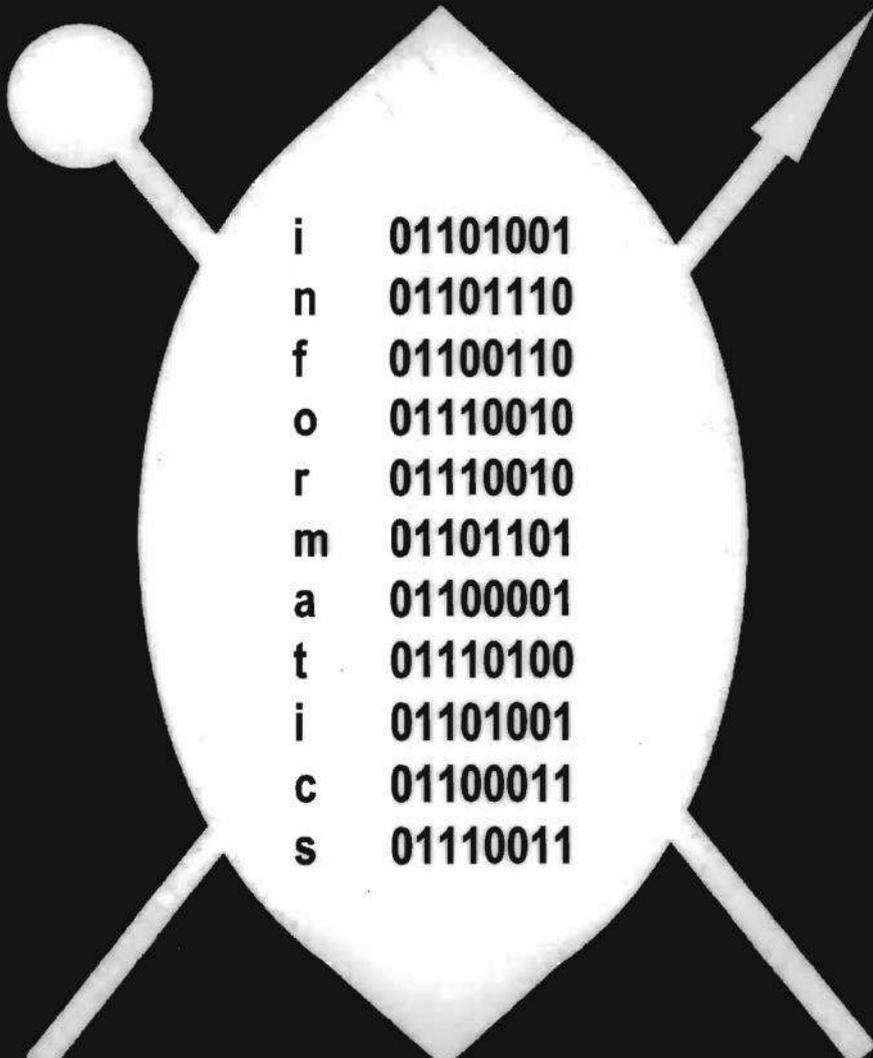


# *ALTERNATION*

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# *Alternation*

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## **Informatics in South African Higher Education**

**Guest Editor  
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**2005**

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**Marie Spruyt**

# Applied Informatics Research in South Africa

Rembrandt Klopper

## Abstract

This article takes as point of departure the nature of coherent research after which it reviews a number of articles that appear in this volume that report the results of a specific applied informatics research project.

In the last part of the article two contributions are reviewed about research in higher education, one dealing with curriculum reform as part of developmental higher education and the other providing a glimpse for supervisors and prospective doctoral students into the minds at work of three PhD examiners.

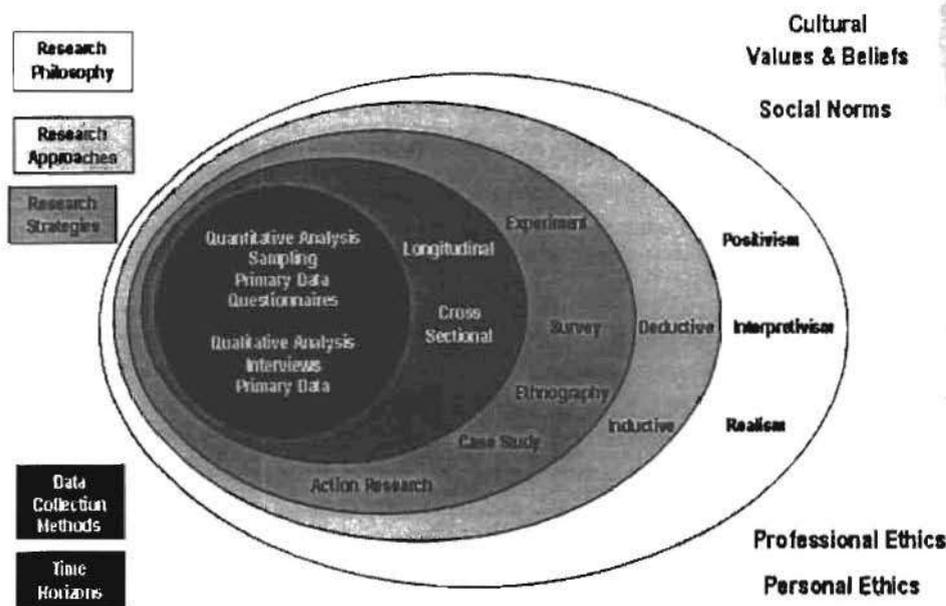
## The Design of the Informatics Research Projects that are Published in this Issue

The empirical basis of individual research processes is usually explained by only providing information about *data collection and analysis methods*, and the *research strategy* (e.g. experimental, survey based, ethnographic, case study based or action research), scant reference to the research *time horizon* (longitudinal if data is collected over an extended period, or cross-sectional if data is collected over a short period), the research approach (deductive or inductive) or the underlying research philosophy (e.g. positivistic, interpretive, or realistic) and how they relate to the cultural values and beliefs, and the social/ moral norms that predominate societies being studied, or, if pertinent, the professional ethics of a group being studied, or the personal ethics of respondents or interviewees.

Figure 1 on the next page graphically represents the relationship

between research processes in the form of a multi-layered schema to be interpreted from the outside inwards:

1. The inner core of the graphic relates to whether a quantitative method of data collection will be followed that the use of a questionnaire to collect primary data from a representative sample of randomly selected respondents and subjected to the appropriate statistical analysis. Of the empirical projects reported here the articles by Govender & Maharaj, Embaye, Lubbe and Klopper, Ngubane and Lubbe, Ramharuk, Naidoo and Klopper, Rambowan, Lubbe and Klopper, Singh and Bradbury, Miller, Acutt and Lemon, employ survey based cross sectional questionnaire based quantitative research during which the research results are interpreted deductively against a particular theoretical background that is sensitive to the cultural values and social norms of the groups being studied.



**Figure 1: The Research Process from data collection method to its cultural grounding.**

2. By contrast the empirical study of Krauss entails a qualitative semi-longitudinal interview based survey of website designers, sensitive to their professional ethics, that used an inductive mode of content and correspondence analysis to determine how they conceptualised and deployed the website design process. The contributions by Remenyi and Price and by Worrall, Klopper and Lubbe, equally constituted a qualitative analysis of respectively the application of Socratic reasoning skills during topic discovery for a PhD, and how external examiners reason while they are examining PhD theses.

Having presenting a generic eagle's eye perspective of similarities and differences between the articles in this volume, the following three sections will characterise each respective contribution in greater detail.

## **Research in Applied Informatics**

Research results reported by Govender and Maharaj investigate the attitudes of educators in the Durban region with regard to the proposed introduction of e-Education in KwaZulu-Natal public schools by 2013 as proposed in the South African Government's 2003 White Paper of e-Education. Their research is opportune because recent studies (Kersaint *et al.* 2003) have shown that the successful implementation of educational technologies depends largely on the attitudes of educators, who eventually determine how they are used in the classroom, and because educators' attitudes are a major enabling or disabling factor in the adoption of technology in the classrooms (Bullock (2004)).

Research results reported by Embaye, Lubbe and Klopper show that as Information Communication Technologies mature, it is expected that the use of powerful, multifunctional networked and wireless computer systems will form as ubiquitous a part of every-day life as the cell phone has already become (Klopper 2002; 2005), also in institutions of higher education. The researchers present a case study conducted on the Westville Campus of the University of KwaZulu-Natal regarding the effective use of the computer systems at a typical residential tertiary institution. Data was gathered by randomly selecting 90 persons, staff members and students of different Faculties at the University who were requested to participate, and of whom

## *Rembrandt Klopper*

80 respondents completed and returned the questionnaires. The data was analysed and processed using the application software Microsoft Excel. Recommendations and conclusions drawn from the findings were the need for teaching and training in computer hardware, computer literacy and the need for computer access and print services facilities. The combination of the new educational technologies with traditional pedagogical models and the appointment of schools (as an important point of social integration), constitute important conclusions of this research.

The research of Ngubane and Lubbe entails a consultative project in the Emkhambathini community to determine whether there is a need for the provision of a community computer centre (Telecentre) for their village. The team collected data by means of a questionnaire and performed a quantitative analysis that confirmed that there is a real need in the community to access information irrespective of gender or the employment status of the inhabitants of the community.

Ramharuk's research demonstrates how information systems could help solve the shortage of medical experts in rural communities through universal Internet connectivity. Ramharuk shows that information technology is increasingly applied in the health sector worldwide. Applications of information and communication technologies to the health sector include: the capture and use of electronic patient records, health information systems, the setup of Intranets and secure Extranets via the Internet, the sharing of information within institutions and between individual participants in the health sector, the use of public networks such as the Internet to distribute information, health decision support systems, the provision of remote diagnostics via Telemedicine, and a community health information system for local, regional and national health planning. The overall goal of Ramharuk's research was to investigate alternative applications of Telecentres and health information systems to help assess healthcare information. Ramharuk's research identified some key areas that planners of health information systems should include in their strategic planning.

Naidoo and Klopper's research on e-Readiness presents a framework of factors that can be used to assess the effectiveness of government policy, infrastructure provision and training to prepare individuals to use

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**Information communication technologies for e-Government, e-Business, e-Health, e-Education and e-Entertainment**

Naidoo and Klopper state that during the last decade, leaders in government, business, and social organizations around the world have considered how best to harness the power of information and communication technology (ICT) for social development. Experts have pointed out that in order for developing countries to put ICT to effective use, they must first be "e-Ready" in terms of ICT infrastructure, the accessibility of ICT to the population, and the legal and regulatory framework. Leaders in developing countries have been urged to use e-Readiness assessment to measure and plan for ICT integration, to focus efforts from within, and identify areas where external aid is required. Several e-Readiness initiatives have been launched to help developing countries in this area, and numerous e-Readiness assessment tools have been created and used by different groups, each looking at various aspects of ICT, society, and the economy (e.g. Bridges.org, 2005).

The underlining focus of the research project was to look at the potential of being e-Ready in conjunction with the social and economic success that the society can achieve through sustained ICT initiatives. It also includes a comparative analysis of the economic and social statistics of KwaZulu-Natal and South Africa with the statistical calculations of the data collected from a questionnaire to establish the degree of e-Readiness of Informatics honours students at the University of KwaZulu-Natal). The researchers agree with the recommendation of the International Telecommunication Union (2003) that in order to measure the ICT potential of an organisation, a community or a region in full, new multi-stakeholder partnerships will be required, involving not only the statistical agencies that are traditionally responsible for conducting surveys, but also involving policy-makers, the private sector, civil society, multilateral organisations and others involved in the ICT sector. The potential of being e-Ready in conjunction with the social and economic success that the society can achieve in sustaining ICT initiatives is seen to be a difficult but a worthwhile achievement.

