presenter makes an ethical appeal by invoking their *ethos*, the characteristics of the person they are, and their academic background. Aristotle defines the ethical appeal as follows:

> [There is persuasion] through character whenever the speech is spoken in such a way as to make the speaker worthy of credence; for we believe fair-minded people to a greater extent and more quickly [than we do others] on all subjects in general and completely so in cases where there is not exact knowledge but room for doubt. And this should result from the speech, not from a previous opinion that the speaker is a certain kind of person (Rhetoric, Book 1, 2, 1356a).

Our rhetorical analyses concentrate on how the *ethos* of the presenter is displayed in and used in the presentations. The ethical appeal can be seen as a feature of the presentations themselves, as opposed to being derived from the speakers' *ethos* already developed outside of the text. The ethical appeal cannot be taught and must be developed by the presenter as a person through the delivery of their speech (Corbett, 1990: 81). Aristotle defines *ethos* of a speaker as:

> … three things which inspire confidence in the orator's own character – the three, namely, that induces us to believe a thing apart from any proof of it: good sense, good moral character, and goodwill. … It follows that anyone who is thought to have all three of these good qualities will inspire trust in his audience (Rhetoric, Book 2, 1, 1378a).

The presenters rely heavily on their personal *ethos* within the speech as well as showing the *ethos* of the presentation as a 'team effort' of the university.

In Nic's presentation he uses the personal pronoun often, as in:

> But I also want to give some background…
> So this is the outcome I was aware of…
> I think this is where Andrew did some amazing work…
> Andrew and I were negotiating… so we decided… Andrew and I worked out…
> That was one of the main things that we wanted to teach students…
> I just want to talk quickly about the problems and difficulties…

This is Nic's personal testimony showing that he was responsible for the project, providing a critical comment of its success, praising the project and giving collaborators due credit. It comes across in the way the presentation was structured and delivered that Nic is a dedicated lecturer who uses educational technology successfully in his course. When the audience perceives this *ethos,* they are persuaded that educational technology could be something valuable in their own teaching too.

In Jane's presentation she uses the personal pronoun in a similar way for the same effect. She also shows a montage image of herself in her presentation, created by Vera Vukovic of CET. This amuses the audience and captures their attention. Examples from Jane's presentation include:

> I'd try and get in there at every topic…
> I was guided to do that in fact by staff members in this department [CET] because I had rarely worked in online environments before, like the tutors, I hadn't really thought about how to facilitate them very much.
> I'd really tried to encourage tutors to post some things…

> So I really enjoyed working with the program [NewsFrames] …
> I am very happy with this…
> So I was very pleased with the student producing this jam, that's purely the result of Marion's Photoshop workshops, a lot of work went into that little image.

Similarly, here we can see from the use of these self-assured and convincing uses of personal pronouns as well as in the structure of the speech and situation of the audience that Jane comes across as a confident speaker and competent lecturer. She is shown to be dedicated to her students and committed to collaborating around issues involving educational technology. Again, this serves to show her *ethos* to the audience who in turn are persuaded by her bright personality and interesting perspectives based on her own experiences.

Epideictic address: ceremonial speech

Aristotle recognised three types of speech: the forensic, deliberative, and the epideictic. Kennedy (1991: 7) explains that:

> In Rhetoric 1.3 Aristotle identifies three occasions, or species, of civic rhetoric: (1) deliberation about the future actions in the best interest of the state; (2) speeches of prosecution or defence in a court of law seeking to determine the just resolution of actions alleged to have been taken in the past; and (3) what he calls epideictic, or speeches that do not call for any immediate action by the audience but that characteristically praise or blame some person or thing, often on a ceremonial occasion such as a public funeral or holiday.

The ceremonial discourses are exemplified in funeral orations, graduation speeches, obituaries, letters of reference, and the introduction of a speaker (Corbett, 1990: 139). Here the orator praises the day, the idea, and particular path of action or a person. They seek to obtain the audience's sympathy through paying tribute to people, things or events and criticising others, emphasising what is either honourable or shameful. The epideictic speech focuses on the noble or base in actions, people, governments or ideas. Aristotle describes epideictic speech as ceremonial oratory that is only for display purposes, and believed that:

> Those who praise or attack a man aim at proving him worthy of honour or the reverse, and they too treat all other considerations with reference to this one (Rhetoric, Book 1, Chapter 3, 1358b).

In Nic and Jane's presentations we see evidence for the epideictic because they speak about the virtues of educational technology, they speak about their own achievements, and they praise their CET collaborators. Both Nic and Jane were given a brief where they knew that at the end of their projects they might be asked to reflect on their project, using their personal testimony, as a future case study. In addition, Jane's presentation was delivered at the end of her tenure at UCT which added to the epideictic flavour of her presentation.