The research of Rambowan, Lubbe and Klopper, reports the perspectives of the inhabitants of the Bayview rural community on the

eastern seaboard of KwaZulu-Natal, South Africa. The researchers reviewed various refereed sources from which was concluded that in order to access information prospective, beneficiaries first need to know what information is, what information is available digitally and how the information that they require can be accessed via a Telecentre. A questionnaire was distributed in the community, the data was collated and analysed. The major findings are that the community would benefit if a central information accessing facility were created, provided that people are being taught how to use such a facility and what they need to do to ensure that the facility remains viable and to ensure that inequalities in access are removed.

Singh's research focuses on how African Universities can move beyond the traditional "chalk-and-talk" method of delivering practical computer studies through instructor-led sessions conducted in computer local area networks (LANs). In order for LAN-based training to succeed the design of laboratories has to be conducive to learning. Laboratories that are designed using ergonomic principles tend to be more user-friendly and facilitate the learning process. This raises the question: are University computer teaching laboratories ergonomically designed for the comfort of the student? In order to answer this question, this study was conducted at the University of KwaZulu-Natal's Westville campus in the Department of Information Systems and Technology. A convenience sample of one hundred first year students was used. A simple questionnaire covering the main constructs of the study was administered to the students. It was found that there were a number of significant relationships between the design of the laboratories and student discomfort, some students who were exposed to previous computer training found the University facilities better, although not significantly so. Students found lighting, positioning of the screens, ventilation and the direction that they had to face as some of the poor design features of the laboratories. A number of recommendations were made in order to ensure that the design of new laboratories took a learner centric and ergonomic approach which included: students facing the instructor and a projection screen, use of Smartdesks<sup>®</sup>, tiered floors and instructors should have control of lighting and room temperatures. Implementing the recommendations requires large investments. However, providing a quality learning environment is bound to produce quality graduates.

## **Theoretical Research in Informatics**

Applied Informatics research is never conducted in a vacuum because it has to employ a specific research approach to obtain empirical results, and then needs a theoretical framework to constrain the interpretation such empirical results. De Villiers presents a metaresearch study that provides an overview of research paradigms for Information Systems (IS) research, after which she describes, discusses and illustrates some interpretive approaches: action research, grounded theory, and the family comprising development research and two forms of design research, namely, design-science research in IS and design-based research in the realm of educational technology. In the current milieu – with its emphasis on interactivity, user-centricity, usability, empowerment software, and e-learning – inquiry processes originating from the social sciences are relevant to IS, particularly for research on human aspects of the design and development of personal computing applications. The five approaches advocated have underlying theoretical and methodological frameworks and reflective methods. Each one can serve as a model to guide the research process, offering a unifying thread, cohesion and internal consistency to a research study.

## **Research in Undergraduate Curriculum Reform**

The contribution of Bradbury, Miller, Acutt and Lemon, reports the results of an investigation into the rates of participation among English first and second-language students in the different components of learner support system in the first-year Psychology programme at the University of KwaZulu-Natal, which has been designed to provide a hybrid mixed-mode offering, in which tutors play a crucial mediational role interacting with students to combine the flexibility of open learning and the essential learner support structures more typical of face-to-face delivery systems.

The research results show that the differentiation of learner support offerings in an open system has been substantially effective in response to the challenge of diversity, that students who would ordinarily perhaps have remained anonymous in a large class or even in workshop sessions, developed strong relationships with tutors, and that it is imperative that the

focus remains on developing students' autonomous academic engagement as opposed to setting up relationships of dependency between tutors and students.

## **What PhD Candidates and their Supervisors Ought to Know about the Minds at Work of PhD Examiners**

A shared concern about the current performance of higher education research and research training which is compounded by a seeming lack of general acceptance among supervisors of the need to improve student completion rates and times before examining the theses, and their perceptions of the *viva voce* the oral defence of a submitted thesis. Their article provides information on postgraduate completions, and provides insights into what PhD examiners look for in dissertations as part of the duties of responsible supervisors and as part of departmental responsibilities towards their doctoral students.

## **Conclusion**

Alternation 12.2 of 2005 has a strong research focus. Of the thirteen articles published in this issue the first one presents an overview of the issue. The next seven present the results of problem based surveys on particular aspects of Information Technology for Development within an applied Informatics framework. One article presents the results of a qualitative analysis of website design, and another one reports the outcome of undergraduate curriculum reform in Psychology at the University of KwaZulu-Natal. Yet another article deals with philosophical and methodological aspects of research in Informatics. Finally, the last article reveals how PhD examiners reason and go about examining PhD theses.

## **References**

- Bullock, D 2004. Moving from Theory to Practice: An Examination of the Factors that Pre-service Teachers Encounter as they Attempt to Gain Experience Teaching with Technology during Field Placement

Experiences. *Journal of Technology and Teacher Education* 12,2: 211-237.

Kersaint, G, B Horton, H Stohl & J Garofalo 2003. Technology Beliefs and Practices of Mathematics Education Faculty. *Journal of Technology and Teacher Education* 11,4: 549-577.

Klopper, Rembrandt 2002. e-Communication and the Theory of the Optimisation of Human Communication. *Alternation* 9,2: 277 - 298.

Klopper, Rembrandt 2005. Future Communications: Mobile Communications, Cybernetics, Neuro-Informatics and Beyond. *Alternation* 12,1a: 121-144.

Bridges.org. 2005. 11 May. *E-Ready for What? E-Readiness in Developing Countries: Current Status and Prospects toward the Millennium Development Goals*. Retrieved August 9, 2005 from <http://www.bridges.org>

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# **Interpretive Research Models for Informatics: Action Research, Grounded Theory, and the Family of Design- and Development Research**

**M.R. (Ruth) de Villiers**

## **Abstract**

Various research models based on the interpretive paradigm, can serve effectively as research approaches for studies in Informatics (Information Systems). This metaresearch study overviews research paradigms and Information Systems (IS) research, then describes, discusses and illustrates some interpretive approaches: action research, grounded theory, and the family comprising development research and two forms of design research, namely, design-science research in IS and design-based research in the realm of educational technology. In the current milieu – with its emphasis on interactivity, user-centricity, usability, empowerment software, and e-learning – inquiry processes originating from the social sciences are relevant to IS, particularly for research on human aspects of the design and development of personal computing applications. The five approaches advocated have underlying theoretical and methodological frameworks and reflective methods. Each one can serve as a model to guide the research process, offering a unifying thread, cohesion and internal consistency to a research study.

## **Key Concepts**

Action research, design-based research, design research, design-science research, development research, educational technology, evaluation,

grounded theory, human-computer interaction, information systems, metaresearch, research design.

## **Introduction**

Interpretive research, an approach that originated in the social sciences and humanities, is increasingly applied in Informatics, a discipline more formally called Information Systems (IS). This article suggests some practical approaches and models to operationalise interpretive research in IS. Two models – action research and grounded theory – are addressed, after which three models from the family of design- and development research are discussed – development research, design-science research for IS, and design-based research for educational technology. In some of the latter, influences from positivism are not excluded. The context of the study is not primarily research in the generation of systems for business organizations, but rather smaller-scale research for personal computing, including user-centric applications to bridge the digital divide or to support e-learning. This metaresearch study is particularly relevant to postgraduate students doing research for masters/doctoral dissertations, who require an underlying theoretical framework to guide the research process and to provide cohesion and internal consistency.

Research design and -paradigms in IS are currently receiving attention (Baskerville, 1999; Baskerville & Wood-Harper, 1996; Cockton, 2002; De Villiers, 2005a; du Plooy, 2004; Glass, Ramesh & Vessey, 2004; Klein & Myers, 1999; Myers, 2004; Pather & Remenyi, 2004; Roode, 2003; 2004; Travis, 1999; Walsham 1995a; 1995b; Wood-Harper, 1985). In the present milieu with its emphasis on user-centricity and usability, research models originating from the social sciences also hold relevance.

## **Research Paradigms and Methods**

Different research paradigms and models are based on varying philosophical foundations and conceptions of reality (Cohen, Manion & Morrison, 2000; du Poy & Gitlin, 1998; Lincoln & Guba, 1985; Olivier 2004). Each

paradigm, in turn, is implemented by associated methodological approaches and strategies.

### *Positivist and Interpretivist Paradigms*

The *positivist* paradigm holds that knowledge is absolute and objective and that a single objective reality exists external to human beings. Positivism is equated with the scientific method, whereby knowledge is discovered by controlled empirical means, such as experiments. Positivist research is intended to produce an exact representation of reality, unbiased and value-free. Research results should be reliable and consistent, free from perceptions and biases of the researcher. Findings should be replicable by other researchers. Positivist research relies primarily on quantitative methods, where data comprises mainly numbers and measures and analysis is done by statistical methods. Results can be used for prediction. Studies are usually hypothesis-driven. These methods originate in the natural sciences, but are also applied in the social sciences.

*Interpretivism*, by contrast, aims to find new interpretations or underlying meanings and adheres to the ontological assumption of multiple realities, which are time-and context dependent. A related term is 'naturalistic', which has connotations of research done in a natural setting, rather than in a laboratory (Cohen, Manion & Morrison, 2000; Lincoln & Guba, 1985). Terminology is not absolute, for example, Walsham (1995a) refers to the 'interpretivist school', yet as a general adjective refers to 'interpretive approaches, -methods, -studies', etc. Travis (1999) and Roode (2003; 2004) prefer 'interpretivist'. Interpretive research emanated from the social sciences and is also used in educational research, in which context Reeves (2000a or 2000b:6) explains that interpretive goals determine how something works by describing and interpreting phenomena regarding domain processes, performances, innovations, etc. In recent years interpretive research has become accepted in IS (Klein & Myers, 1999; Roode, 2003; Walsham, 1995a; 1995b). Klein and Myers (1999) point out that interpretive studies can provide deep insight into IS phenomena, including both their management and their development. They can help the IS research community to understand human thought and action in social or organizational contexts.

Inquiry is value-related as interpretivism leads to subjective findings which may differ between researchers. It is an appropriate view for studies of complex human behaviour, shared meanings, documents and other artifacts, and social phenomena. Just as positivism is most naturally operationalised using quantitative methods (yet not exclusively), so interpretivism lends itself mainly (but certainly not exclusively) to qualitative studies. Where positivism tests hypotheses, interpretivism investigates research questions, focused on understanding phenomena that occur in natural settings (ethnographic) and which use verbal data. Qualitative data collection and analysis produce findings related to intricate details where values and human experiences are relevant. In such contexts, the ability to interpret data is important and, in fact, 'the researcher is an instrument' (Leedy & Ormrod, 2001:147). Reliability in qualitative research can be considered as a 'fit' between the findings recorded and occurrences in the natural setting. Research methods are frequently triangulated by multiple data collection methods.

### *Research Methods: Qualitative and Quantitative*

Mertens (1998) describes qualitative research as a naturalistic interpretive science which is multi-method in focus. It involves the use of methods such as case studies, interviews, observation and textual analysis, which provide insights into cultural aspects, organizational practices and human interactions.

Qualitative and quantitative methods are not mutually exclusive. Many studies require eclectic inquiry methods to cover the terrain and provide triangulation. Another role of qualitative research is as exploratory work, where qualitative findings from basic research in new areas are used to formulate hypotheses and questions for subsequent quantitative analysis, which yields empirical results to test, verify and extend the qualitative hypotheses. Figure 1 shows common research methods on a Positivist–Interpretivist axis, tending from the quantitative to the qualitative, yet with an overlap.

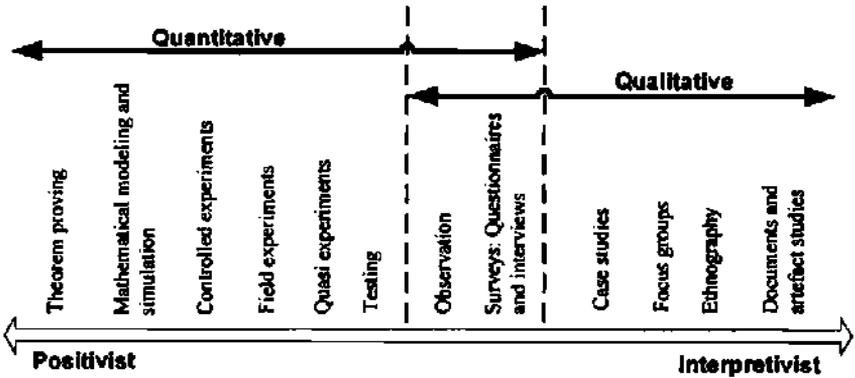


Figure 1 Research methods/strategies

### Information Systems Research

With a view of paradigms and methods as background, we move on to a discussion of information systems research. IS is a multi-perspective discipline and, as Wood-Harper (1985) asserts, it can rightly engage a plurality of research methods. Its domain incorporates scientific, technological, engineering, organizational, managerial, psychological and societal aspects. The subdiscipline of human-computer interaction (HCI) is currently prominent, highlighting the role of the end user, and adding more disciplines: sociology, philosophy, physiology, anthropology, linguistics, ergonomics, graphical design, marketing and engineering. The increasing power and stability of technology has pushed the application of information systems into multiple domains (Pather & Remenyi, 2004), making it appropriate territory for practicing reflective methods and, as Pather and Remenyi propose, IS research needs corresponding reorientation.

Walsham (1995b) examined IS research journals from 1992 onwards, four each from the UK and USA, and noted the advent of interpretive studies. In an extensive analysis of computing research, based on a study of selected papers from leading journals between 1995 and 1999, Glass, Ramesh and Vessey (2004) coded 628 papers from Computer Science (CS) journals and 369 from Software Engineering (SE), including the ACM and

IEEE publications, as well as other well-recognised journals. They also examined 488 Information Systems papers, mainly from 'Management' IS literature. Their metaresearch investigated the kind of studies conducted in these three disciplines, noting similarities and differences.

The IS topics focused heavily on organisational concepts (66%) with systems/software management and systems/software concepts next, both at 6-7%. Of the CS papers investigated, systems/software concepts comprised 19% and the SE focused on systems/software (55%) and systems/software management concepts (12%). Each category was further divided into subcategories and it was found that 24% of the IS related to usage/operation and 19% to technology transfer, with other IS papers focusing on the problem domain, e.g. decision support systems and group support. With regard to research approaches, 67% of the IS papers used evaluative approaches. IS research methods were field study (27%), laboratory experiment on humans (16%), conceptual analysis (15%), and case study (13%). Finally Glass et al report on levels of analysis, stating that most of the IS work was related to behavioural aspects: organizational behaviour (26%), individual behaviour (26%), and group issues (11%), whereas behavioural analysis in CS and SE occurred in only 2% and 8% of the cases respectively.

Walsham (1995b) and O'Donovan and Roode (2002) attach importance to the editorial policy shift in the journal MIS Quarterly, which has expanded its range of research by explicitly calling for papers based on interpretive or integrated, as well as positivist, approaches.

This tendency of IS to take cognizance of human behaviour and to use evaluative approaches is notable. There is a current gravitation – particularly in the HCI subdiscipline – towards interactive, user-centric computing, usability support for personal computing, and the empowerment of domains beyond business and management information systems. Applications are also being developed to bridge the digital divide and to offer accessible e-learning and e-training.

Much of the IS research conducted, is done for postgraduate study. Du Plooy (2004) and Roode (2004) held a seminar on non-positivist IS research methodologies, with particular reference to doctoral studies. Du

Plooy (2004) notes concerns, describing IS research as a 'maturing science' and a 'fragmented adhocracy' lacking theory and methods, which does not fit well into a positivist paradigm, especially when qualitative methods are used. IS places a major focus on the unique qualities of information itself, as occurs during enquiry into design, management decisions, and social processes. Du Plooy suggests that academic IS research is often geared to the dissertation examiner as target, rather than the IS community, and that results seldom reach practitioners. His consequent *axiology of relevancy* posits that current interpretive IS research is weak in clear proposals on how to improve practice and that it avoids value-laden research issues. PhD students should address practical problems, using sound interpretive and evaluative approaches based on methods such as field studies, semi-structured and unstructured interviews, and ethnographic data. Analysis should be conducted using, for example, grounded theory, hermeneutics, or critical social theory, all of which contribute to the production and refinement of theoretical frameworks (du Plooy, 2004). In line with his notable editorial (Roode, 2003:1) proposing 'acceptance of interpretivist research on a semi-equal footing with positivist research', Roode (2004), referring to Hirschheim and Klein (2000), addresses the intellectual state of IS research, with its internal and external views. The internal view of the IS research community indicates fragmentation, particularly due to the paradigm war between interpretivists and positivists. The external view relates to the gap between IS research and external expectations, where current research is insufficiently relevant to practice. Research outputs produce *ad hoc* findings, yet lack generality, and do not broaden theoretical constructs. Roode promotes a broadened notion of relevancy. While the accepted scientific method – entailing hypethetico-deductive studies – is relevant, non-positivist forms of scholarly research should not be excluded.

Regarding postgraduate research in general, Mouton (2001) points out the multidisciplinary and heterogeneous nature of current knowledge. He further cites methodological difficulties as a major factor in the non-completion of postgraduate studies.

In this milieu, the contribution of this study is to suggest practical, methodologically- and theoretically sound approaches for interpretive research in Informatics. Most of the approaches originated in the social

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sciences, yet they are applicable to research in computing disciplines, where the design of human-computer interaction is highly relevant in a society and economy increasingly geared to user-centric values. The approaches are applicable to postgraduate studies, as well as to basic, *ad hoc* and contract research.

## **Interpretive Information Systems Research**

This section focuses on theoretical frameworks to underpin IS research. Pather and Remenyi (2004) propose critical realism as an appropriate approach to bridge the gap between the positivist and interpretivist paradigms, using both qualitative and quantitative techniques. De Villiers (2005a) suggests approaches and methods that primarily implement the ethos of the interpretive school, namely development research, action research and grounded theory. This present article extends the field by introducing two further models from the prevalent family of design research, which is implemented in different ways in different contexts. When conducting IS research, an explicit theoretical framework or conceptual model should, ideally, support the study and provide internal continuity and cohesion in the reasoning process.

Research terminology is briefly addressed, with its plethora of overlapping, exclusive, interrelated and, at times, confusing terms. A taxonomy of terms is provided, explaining how they are used in this study, although other authors may well use them differently:

- Paradigm - the primary philosophical point of departure: in this study, the *interpretive* (rather than positivist) stance.
- Model - the underlying research approach used to guide and operationalise the study: the approaches suggested here being *action research*, *grounded theory*, *development research*, and two forms of *design research*.
- Methods - practical means/strategies/techniques/instruments used for data collection: each approach has its own set of methods, usually multiple methods and often hybrid methods.
- Adjectives to describe the methods: some methods are qualitative and others quantitative.

With the acknowledgement that computing has human and sociological, as well as technological and computational dimensions, research methods from the interpretive paradigm have a definitive role to play. Preece et al (2002) distinguish between the usability and user experience of software systems. The latter, in particular, lends itself to interpretive and qualitative analysis.

The next sections describe, discuss and illustrate the selected approaches/models and their application in interpretive IS research. Each approach has associated methods and techniques to operationalise it.

## **Action Research**

### *Definition and Origins*

The action research approach (Baskerville, 1999; Baskerville & Wood-Harper, 1996; Cohen, Manion & Morrison, 2000; Zuber-Skerrit, 1992) emanates from the behavioural sciences and encompasses a variety of research and intervention methods. Action research (AR) originated in action-based social psychology. Its founder in the 1940s, Kurt Lewin of the University of Michigan, contended that complex real social events could not be investigated under laboratory conditions (du Poy & Gitlin, 1998; Wood-Harper, 1985). AR was used independently at the Tavistock Clinic to study post-WW2 social disorders among veterans (Baskerville, 1999). Zuber-Skerrit (1992) defines AR as inquiry by higher-education academics into issues encountered when students learn. Its participative, practitioner-researcher approach lends itself to the domain of educational research, where an evolving intervention or product is investigated over several cycles. It is appropriate for inquiry into educational technology and for investigating the introduction of technologies into organisations.

Aiming to bridge the gap between research and practice, AR encompasses action outcomes and research outcomes (Dick, Passfield & Wildman, 1995). Commencing with the identification of a problem or situation that calls for action, AR functions as a liberating agent of change, and is (Baskerville, 1999; Dick, Passfield & Wildman, 1995; du Poy & Gitlin, 1998):

— *Cyclic*: as iterative steps recur in a longitudinal time frame, generating

knowledge to inform further action.

- *Participative*: as clients, end users and researcher collaborate in close partnership as co-researchers; or as practitioner-researchers examine their own work. Where stakeholders are full participants in the research process or where practitioners serve both as subject and researcher, one refers to *participative action research*.
- *Qualitative*: operating more via verbal aspects than by numbers.
- *Reflective*: since critical reflection on the process and outcomes is vital to each cycle, and is used in designing subsequent steps and events.
- *Responsive*: as it reacts and adapts flexibly to the findings from each previous cycle.

In a parallel from the professional disciplines, Schön (1987) defines reflective practice or reflection-in-action as the professional artistry that occurs when skilled practitioners tackle work-related activities, going beyond rigid rules of inquiry, and generating new rules in situations that are uncertain and unique. Furthermore, the reflective practitioner is both a participant in the process and a critic who observes and analyses. Similarly, AR aims to improve practice and advance knowledge.

### *Research Processes and Methods*

Zuber-Skerrit (1992) terms the four repetitive processes undertaken in each cycle as plan, act, observe, and reflect. The megaprocess comprises a series of cycles that feed into each other. AR is accordingly more of an ongoing process than an event. Du Poy and Gitlin (1998) state that action research employs or integrates methods from both the experimental and naturalistic (interpretivist) traditions, yet is consistent with naturalistic inquiry in that all research occurs within its natural context.

In the context of rigour and validity, Kock (2004) cautions regarding three potential 'threats' in AR. First, the issue of control: while the natural environment, as opposed to a lab setting, is one of AR's benefits, the researcher does not have complete control over the environment and the subjects. As a methodological tool to counteract this, Kock recommends that data collection and analysis be based on the units of analysis method, with

the units predefined before research commences. Second, he refers to the contingency threat: as a change agent, the researcher has access to a large body of data, which may be 'broad and shallow' and thus complex to analyse, because its rich context makes it difficult to separate components relating to particular constructs. An antidote is the integration of grounded theory (see next section) with a three-step coding process, involving the identification of (i) categories, (ii) relationships between them, and (iii) grouping of the related categories into theoretical models. Third, the close involvement of the researcher might lead to subjective bias in interpreting the data. This can be counteracted by multiple iterations of the AR cycle to support collection of cumulative data about specific units of analysis (Kock, 2004).