The goal of epideictic speech is to strengthen the consensus around particular ideals, values or plans of action (Perelman, 1982: 20). The epideictic address does not merely focus on the artistry of the speaker, but is integral to shaping reality through showing the audience what is praiseworthy or not. In the seminars, the presentations are wholly dedicated to establishing education's ethos, and promoting the soundness of the ideas presented. The epideictic speech is used because it will create a positive view of the learning activities, and aims to encourage the audience to think favourably of them:

> … Epideictic oratory has significance and importance for argumentation because it strengthens the disposition toward action by increasing adherence to the values it lauds … [The orator] tries to establish a sense of communion centered around particular values recognised by the audience (Perelman & Olbrechts-Tyteca, 1969:50-51).

The presenter wishes to 'increase the adherence' of the audience to working collaboratively and grappling with designs for learning. Through the presentation, the presenter directs the audience towards engaging with the ideas of the speech as praiseworthy, and reasonable. But in the speech, the presenter also aims to mirror the values and aspirations of the audience so that it will be easier for them to accept their ideas. This speech seeks to stir the audience, to inspire them given the vision presented by the speaker.

Perelman and Olbrechts-Tyteca (1969: 27) note that the epideictic also has an element of the argumentative or deliberative discourse since it is not just a ceremony that is being performed, but people are being asked to engage with the ideas being presented. Even though we might be able to see deliberative and forensic aspects in the presentation, the principled classification to which these are most closely associated is epideictic. In the case of the seminars, the presenter seeks to justify and give reasons for the way that the presentation has been structured and the educational motivations behind it.

The presentations analysed are not argumentative; they seek to unify the audience while promoting learning and research, but not merely in terms of the evidence and theories. Rather, they seek to involve the audiences in the speaker's experience and vision, which is presented as the university's or a department's vision. The presentations reflect the values of a successful educator using technology tools and it seeks to bring others to recognise the reasoning, values and the ethos behind their innovations. The presentations are epideictic speeches because they aim to bring about a common agreement amongst the audience to consider a particular use of educational technology because it is good, because it is praised by the presenter in his speech, and so made worthy in the minds of the audience.

TOWARDS BUILDING A COMMUNITY OF PRACTICE

Classical rhetorical analysis, with its long tradition and establish form, captures salient features of the presentations. A goal of this analysis has been to recognise contributions of these presentations to community building. To summarise, the important points from the analysis include:

- The rhetorical situation describes the eloquence of educators, who as course conveners are knowledgeable about pedagogical design, the interests of educators, and student learning issues. Their brief was to speak about collaborative projects and their experiences using educational technology. This type of rhetorical situation lends itself to epideictic speech.
- Both speakers' *inventio* highlighted the management of their teaching environment, educational technology tools and the fact that collaborative design often achieved more than they would have been achieved had they worked in isolation.
- The *dispositio* used by the speakers took the shape of short introductions and conclusions. This is in contrast to presentations on research where introductions are preparatory and conclusions reinforce what was said in the body of the speech. Nic's refutation and Jane's use of temporal sequences are highlighted here.
- Both presenters used the plain style of *elocutio*, which is aligned with their *ethos*. Sometimes technical terms were used to illustrate the speakers' command of their discipline.
- The *pronuntiatio* is relaxed and informal, and the *memoria* is characterised by the presenter speaking freely from experience which is in keeping with their *ethos* and epideictic speech.

The rhetorical analysis highlights the epideictic form of presentations which, by definition, tries to build consensus. Those people honoured or criticised in these presentations need to appreciate the ceremonial form and the role of praise. It is a role of staff developers to create awareness among presenters that their presentations can build community. For those in the audience

expecting technical details there are other more appropriate opportunities to engage. Simply making the information about the work of academics available online is unlikely to achieve the same effect. The speakers' ethos and the carefully constructed epideictic style would be difficult for the presenters to convey outside the context of the presentations.

The speeches are fleeting text, transient, once-off presentations, while the concept of community is more concerned with interactions on an ongoing basis. They are just one of opportunities for academics to share and learn. Our interest in the presentations is in part because they were in a public space and one anticipates an acknowledgment of the other less visible activities. The presenters make reference to collaborative designs, communities of practice and divisions of labour in relation to CET. The presenters remark on how their students impressed them both in a relative and complimentary sense. They implicitly encourage the audience to consider social constructivist inspired designs for learning over those where technology is primarily used for the transmission of information or administration.

The presentations need to be understood in terms of how they might contribute to persuasion and consensus building within a community and how a new academic discourse comes into being. The rhetorical analysis demonstrates how emulation and adherence lead to the enrichment of the community of practice. Aristotle, in explaining what emulation means rhetorically, wrote:

> Emulation makes us take steps to secure the good things in question, envy makes us take steps to stop our neighbour having them. Emulation must therefore tend to be felt by persons who believe themselves to deserve certain good things that they have not got, it being understood that no one aspires to things which appear impossible. (Aristotle, Rhetoric, Chapter 21,1388b)

Here one can infer that the audience, as a result of the epideictic presentation, would want to emulate the successful speaker or emulate the processes the speaker has experienced. In any community of practice one would hope that success will be emulated, or that fellow academics will aspire to similar achievements in their teaching practice. This suggests the community of practice is reinforced when members identify with successful educators who have made use of educational technology in interesting ways.