### *Epistemology and Philosophy of AR*

Action research has an interpretivist ethos, incorporating social enquiry based on the views and interpretations of the participants, all regarded as equals, making it an emancipatory process, while also incorporating the researcher as participant. It is a holistic, not a reductionist, approach, which includes ethnographic enquiry and works from an ideographic standpoint, promoting the uniqueness of each setting (Baskerville, 1999). At the time when AR originated, emphasis was placed on the precise collection of quantitative data and there was a shortage of qualitative research skills. In due course, it was recognised that AR operated under a different epistemology and, although it can be less rigorous in design and methodology than other approaches, it came into its own as a human-related research process which generates reliable knowledge.

AR research can be distinguished from development research (a subsequent section) in that first, it operates over a longitudinal time framework of several cycles and, second, in the in-depth involvement of researcher as participant. Third, it focuses more on refinement of existing processes or products rather than on new developments. Fourth, in many cases there is no attempt to construct theory, models or principles to guide future work.

### ***Application within IS***

AR is a valid research approach for applied fields (Myers, 2004). Baskerville (1999) asserts that the AR approach generates highly relevant research results due to its basis in practical action, aimed at explicit problem solving while also informing theory. In the 1980s, AR techniques were applied by Peter Checkland in systems analysis, as he developed soft systems methodology, i.e. use in development, rather than in research (Baskerville, 1999).

IS research has been characterised by lack of relevance (Keen, 1991; Westfall, 1999; both cited by Baskerville, 1999). In the previous decade, however, Trevor Wood-Harper had already set out to address the tensions between theory and practice and the confusion that existed between traditional scientific research and the more sociological approaches, by introducing AR to the IS community as a purely research methodology with his landmark paper, *Research Methods in Information Systems: Using Action Research* (Wood-Harper, 1985).

AR is increasingly used for scholarly research in IS. Baskerville (1999) advocates it to inquire into the complex and multivariate nature of IS's social setting, using:

1. Joint goals of solving practical computing problems and expanding scientific knowledge.
2. Collaborative performance, which enhances the competencies of all participants.
3. An emphasis on action and change orientation in social settings.
4. Systematic, iterative stages.

Baskerville lists forms of IS action research: prototyping, soft systems methodology, action science, participant observation, fieldwork, and process consultation. The present author adds investigation of evolving solutions in their context of use, e.g. e-learning applications and customised interfaces, where the designer conducts research into his/her own product. AR for producing e-learning solutions is also advocated by Dertl and Motschnig-Pitrik (2004).

Action research can be graphically depicted as a spiral, but the model developed for the author for Figure 2 is a series of cycles which close in as a solution is attained. The researcher occupies a central, participative, and influential position. This model forms a useful framework to guide and monitor the progress of a research project.

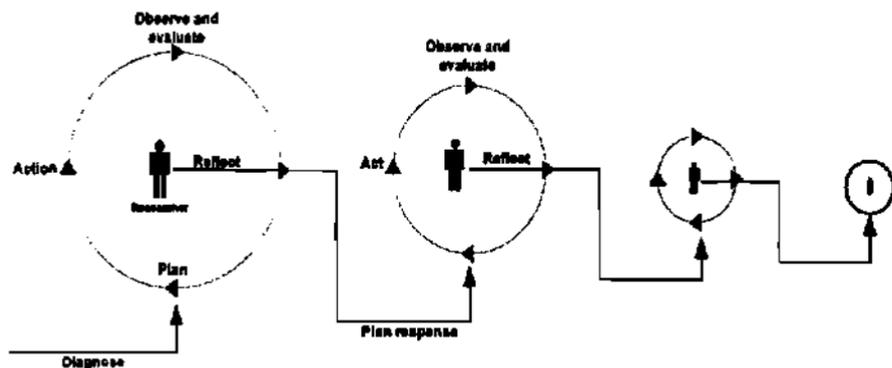


Figure 2 Action research model (synthesized by the author)

## Grounded Theory

### Definition and Origins

Grounded theory (Cockton 2002; Glaser & Strauss, 1967; Glaser, 1992; Leedy & Ormrod, 2001; Strauss & Corbin, 1990) is an approach in which theory and models are generated inductively from the analysis of contextual data. Grounded theory (GT) involves the discovery of concepts and hypotheses as theory emerges from empirical data. There is no testing or replication of a-priori theory. Like action research, it has roots in social science, but specifically in sociology, where attitudes to conditions (initially attitudes to death) were investigated by Glaser and Strauss. Strauss and Corbin (1990) describe its extension to anthropology, education, medical professions, and the economic sciences. Cockton (2002; 2004) uses it in the design of computing interactions. It provides a conceptual grasp of substantive areas, which evolves and is modified to fit as findings emerge

and new data occurs. GT should account for variation in domain behaviour by defining categories, properties and relationships. The data may be quantitative, qualitative or a combination, but in the case of qualitative, it is essential that it be systematically collected, analysed and coded. Defined sets of methods should be applied so that a grounded theory emerges systematically and inductively through covariant ongoing collection and analysis. Lincoln and Guba (1985) state that a GT is adjusted, expanded, and refined via this ongoing process.

As with AR, there is a parallel from the social professions. The notion of emerging patterns has an analogy in Christopher Alexander's patterns within architecture and town planning, which form practical architectural languages, as physical and social relationships articulate themselves (Alexander, Ishikawa & Silverstein, 1977). Within a pattern language, it is also possible to integrate overlapping patterns in a densifying process, which provides added meaning.

The four criteria for a well-constructed grounded theory within a substantive area are:

1. *Fit*: its categories and their properties should fit the realities being studied.
2. *Work*: in order to work, it should explain variations in behaviour.
3. *Relevance*: this is achieved when a grounded theory both fits and works.
4. *Modifiability*: the emerging theory is open to adaptation as new data and variations are integrated.

### *Research Processes and Methods*

Urquhart (2002), citing Bryant (2002), refers to the term 'grounded theory method' (GTM) to distinguish the actual process and methods of generating grounded theory from the ultimate objective, namely, the grounded theory itself. Urquhart acknowledges the clear guidance given in GTM literature on how to code qualitative data. Covariant data collection and analysis, which are methods from the social sciences, entail initial interviews and fieldwork, which after transcription, coding and analysis delimit the field, prompting

theoretical sampling methods and densifying (Glaser, 1992). Other methods (Strauss and Corbin, 1990) are observation, document analysis, historical records, and videotapes, which reflect perspectives of the subjects of study. GT integrates quantitative and qualitative perspectives (du Poy & Gitlin, 1998). Back-and-forth mobility occurs between data collection and analysis, with analysis driving collection. Patterns are identified and conceptualized as the researcher systematically codes, compares, analyses and records. Constant comparative coding (du Poy & Gitlin, 1998; Glaser & Strauss, 1967; Glaser, 1992) is the validation process whereby observations and behaviours are compared/contrasted with core categories and properties, then coded into categories. The developing conceptual model is modified as new data is explored and new concepts are integrated into the emerging theory, reviewing and expanding where necessary. When multiple behaviours indicate similar patterns and properties, saturation has occurred. When disconfirming evidence is found, revisions are required. In this way the emerging theory is inductively discovered, bounded and confirmed. Lincoln and Guba (1985) suggest the generation of alternative theories. As the researcher encounters confirming cases, negative cases and discrepant cases, the theory with the most confirming cases and the least negatives and discrepant, emerges as the most robust. GT thus has similarities to case study research and ethnography, since both the latter aim to detect and interpret patterns within activities and events.

### *Epistemology of GT*

The researcher's bias and subjectivity may influence conceptualization and interpretations. However, grounded theory has built-in mechanisms to prevent this, such as constant comparison, saturation and core relevance (Glaser, 1992). Furthermore, data collection, analysis and presentation to peers should be linked at each step, adjusting one another to the emergent theory and preventing forcing.

The Glaser model posits, contentiously, that so as not to force or make preconceptions, there is little initial need to review literature. Once the emerging theory is sufficiently grounded in core variables, literature reviews in the substantive field can commence and be related to the new work. Where new fields are opened the researcher, according to Glaser, is a 'pre-

empting pioneer', producing a new general theory to be integrated with other literature. Scholarship starts and expands as the emerging grounded theory develops. Glaser claims that this approach also obviates the problem of more and more to read and less time to do! According to Urquhart (2002), however, the originators' actual position on avoiding study of existing literature is less stringent than it appears to be at first encounter with GT.

### *Application within IS*

Orliowski's (1993) award-winning paper in an issue of the MISQ describes a project in which a grounded theory research approach was used to study organizational experience with the adoption and use of CASE tools. Findings were used to develop a theoretical framework conceptualizing organisational change and social issues in such cases, where installation involves not only new technologies, but also organisational change over time. GT was a relevant approach, because of its emphasis on contextual elements, process management, and human actions. Urquhart (2002) describes GTM as an appropriate means of analysing qualitative data in IS research and highlights its use in interpretive studies, as applied for example, in her own work (Urquhart, 2001).

Cockton (2002; 2004) discusses the applicability of grounded theory to computable interactions, and explains how, as theories and themes emerge, corresponding models can be defined and implemented using an HCI contextual approach. Such models could include personas, scenarios and sequence models, where the persona describes a stereotypical user and the scenario a stereotypical usage. It is a rich context-centred approach, which takes account of users' goals and aspirations, aiming for high relevance. The models, in turn, are used in design to generate prototypes, following which the fit between context of use and interaction surfaces can be tested and mediated. Thus grounded theory research in IS investigates data, resulting in theory, which leads to models, which lead to innovative grounded designs or design models, which satisfy 'fit to context' (Cockton, 2004).

The GT process can be applied in studies that focus on the extraction of design guidelines by analysis of practice or best practice in substantive areas, synthesizing them into theoretical proposals, which are further refined; tested and ratified by use. This is being done in certain current South African

postgraduate studies. The associated generation of design principles and evaluation criteria for software applications and web site development is a notable role for GT in information systems research and development.

Glaser's (1992) concept of pre-emption is appropriate in the emerging Southern African technological domains where innovative work is underway in, for example, the design of non-standard interactive environments, such as development software explicitly for the formerly disadvantaged, emergent information systems, culturally-sensitive environments, and contextualized e-learning and e-training. Research on culturally-sensitive interfaces is being extended beyond the work place, to address accessibility for under-educated indigenous peoples.

Figure 3 graphically illustrates the processes and concepts of GT. This model can serve as an underlying framework for IS research processes which investigate phenomena to determine their underlying theory and to derive principles.

### **The Family of Design- and Development Research**

The 'family' of design- and development research, comprising several research models and varied terminology, is currently under the spotlight. The plethora of papers and articles published between 2003 and 2005, justifies a serious analysis of these approaches, particularly their implications for research into producing artefacts, such as development software and e-learning applications. Terminology varies and approaches range between and within domains, but concepts such as design, artefacts and/or interventions are common to all. Three sections are devoted to this family. *Development research*, fairly precisely defined and established, is described first. This is followed by two separate overviews of the more complex *design research* – first as it is practiced in the Information Systems (IS) and Information Technology (IT) disciplines, mainly under the name *design-science research*, and second as it occurs in the domain of Educational Technology (ET) where the prevalent term is *design-based research*. The ET variants are included, because educational systems, or e-learning applications, are a subset of IS at its intersection with the learning sciences, and also due to the

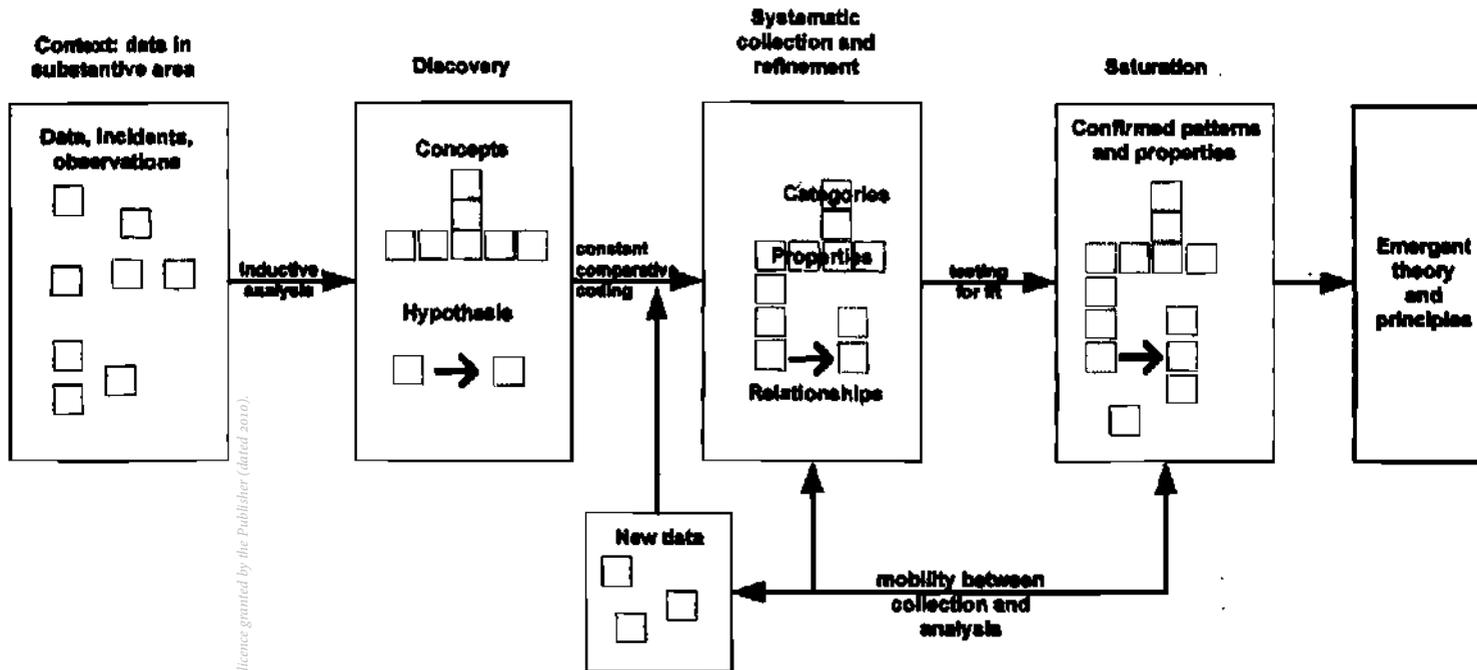


Figure 3 Model of grounded theory emergence (synthesized by the author)

emphasis of this article on small-scale research, such as that which is undertaken for masters- and doctoral studies, where studies relating to aspects of e-learning are on the increase.

## **Development Research**

### *Definition and Origins*

Development research (DR), also called research with a development goal, has a dual focus, as it:

1. develops practical and innovative ways of *solving real problems*
2. proposes general design principles to *inform future decisions*

DR is not to be confused with 'developmental research', which relates mainly to sustainable development in the context of transformation and community issues in developing countries. The DR approach (Reeves, 2000a; van den Akker, 1999; 2002), which aims to make both practical and scientific contributions, originated in educational technology research, giving graduate students and researchers support in pursuing development goals after decades of research with empirical goals. It is also applied in curriculum research, where some of its key concepts emerged. It is not yet a mainstream IS research approach. Other candidate approaches for development goals have drawbacks. Postmodern perspectives and critical theory are emancipatory, addressing inherent problems and injustices, but do not necessarily improve conditions. Action research (see earlier section) is not always explicitly geared to producing new solutions and may not be generalisable. Development research is problem-oriented, searching for new and innovative solutions, while also seeking findings that are transferable, practical, and socially responsible. DR acknowledges the complex and dynamic relationship between theory and application, and aims to provide a relevant foundation to guide practice by generating design principles and methods that are both theoretically underpinned and empirically tested.

### ***Research Process and Methods***

Development research generates different kinds of research questions. A *descriptive* question examines the nature and extent of a problem, while a *design/development* question investigates an intervention or new product to address the need. A *principal* question aims for generalisable principles and guidelines for use in an application domain.

The process commences with the analysis, design and development of an artefact or intervention as a solution for a real-world problem. This, in and of itself, is not yet research (though many postgraduate students wish it was!). It becomes research when the design-and-develop project is conducted from the perspective of a researcher striving to understand the issues of the application domain and its target users, such as the required characteristics of products and artefacts. Such research is based on iterative analysis, design, development, implementation and formative evaluation (ADDIE – a design model that originated in instructional technology), which feeds into redevelopment. DR is closely related to evolutionary prototyping, and entails formative research during the development process of the intervention/product to improve its quality. Van den Akker (2002) terms the process ‘successive approximation of the ideals’. Evaluations can be done by one or more usability evaluation methods, e.g. formal usability testing in a laboratory, logging, surveys among end users, observation, etc.

There are various models of the DR process. The model used by Plomp and his co-researcher, van den Akker (van den Akker, 1999; 2002; Plomp 2002) refers to outcomes of an intervention. *Immediate outcomes* relate to results of using an intervention or product within the cyclic process, and *distant outcomes* emerge when the immediate outcomes lead to distant outcomes in the form of generalisable principles. Reeves’ (2000a) model emphasises the iterative interaction between researchers and practitioners to clarify the problems and refine potential solutions in a process of evolutionary prototyping. Plomp’s and Reeves’ models both influence the representation in Figure 4.

### ***Epistemology of DR***

Development research has a pragmatic epistemology as it acknowledges collaborative shaping by researchers and practitioners. Van den Akker

(1999), describing the knowledge acquired from DR, distinguishes between:

- *Substantive design principles*, relating to the generic characteristics of suitable interventions or *products*.
- *Methodological aspects*, with a procedural emphasis, suggesting optimal development *processes*.

In formative research a great deal of such knowledge is inductively extracted from the experience of using and evaluating the prototype developed for the study. This provides a link between the two branches of the dual development focus, namely the developing solution to a specific problem and the evolution of generalisable design principles. The experiential evidence obtained from studying the prototype in use in its various iterations, is enhanced when integrated with theoretical arguments.

### *Application within IS*

Many IS studies involve the generation of software artefacts or web-based applications. These vary, for example, from simple prototypes through interactive web sites with backend databases through to virtual reality simulations. Design, implementation and testing comprise the focus area of development but are not research. The introduction of evaluation, where evaluation entails more than mere testing of functionality, constitutes a meaningful contribution to the body of knowledge. However, dual-focused research producing both an effective solution and generalisable principles for the application domain, enriches the process even more and is a useful approach for a variety of studies in domains such as e-learning, e-commerce, e-health, etc. A product – often a prototype – can be custom-built as a solution to a problem and iteratively evaluated and refined, as described by Conradie and de Villiers (2004). DR has also been used for computer-based support materials, and is relevant to computer science and engineering as well for generating hardware solutions and associated generic principles.

Figure 4 is a generic model of the DR process. Its iterative phases can be effectively used to structure an IS research process, providing continuity and cohesiveness.

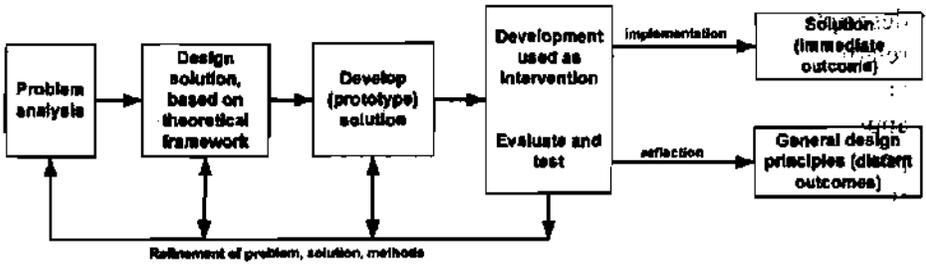


Figure 4 *Development research model* (synthesized by the author, influenced by Plomp (2002) and Reeves (2000a))

### Design-science Research in Information Systems

*Design research* is increasingly undertaken in disciplines such as Informatics, the learning sciences, and educational technology. Due to differences between the ways it is applied in different areas, terminologies, methodologies, and practices vary considerably. Even within a discipline, variations occur. For this reason, the so-called *design-science research* in Information Systems (IS) and Information Technology (IT) is treated separately from the *design-based research* of educational technology (ET).

This section relates specifically to design research in IS and IT, disciplines in which it is also called design-science research (DSR). The context of the literature surveyed, relates more to ISs in the workplace than to research on applications for personal computing. The next section will address design research and its variants in the context of educational technology research.

### Definition and Origins

Design research owes its origin to the Nobel laureate, Herbert Simon (Simon, 1981), who distinguishes between the *natural sciences* and the so-called *design sciences*. Natural sciences relate to natural phenomena such as those described in physics, astronomy, anatomy, etc. Associated

descriptive theories explain how phenomena occur, setting out laws and relationships. Design sciences, by contrast, are the 'sciences of the artificial' and relate to man-made objects and artificial phenomena, generated in applied sciences such as medical technology, engineering, architecture, product design, and instruction. Associated prescriptive theories and models set out goals to be achieved and procedures to accomplish ends. Applied sciences are characterized by problem-solving processes, invention, construction, and evaluation of artefacts or interventions. Design science led in turn to *design research*.

The *Design Research in Information Systems Group (DRIS)* (2006) is a Web-based community that collates information on design research. DRIS views design research as a problem-solving, performance-improving activity, involving invention and evaluation, including measurement of artefacts and their impact on the overall system. Similarly, Hevner, March, Park and Ram (2004) describe design science in IS research as a problem-solving approach, rooted in engineering and Simon's sciences of the artificial. It aims to be technologically proactive, focusing on creating innovative IT artefacts and effective products, with the challenge being to determine how and why they work. To this end, they are evaluated to identify and to solve problems.

### *Research Process and Methods*

Design has double connotations. As a verb, it relates to processes and, as a noun, to products or artefacts. When design research is applied to classic ISs, business applications in large organizations, its outputs are not only full systems, but also their building blocks. March and Smith (1995) and Hevner, March, Park and Ram (2004) describe the artefacts and activities of DSR. The *output artefacts* are defined as constructs, models, methods and instantiations: *Constructs* or *concepts* are the domain vocabulary, terms used to describe problems and specify solutions. They may be formal notations for data modelling or informal text. *Models* are forms or representations where constructs are combined to show relationships, e.g. entity-relationship diagrams. Models are useful in the process of designing an application. *Methods* are ways of performing goal-directed activities, often involving a

set of steps, e.g. an algorithm. They build on constructs and models and transform one model to the next in the problem-solving process of systems development. An *instantiation* is an actual implementation – a product to perform a task in a particular environment. It may be an IS itself, a prototype, or a tool to support the design of ISs. Instantiations are the final link in the research chain as they operationalise constructs, models and methods. In actual practice, an instantiation may pre-exist an articulation process defined with constructs, models and methods. When the instantiation is studied, the latter can be formalised and used to generate improved instantiations. DRIS (2006) suggest a fifth output, a generic one, namely ‘better theories’ as in development research. Theories emerge as construction methods are studied and as construction and evaluation elaborate existing theories. This suggestion is re-visited after the next paragraph.