Perelman, whose contributions to rhetoric include the introduction of the term 'adherence,' observes that:

> …the epideictic genre is central to discourse because its role is to intensify adherence to values, adherence without which discourses that aim at provoking action cannot find the lever to move or to inspire their listeners (1982: 19).

Adherence to values of good teaching and learning can be brought about with epideictic speech. Since the speeches are epideictic, they aim to inspire and provoke action; therefore it is not surprising that the *logos* is less explicit. If it were educational researchers presenting one might expect a clearer theoretical framework and the speaker would be more likely to reference well-known concepts. The logical appeals here are not in the forms of straightforward syllogism or enthymeme.

The epideictic exhortation found in these presentations can be analysed as follows: in the teaching as described by both presenters, theory in isolation is not enough and nor are practical exercises in isolation of theory effective. The presenters describe how the theory they cover in lectures is enhanced through linked practical exercises to produce better outcomes in student learning. While the presenters do not use an educational theory framework in the cases analysed, the structure of the presentations makes the case for the use of educational technology. Here it is clear that the presenters are increasing adherence to the thought that the use of educational technology is good and worthy and that others should follow their examples.

The social learning theory of communities of practice, as developed by Lave & Wenger (1991), establishes links between informal and formal learning by educators related to organisational goals. All communities of practice share common structural features that include 'a domain of knowledge, which defines a set of issues; a community of people who care about this domain and the shared practice that they are developing to be effective in their domain' (Wenger et al. 2002: 27). The epideictic presentations, with adherence to values, emphasises the 'care about the domain' over more structured knowledge. Through leaders and 'community coordinators' in communities of practice some aspects of adherence to values and emulation might be invoked by a speaker (Wenger et al. 2002: 78-80). The presentations concern informal learning. While some members of the audience are established members of communities, the presentations will be 'boundary encounters' for others (Wenger, 1998: 112). Such boundary encounters can be important in the negotiation of meaning and the emulation of others.

Wenger (1998) explains that participation within communities of practice promotes learning among experts and novices alike since peripheral participation in the practices of the community is as legitimate as full participation. Peripherality can then only provide access to a practice if it 'engages newcomers and provides a sense of how the community operates' (Wenger, 1998: 100). The epideictic form and speakers' ethos are easily recognised by newcomers, contributing to greater peripheral participation and possibly encouraging adherence to community values.

CONCLUSION

A problem with viewing the perceived gap between theory and practice as a 'staff training problem' is the assumption that practical knowledge derives directly from research knowledge. Clearly building a community of practitioners also involves considering how a speaker is viewed as a respected practitioner and is able to stir the human emotions of fellow academics. Drawing on some of these understandings acknowledges other possibilities of transforming perspectives, identities and practices among academics that staff development is interested in supporting (Carr et al. 2005).

There is value in an analysis of how ideas and a sense of community are communicated by academics who have had experience with successful collaborative projects. At one level this might help explain why some presenters are more effective in sharing their experiences and persuading an audience. This would be useful when briefing presenters. Of more interest has been the identification of some common elements of presentations, such as their epideictic form and the role of ethos, together with their possible implications in the broader context. Alongside more familiar articulations of learning and software designs, such perspectives open up reflective spaces. While this is surely common existing practice, in the absence of theorising or agreement on a common language this might not to be fully recognised. If the community of practice relied only on forensic and deliberative texts, it is likely that important ceremonial and emotional communications crucial to community building and enrichment would be left invisible.

The apparent divide between academics who seek to minimise their teaching roles and those academics who continually try to broaden their practice of teaching and learning or service to the broader community is easily appreciated in universities. A research focus is likely to privilege forensic and deliberative outputs, yet a community can only be built and flourish when the humanity of the practitioners is recognised. Nic and Jane's presentations were delivered in a risky environment. The idea that epideictic speech was used to carry across a message about the success of a small educational technology project brings about the situation where the presenters open themselves up to criticism. Geiger (2004) observes that while the research output at leading universities he has analysed has increased dramatically over the last 20 years, there is no similar evidence for improvements in the quality of teaching and learning. Generally the relationship

between a university's income and the quality of teaching and learning is not acknowledged as much as say the relation between income and increased research output. This places many academics in difficult positions as to how they should balance research with teaching and learning activities. Here we suggest that understandings of rhetoric shed light on staff development initiatives that are concerned with communicating how academics are making such difficult choices in practice.

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