The two main complementary *activities* in generating DSR outputs are (March & Smith, 1995; Hevner, March, Park, & Ram, 2004):

- *Building*: the design and construction of constructs, models, methods, and instantiations to meet identified needs. Judgments and decisions must be made based on value to the user community – in this case, the business context. To build artefacts, foundational knowledge is required: theories, frameworks and tools from prior research, although when completely new artefacts are created, each is an experiment, and often done with little prior knowledge.
- *Evaluation*: determining how well an artefact works in its environment and feeding back into building, so as to replace technologies with more effective ones. Evaluation criteria and metrics must be set up to judge performance in context or to compare performances when evaluating subsequent versions. IS evaluation makes use of mathematical modelling and computational techniques, and also empirical and qualitative methods. In evaluating instantiations, efficiency, effectiveness, and impact on environment should be considered, as well as rich phenomena as subjects interact with it in context. These human issues involve the selection of subjects, training, and the definition of tasks, so as to gain further understanding of the design problem. The interaction of humans,

organisations, and technology may require qualitative study. The knowledge needed for the evaluation activity is methodological, in the form of guidelines.

The artefacts and activities described above are combined in the *information technology design-research framework* (March and Smith, 1995), which maps the activities of building and evaluation against the four artefacts: constructs, models, methods, and instantiations. The framework explicitly excludes justifying and theory generation from design research, positing that these subsequent activities fall into the natural sciences, a view supported by Hevner et al (2004). This contrasts with the belief of DRIS (2006), who citing Rossi and Sein (2003) and Purao (2002), add a fifth output: construction of better theory.

DRIS describes the methodology of design research. Each step results in an output and, typically, these steps are:

- *Awareness of problem*: resulting in a proposal;
- *Suggestion*: using human creativity to suggest new functionality, leading to a tentative design;
- *Development*: actual production of the artefact. This may involve normal methods of practice, with the novelty being in the design;
- *Evaluation*: which may involve quantitative and qualitative methods, and which produces performance measures. If they deviate from expectations, this must be tentatively explained. Where initial hypotheses about an artefact's behaviour are not borne out (as occurs frequently), the new information is used to generate modified hypotheses and is fed into an iterative loop back to earlier processes. When the final cycles of design and development are done; there is:
- *Conclusion*: bringing the research to a 'satisficing' end, where the results are deemed to be adequately satisfactory. Satisficing means finding satisfactory solutions while sacrificing an exhaustive search through all the possibilities.

The question arises: What is the difference between design research (here termed design-science research) and normal design?

DRIS (2006) maintains that DSR produces interesting new knowledge for the user community over and above the designed artefact/s. Research efforts should be focused on areas of complexity. March and Smith (1995) posit that building the first version of an artefact can be considered research, provided that it holds utility. The contribution to research is in its novelty and in the credibility of its claims to effectiveness. The research contribution in building subsequent artefacts is on the basis of improved and more comprehensive performance. This is supported by Hevner *et al.* (2003), who believe that design-science research addresses major unsolved problems in unique or innovative ways and previously-solved problems in more efficient or effective ways. Finally, March and Smith (1995) stress that IT research should pay as much attention to novel instantiations as it does to constructs, models and methods, such as various formalisms. Actual instantiations and implementations can provide real-world proof that artefacts work.

Design research in the disciplines of IS and its MIS subarea is characterized by rigour and thoroughness. Hevner *et al.* (2004) present a comprehensive *information systems research framework*, which is an extension of March and Smith's (1995) information technology design-research framework. The environment of Hevner *et al.*'s framework is Simon's (1981) 'problem space' containing organizations, people, and technology. This integrated framework shows the contributions of design research and behavioural research to IS research, where design science conducts the *develop/build* phase, building and evaluating artefacts, while behavioural science induces the complementary *justify/evaluate* phase, developing and justifying theories, and explaining and predicting phenomena.

To conclude this subsection Hevner *et al.*'s (2004) seven guidelines for design-science research in IS are presented:

1. **Design:** An innovative, viable artefact must be designed and produced (construct, model, method, or instantiation) to address a particular organisational problem. The artefact is unlikely to be a full-scale operational product for use in practice.

2. **Relevance:** A technology-based solution must have utility in addressing the problem.
3. **Evaluation:** Utility, quality and efficacy must be rigorously demonstrated by appropriate well-executed evaluation methods. Integration of the artefact into its technological environment should be investigated, as well as the artefact's 'style' (Norman, 1988, cited by Hevner *et al.*) Evaluation methods include observational, analytical, experimental, testing, and descriptive techniques.
4. **Research contributions:** These should be clear and verifiable in terms of the artefact and its design foundations or creative methodologies; as well as new, innovative and interesting.
5. **Rigour:** Rigorous methods should be used in construction and evaluation, but the emphasis on rigour and mathematical formalisms should not reduce relevance. The use of effective metrics related to the evaluation criteria is vital, because performance claims are based on these metrics. Furthermore, the human aspects should be addressed appropriately.
6. **Design as a search process:** Desired ends should be achieved and an effective solution found, while still satisfying laws in the problem space. Suitable methods are iteration, heuristic search, generate-and-test cycles, and means-ends analysis. The problem can initially be simplified and decomposed, followed by expansion, i.e. a satisficing approach.
7. **Communication:** Results should be presented both to technology- and management-oriented audiences. The former require construction and evaluation details, while the latter (potential end-users) are concerned about the artefact's impact, novelty and effectiveness.

### *Epistemology of DSR*

Design research changes the state-of-the-world by introducing novel artefacts (DRIS 2006). Thus, in contrast to a positivist ontology, it acknowledges alternative world states, but these multiple world states are

not identical to the multiple realities of interpretivism. In view of this, DRIS suggests that DSR is neither positivist nor interpretive research, but in between as a philosophical perspective with a pragmatic, problem-solving approach that tolerates ambiguity. However, DSR's cycles of observation and interventions are similar to those of action research and thus DSR has aspects of interpretivism, although its time frame is shorter than that of AR, because it excludes social group interactions.

Regarding the epistemology of DSR, the basis of its knowledge claims are as follows (DRIS 2006): an artefact is constructed; its behaviour is determined by its interactions; descriptions of these interactions are information; and to the degree that the behaviour is predictable, the information is true. This can be termed 'knowing through making', and is in line with the claim by Hevner et al (2004) that knowledge resulting from DSR is obtained via construction in context, and its meaning is iteratively revealed through cyclic study of the constructed object.

### *Application within IS*

DSR is appropriate for problems with ill-defined environments, complex interactions, and flexibility for change. There is a critical dependence on human cognition, creativity and teamwork to produce solutions. Use of existing foundational and methodological knowledge helps to achieve rigour, but where there is no pre-existing knowledge, designers must rely on intuition, experience and trial-and-error. An artefact developed in this way is an experiment, hence the value of building prototypes.

At this stage there are not many well-documented cases of the use of DSR in IS projects. Hevner *et al.* (2004) identify and cite three IS studies, which can be considered as design-science research and use them to illustrate the application of their seven design-science guidelines for IS research (previous-but-one section). The application domains of these three are, respectively: (i) the development of new techniques for implementing anonymity in group decision support systems, (ii) a proposed design for a routing language, and (iii) a design theory for the development of a particular class of IS.

## **Design-based Research in Educational Technology**

As stated in the previous section, design research is undertaken in various disciplines, including the learning sciences and educational technology (ET). This section considers design research in ET, where certain researchers refer to the ‘design experiments’ of educational practice, yet others to ‘formative research’, and where the current prevailing term is *design-based research* (DBR). It is a maturing field, widely discussed in current literature, entailing meta-analyses as well as reported research. To clarify the terminology, Wang and Hannafin (2005:7) compiled a table of terms and associated methods. This table is not shown here, but interested readers may consult it.

### *Definition and Origins*

As outlined in the discussion of design research in IS, the design sciences relate to man-made objects/phenomena, including instruction, which is frequently based on prescriptive theories and procedures. Education is characterized by complex problems and the invention of solutions, and also by the construction and evaluation of artefacts or interventions. It is a suitable domain for the application of a design-based research approach which, according to the Design-Based Research Collective (2003) and Wang and Hannafin (2005), is an emerging paradigm for educational inquiry, in which:

1. The goal of designing learning environments in real-world settings is related to the goal of developing prototypical theories.
2. Development and research occur through continuous cycles of analysis, design, development, enactment, evaluation, re-design.
3. Research should result in contextually-sensitive, sharable design theories, communicated to practitioners and designers.
4. The success or failure of a design in its setting should be documented and accounted for.

Barab and Squire define design-based research as a series of approaches which aim to produce new theories, artefacts, and practices

related to teaching/learning in natural settings. In the specific context of ET, DBR is elaborated by Wang and Hannafin (2005) as being:

- *Pragmatic and theoretical*: extending/generating theory and also producing principles to inform and improve practice.
- *Grounded*: design conducted in real-world contexts; ideally, theory-driven, based on an appropriate learning/instructional theory.
- *Interactive, iterative and flexible*: designer-researcher-participant teamwork; iterative cycles; formative evaluation generates evidence to guide revision and improve design; initial prototypes.
- *Integrative*: hybrid research methods; data from multiple sources.
- *Contextualised outputs*: results connected to research setting; the design principles generated vary according to context.

Viewing design science and design research as portrayed in literature of educational technology and the learning sciences, ET research has different methodologies and frameworks from those of IS design research, with its software engineering roots. Current ET research displays a strong interpretive paradigm, in contrast to its former positivist stances and quantitative studies, Reeves (2000b) mentions an increase in qualitative studies and mixed methodologies, along with the recent upsurge in design research and formative research.

### *Research Process and Methods*

The focus of this article is research in computing-related disciplines, including educational technology applications in the broad area of e-learning. However, it is necessary to mention 'design experiments' in the learning sciences, which led to the evolution of design research in ET. Design experiments did not occur solely in the context of educational technology, and the term 'design' may refer to the design of experiments or learning configurations, not necessarily to the design of artefacts. Ann Brown (Brown, 1992) – a learning theorist, trained to work in controlled

laboratory settings – transported her work to research activities in natural settings. She engineered innovative educational environments and conducted experimental studies on methods of teaching and self-reflective learning in the context of children reading educational content, then comprehending and retaining it. Her work is ‘intervention research designed to inform practice’ (Brown, 1992:143), but based on theoretical concepts that show why the methods work, and make them reliable. Despite the applied setting, the ultimate goal is not only to inform practice, but to work towards theoretical models. A further pioneer is Allan Collins (1992) who, using the term ‘design science of education’, conducted design experiments on ways of using technology in the school classroom. His immediate goal was not to design new technology (though this is not excluded), but to investigate, evaluate and compare different educational technologies and computing tools in supporting learning about climate and the earth-sun relationship. The long-term goal is to use design experiments to construct a systematic methodology, a design science, to support educators in exploring the huge problem space of possible designs for classroom-learning with technology. This science would determine how various designs of learning environments contribute to learning. Ultimately, as in Brown’s aim, a design theory should be developed to guide educational innovations.

A decade and more later, several well-known researchers refer back to this original work and reflect on the present status and impact of DBR in the learning sciences and educational technology, among others: Sasha Barab and Kurt Squire, Allan Collins and team, Paul Cobb and others, the Design-Based Research Collective, Michael Hannafin and Feng Wang, Thomas Reeves, and EduTech Wiki (an ed-tech design-based research group, similar to DRIS in IS).

Citing the pioneers, Brown (1992) and Collins (1992), Reeves (2000b) notes the relationship of design experiments with development research and lists some characteristics of design experiments. They:

- address complex problems in real contexts in collaboration with practitioners, and
- integrate existing design principles with technology to produce plausible solutions to the problems.

- Rigorous and reflective inquiry is conducted to test and refine innovative learning environments and to define new design principles.

Collins (same Collins), Joseph and Bielaczyc (2004), now using the term 'design research', reflectively outline theoretical and methodological issues that have emerged in the evolution of design research in the study of learning, namely:

- theoretical issues about the nature of learning in context.
- approaches to studying learning phenomena in the real world rather than in a laboratory.
- derivation of generic research findings from formative evaluation.

Are these approaches always successful? No; complex real-world situations present challenges, due to the inherent lack of control and large amounts of data from triangulated ethnographic and quantitative studies. There is a notable correspondence between these challenges and Kock's (2004) concerns (in the section on action research), highlighting again the commonalities between the interpretive approaches in this meta-research study. Collins et al (2004) raise the further issue that design as implemented, or enacted, often differs from the design as intended. This is in line with 'incorporated subversion' (Squires, 1999), a term describing how users configure, or subvert, an environment or system to their own needs, and use it in ways not intended by the original designer.

What is distinctive about DBR? Barab and Squire (2004) refer to the methodologies of Brown and Collins, which investigate learning in natural contexts – yet explicitly designed by the researcher and with systematic adjustments so that each adaptation provides further experimentation. Barab and Squire's view of design research involves the development of technological tools and, particularly, the generation and testing of theories to support understanding and prediction of learning. Other research methods also generate theory, but DBR's defining feature is its aim to influence

practice with real changes at local level and to develop tangible artefacts that can be used elsewhere. DBR also has similarities to action research in that it is an action-oriented perspective, which sets out to change situations (EduTech Wiki, 2006). Barab and Squire (2004) do, however, exercise a word of caution regarding to what extent context-specific research claims can be used in inform broad practice.

Features have been extracted from the extensive meta-analyses and reflective studies of Barab and Squire (2004); Cobb, Confrey, diSessa, Lehrer, and Schauble (2003); the Design-Based Collective (2003), EduTech Wiki (2006), and Wang and Hannafin (2005) and have been synthesized and classified by the present author into Table 1, which is a summary of the main features of DBR in educational technology and the learning sciences.

<i>Feature of DBR models</i>	<i>Elaboration</i>
<b><i>Real-world problems</i></b>	<b><i>Design theory addresses complex problems in collaboration with practitioners/educators.</i></b>
<b><i>Problem solutions grounded in pre-existing theories,</i></b>	<b><i>Where appropriate theories/principles pre-exist, design should be theory-driven, along with technological affordances, to propose solutions to the problems.</i></b>
<b><i>Innovation</i></b>	<b><i>DBR should investigate less-common practices and generate technological support; design of innovations, novelty, interventionist approaches.</i></b>
<b><i>Engineering</i></b>	<b><i>Designing forms, means, or artefacts of learning; systematically studying them and the consequent learning.</i></b>
<b><i>Iterative design,</i></b>	<b><i>Cycles of design, enactment, analysis, redesign.</i></b>
<b><i>Context</i></b>	<b><i>Research studies in context, i.e. in naturalistic settings; use of artefacts/ interventions in the real-world; theories also to be contextualized.</i></b>

<b>Empirical research</b>	<i>Researching tangible, real-world products, which ideally, should be usable elsewhere, i.e. influence on practice.</i>
<b>Refining the artefact /system,</b>	<i>Using formative evaluation to derive research findings; design and explore artefacts, environments, etc. with rigorous inquiry methods to refine them and define new design principles.</i>
<b>Output artefacts</b>	<i>Real-world products; technical and methodological tools; frameworks and models; curricula; theories.</i>
<b>Developing theories</b>	<i>The generated theories to be evaluated and refined, a prospective-theory-conjecture-reflection cycle.</i>
<b>Pragmatic</b>	<i>The theories developed should do real work,</i>
<b>Synergy</b>	<i>Design, research, theory and practice are advanced concurrently.</i>

Table 1: *Summary of features of design-based research models (synthesized by the author)*

### *Epistemology of DBR*

Reeves (2006) queries whether ET research is basic research to extend the body of knowledge or applied research to solve real problems. Reeves cites Stokes' (1997) call for 'use-inspired basic research', where advances in technology advance new types of research, producing a reversed model that moves from applied- to basic research.

The previous section noted the suitability of design experiments and design research for problems in ill-structured environments with complex interactions. The experimental generation of new prototypes highlights the roles of cognition, intuition, creativity and teamwork in solving problems and knowledge generation. The philosophical foundation of DBR is thus not a positivist approach to enquiry, but a pragmatic form of enquiry, where judgement is based on the ability of a theory to work in the real world (Barab & Squire, 2004). Evidence-based claims demonstrate that a particular design works, relating it to contemporary theoretical issues and furthering theoretical knowledge. This enquiry occurs in naturalistic settings, as

knowledge about artefacts such as e-learning applications evolves in context, and even by trial and error.

This investigation in context leads to a 'minimal ontology', in that researchers cannot return to the laboratory to further test their claims. Moreover, the research is not replicable due to the role of context.

Validation occurs when results regarding the designed object are validated by actual use. The Design-Based Research Collective (2003) points out that validity can be addressed by iterative evaluation processes, confirming findings and aligning theory, design and practice.

### *Application within IS*

The e-learning subset of IS applications, according to a broad definition, includes multiple formats and a range of technologies such as the Internet, Web-based learning, multimedia CD-ROM, online instruction, learning management systems, educational software, and traditional computer-assisted learning (CAI) (de Villiers, 2005b). Research on aspects such as the delivery, content and architecture of some of the above forms of e-learning is being undertaken for masters- and doctoral studies. A number of these studies can be considered as design-based educational technology research approaches. For example, a recent South African study (Masemola & de Villiers, 2006) in the HCI subdiscipline, proposes, uses and refines a framework for usability testing of e-learning applications. The approach, although not explicitly set out as a design research study, qualifies as design research. The research output is not the pre-existing e-learning application. Instead, the output artefact is the usability-testing framework, which informs practice in the immediate context of the usability study, and also contributes to a generic usability testing framework, due to innovative ways of using usability laboratory technology to add value to evaluation of applications in non-standard domains.

Wang and Hannfin (2005) propose that design-based research has an important role to play in the development of technology-enhanced learning environments (TELEs) (Wang & Hannfin, 2005). TELEs are learning and instructional systems incorporating teaching for the acquisition of skills and knowledge, a variety of tools, and technological resources. However they

have had little direct influence on practice. Facing a core problem, namely, that TELÉs lack a clear underlying theoretical framework, Wang and Hannafin recommend DBR to address the future situation, so that design and research activities can become reciprocal as the design of TELÉs and the development of appropriate learning theories proceed concurrently, each mutually informing the other.

## **Conclusions about Design- and Development Research**

### **Family**

The design-and development family of research models differ from classic research, in that they address complex and 'messy' real-world practice, founded on contexts with multiple dependent variables. The role of end-users should be not as subjects, but as participants (although this is not always the case in IS research within organisations). There is no testing of hypotheses, but rather reflection and evaluation, flexible design revision of artefacts and products, and development of theories for actual practice (Barab and Squire, 2004).

The present author believes that the currently prevalent forms of design research are maturing, particularly as their theoretical and methodological underpinnings are the object of focused attention. In time it is possible that they will subsume the less high-profile development research.

### **Conclusion to Article**

Certain research issues are best suited to interpretive and context-dependent approaches. For situations where human performance and social inquiry are relevant, the research models advocated in this article can be considered as supporting frameworks for Informatics research on an interpretivist platform. Action research, grounded theory, development research, design-science research, and design-based research all provide theoretical frameworks and methodologies to guide a research project, providing cohesion, internal continuity and consistency as the study progresses. When one of these approaches is used as a model, the activities, relationships, and reasoning

entailed in the research process should be explicitly linked to the selected approach, so that its framework dictates the steps. Regular textual and diagrammatic reference to the model in the written document can enhance the study, providing underlying structure and a unifying thread, both for the researcher and the readers.

These approaches are particularly relevant for research focused on applications for end users who are not computing professionals, and for milieus where the IS researcher is not restricted to working in an organisational environment. Examples are the investigation of software or Web applications for personal computing, and systems for the empowerment of learners or indigenous peoples. These may be small-scale studies, often for doctoral- or masters research, with constrained budgets. It is not the intention that the approaches should be used simultaneously; although this metaresearch study has shown commonalities, inter-relationships, and similarities. There are situations where the use, in tandem, of more than one research approach for different aspects of a study, has a synergistic impact.

Walsham (1995a:76, citing Eisenhardt's (1989) discussion on theory in organizational research) stresses the role of theory in interpretive IS research. He identifies 'three distinct uses of theory': (i) as an initial guide to design and data collection; (ii) as part of an iterative process of data collection and analysis; and (iii) as a final product of the research'. From the studies of AR, GT, DR, DSR, and DBR, respectively, it is evident that each of them meets the first criterion in terms of offering a basic research design. With regard to the second required use of theory, each research model requires iterative data collection, evaluation/critical reflection and analysis as an integral part of the approach. And, in general, they aim to generate some new principle or form of theory as a product or byproduct of research.

This study is not intended to be exclusive: there is much scope for positivist IS research, as well as hybrid forms. Furthermore other interpretive approaches exist; the literature mentions interpretive means such as case studies, critical theory, descriptive studies, document analysis, ethnography, field studies, focus groups, hermeneutics, phenomenology, role play and semiotics (du Plooy, 2004; Olivier, 2004; Travis, 1999; Walsham, 1995a; 1995b). However, action research and grounded theory are consistently advocated. One of the sources studied was Michael Myers' detailed,

hyperlinked overview of Qualitative Research in Information Systems (Myers, 2004), which converges closely with the present independent suggestions. He recommends the approaches of (i) action research, (ii) case studies, (iii) ethnography and (iv) grounded theory. The first and the fourth confirm the present suggestions, while the both the second (case studies) and third (ethnography), relating to field-based and contextual studies, can be used as methods within the models proposed here. Then there is the independent plethora of literature (consulted in this study) presenting the design- and development-oriented approaches, which hold high utility for future application in information systems research.

The advent of personal computing and the impact of the HCI subdiscipline are changing the nature of information systems and hence the forms of research in Informatics. The findings of academic research and real-world best practice should inform each other. The social inquiry research approaches outlined in this paper and research activities conducted in natural settings, have the potential to impact on performance in interactive computing applications. Findings should contribute to theory and to real-world systems, should generate design principles and evaluation criteria, should encourage sound interaction practices, and help to support technological bridges over the digital divide.

\* Note: For some who may be unfamiliar with terminology, a few words are explained in a glossary after the references.

## References

- Alexander C, S Ishikawa & M Silverstein 1977. *A Pattern Language*. New York: Oxford University Press.
- Baskerville, RL 1999. Investigating Information Systems with Action Research. *Communications of the Association for Information Systems*, 2 (Article 19). Retrieved May 2006 from <http://cais.isworld.org/articles/2-19/>
- Baskerville, RL & AT Wood-Harper 1996. A Critical Perspective on Action Research as a Method for Information Systems Research. *Journal of Information Technology* 11:235-246.

- Barab, S & K Squire 2004. Design-based Research: Pitting a Stake in the Ground. *The Journal of the Learning Sciences* 13,1:1-14.
- Brown, AL 1992. Design Experiments: Theoretical and Methodological Challenges in Creating Complex Interventions in Classroom Settings. *The Journal of the Learning Sciences* 2,2: 141-178.
- Cobb, P, J Confrey, A Disessa, R Lehrer & L Schauble 2003. Design Experiments in Educational Research. *Educational Researcher* 32,1: 9-13.
- Collins, A 1992. Toward a Design Science of Education. In Scanlon, E & T O'Shea (eds): *New Directions in Educational Technology*. Berlin: Springer-Verlag.
- Collins, A, D Joseph & K Bielaczyc 2004. Design Research: Theoretical and Methodological Issues. *The Journal of the Learning Sciences* 13,1: 15-42.
- Conradie, MM & MR De Villiers 2004. Electronic Assessment of Free Text: A Development Research Initiative. *South African Journal of Higher Education* 18,2: 172-188.
- Cockton, G 2002. *My Grounded Design Page*. Retrieved May 2006 from <http://www.cet.sunderland.ac.uk/~cs0gco/grounded.htm>
- Cockton, G 2004. *A Tutorial: Grounded Design and HCI*. September 2004. Pretoria: University of South Africa.
- Cohen, L, L Manion, & K Morrison 2000. *Research Methods in Education*. London: RoutledgeFalmer.
- Derntl, M & Motschnig-pitrik 2004. A Pattern Approach to Person-Centered e-Learning Based on Theory-Guided Action Research. *Proceedings of the Networked Learning Conference 2004*.
- Design Research in Information Systems (DRIS) 2006. Retrieved September 2006 from <http://www.isworld.org/Researchdesign/drisISworld.htm>
- De Villiers MR 2005a. Three Approaches as Pillars for Interpretive Information Systems Research: Development Research, Action Research and Grounded Theory. In Bishop, J & D Kourie. *Research for a Changing World: Proceedings of SAICSIT 2005*: 142-151. ACM International Conference Proceedings Series.
- De Villiers, MR 2005b. e-Learning Artefacts: Are they Based on Learning Theory? *Alternation* 12,1b: 345-371.

- Dick, B, R Passfield, & P Wildman 1995. A Beginner's Guide to Action Research. Retrieved September 2006 from <http://www.scu.edu.au/schools/gcm/ar/arp/guide.html>
- Du Plooy, N 2004. Information Systems Research. Presentation at *Doctoral Seminar: Research Methodologies in Informatics*. January, 2004. University of Pretoria.
- Du Poy, E & LN Gitlin 1998. *Introduction to Research: Understanding and Applying Multiple Strategies*. St Louis: Mosby Inc.
- Edutech Wiki 2006. *Design-based Research*. Retrieved August 2006 from [http://edutechwiki.unige.ch/en/Design-based\\_research](http://edutechwiki.unige.ch/en/Design-based_research)
- Glaser, BG 1992. *Basics of Grounded Theory Analysis*. Mill Valley CA: Sociology Press.
- Glaser, BG & AL Strauss 1967. *The Discovery of Grounded Theory*. Chicago: Aldine.
- Glass, RL, V Ramesh & I Vessey 2004. An Analysis of Research in Computing Disciplines. *Communications of the ACM* 47,6: 89-94.
- Hevner, AR, ST March, Park & S Ram 2004. Design Science in Information Systems Research. *MIS Quarterly* 28(1) 2004:75-105.
- Hirschheim, R & HK Klein 2000. Information Systems Research at the Crossroads: External versus Internal Views. In Baskerville, R, J Stage & J de Gross (eds): *Proceedings of the IFIP TC8 WG 8.2 International Working Conference on the Social and Organizational Perspective on Research and Practice in Information Technology*, Boston, MA: Kluwer Academic Publishers.
- Klein, HK & MD MYERS 1999. A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems. *MIS Quarterly* 23,12: 67-93.
- Kock, N 2004. The Three Threats of Action Research: A Discussion of Methodological Antidotes in the Context of an Information Systems Study. *Decision Support Systems* 37: 265-286.
- Leedy, PD & JE Ormrod 2001. *Practical Research: Planning and Design*. Upper Saddle River, NJ: Merrill Prentice Hall.
- Lincoln, YS & EG GUBA 1985. *Naturalistic Inquiry*. Newbury Park: Sage Publications.
- March, ST & GF SMITH 1995. Design and Natural Science Research on Information Technology. *Decision Support Systems* 15: 251-266.

- Masemola, SS & MR De Villiers 2006. Towards a Framework for Usability Testing of Interactive e-Learning Applications in Cognitive Domains, Illustrated by a Case Study. In Bishop, J & D Kourie. *Service-Oriented Software and Systems: Proceedings of SAICSIT 2006*: 187-197. ACM International Conference Proceedings Series.
- Mertens, DM 1998. *Research Methods in Education and Psychology: Integrating Diversity with Quantitative and Qualitative Approaches*. Thousand Oaks: Sage Publications.
- Mouton, J 2001. *How to Succeed in your Master's and Doctoral Studies: A South African Guide and Resource Book*. Pretoria: Van Schaik Publishers.
- Myers, MD 2004. Qualitative Research in Information Systems. Original Version: *MIS Quarterly* 21,2, 1997:241,242. Updated in *MISQ Discovery* modified Sept 08, 2004. Retrieved May 2006 from: <http://www.qual.auckland.ac.nz/>
- O'Donovan, B & D Roode 2002. A Framework for Understanding the Emerging Discipline of Informations Syste.ms. *Information Technology & People* 15,1: 26-41.
- Olivier, MS 2004. *Information Technology Research: A Practical Guide for Computer Science and Informatics*. Pretoria: Van Schaik Publishers.
- Orlikowski, WJ 1993. CASE Tools as Organizational Change: Investigating Incremental and Radical Changes in Systems Development. *Management Information Systems Quarterly* 17,3.
- Pather, S & D Remenyi 2004. Some of the Philosophical Issues Underpinning Realism in Information Systems: From Positivism to Critical Realism. In Marsden, G, P Kotzé & A Adessina-Ojo (eds): *Fulfilling the Promise of ICT - Proceedings of SAICSIT 2004*. Pretoria.
- Plomp, T 2002. *Some Reflections on Development Research (DR)*. Seminar at the Faculty of Education, University of Pretoria. August 2002.
- Preece, J, Y Rogers & H Sharp 2002. *Interaction Design: Beyond Human-Computer Interaction*. London: John Wiley & Sons, Inc.
- Reeves, TC 2000a. Socially Responsible Educational Technology Research. *Educational Technology* 40,6: 19-28.
- Reeves, TC 2000b. Enhancing the Worth of Instructional Technology Research through 'Design Experiments' and other Development Research Strategies. Paper at *International Perspectives on*

*Instructional Technology Research for the 21<sup>st</sup> century, Symposium by SIG/Instructional Technology at Annual Meeting of the American Educational Research Association.* New Orleans, April 2000.

Roode, D 2003. Information Systems Research: A Matter of Choice? *South African Computer Journal* 30: 1-2.

Roode, D 2004. The Role of Empirical versus Conceptual Approaches. Presentation at *Doctoral Seminar: Research Methodologies in Informatics*. January, 2004. University of Pretoria.

Schön, DA 1987. *Educating the Reflective Practitioner*. San Francisco: Jossey-Bass Publishers.

Simon, HA 1981. *The Sciences of the Artificial*. Cambridge, MA: MIT Press.

Squires, D 1999. Educational Software for Constructivist Learning Environments: Subversive Use and Volatile Design. *Educational Technology* 39,3: 48-53.

Strauss, AL & J Corbin 1990. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Newbury Park, CA: Sage.

The Design-Based Research Collective 2003. Design-based Research: An Emerging Paradigm for Educational Inquiry. *Educational Researcher* 32,1: 5-8.

Travis, J 1999. Exploring the Constructs of Evaluative Criteria for Interpretivist Research. In *Proceedings of the 10<sup>th</sup> Australasian Conference on Information Systems 1999*: 1037-1049.

Urquhart, C 2001. Analysts and Clients in Organizations; A Conversational View. *Journal of Strategic Information Systems* 10,3: 243-262.

Urquhart, C 2002. Regrounding Grounded Theory – or Reinforcing Old Prejudices? A Brief Reply to Bryant. *The Journal of Information Technology Theory and Application (JITTA)* 4,3: 43-54.

Van den Akker, J 1999. Principles and Methods of Development Research. In van den Akker, J, RM Branch, KL Gustafson, N Nieveen & T Plomp (eds): *Design Approaches and Tools in Education and Training*. Dordrecht: Kluwer Academic Publishers.

Van den Akker, J 2002. The Added Value of Development Research for Educational Development in Developing Countries. In Osaki, K, W Ottevanger, C Uiso & J van den Akker (eds): *Science Education Research and Teacher Development in Tanzania*. Amsterdam: Vrije Universiteit, International Cooperation Center.

- Walsham, G 1995a. Interpretive Case Studies in IS Research: Nature and Method. *European Journal of Information Systems* 4,2: 74-81.
- Walsham, G 1995b. The Emergence of Interpretivism in IS research. *Information Systems Research* 64: 376-394.
- Wang, F & MJ Hannafin 2005. Design-based Research and Technology-enhanced Learning Environments. *Educational Technology Research and Development* 53,4: 5-23.
- Wood-Harper, T 1985. Research Methods in Information Systems: Using Action Research. In Mumford, E et al (eds): *Research Methods in Information Systems*. North-Holland: Elsevier Science Publishers B.V.
- Zuber-Skerrit, O 1992. *Action Research in Higher Education*. London: Kogan Page.

## **Glossary**

- Empirical:** Based on the results of experiments and/or observations, not based on theory.
- Epistemology:** Theory of the grounds of knowledge, how knowledge is produced, basis of claims to knowledge.
- Hermeneutics:** The science of interpreting the intention of the original author or researcher.
- Methodology:** A set of methods used in a process of inquiry.
- Ontology:** The science of the essence of being; closely related to one's view of reality.
- Paradigm:** The underlying philosophy and assumptions that form the foundation to one's approach and methodology.
- Substantive:** Having a separate and independent existence, not merely inferential or implicit.

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# **The Effective Use of Computer Systems at the University of KwaZulu-Natal**

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## **Abstract**

As Information Communication Technologies mature, it is expected that the use of powerful, multifunctional networked and wireless computer systems will form as an ubiquitous part of every-day life as the cell phone has become today (Klopper 2002, 2005), also in institutions of higher education. The case study conducted on the Westville Campus of the University of KwaZulu-Natal begins to provide answers regarding the effective use of the computer systems at residential tertiary institutions. Data was gathered by randomly selecting 90 persons, staff members and students of different Faculties at the University of whom eighty respondents completed and returned the questionnaires. The data was analysed and processed using the application software Microsoft Excel. Recommendations and conclusions drawn from the findings were the need for teaching and training in computer hardware, computer literacy and the need for computer access and print services facilities. The combination of the new educational technologies with traditional pedagogical models and the appointment of schools (as an important point of social integration), constitute important conclusions of this research.

## **Introduction**

The sophistication and complexity of computer hardware has been growing exponentially, especially computer hardware in business. Hardware affects computer storage (data), communication and the output and input of data (on

which business depends). All educational grade levels use computer hardware to provide students and teachers with access to information in order to offer a range of exciting and innovative multidisciplinary courses that broaden perspectives, foster a capacity for independent critical thinking, and provide intellectual tools for development. Education management needs to know how effective the computer hardware being used, is.

## **Problem Statement**

For the quality of education to be improved, instructors and students need to know how to use the hardware as it is a key issue when deciding how information is translated into comprehensible knowledge or if it is worthwhile application for education. Using traditional educational approaches is difficult when the costs and benefits of Information Systems (IS) technologies, are intangible. This does not mean that education should abandon them. On the contrary, caution should be applied to avoid the assumption that if something cannot be measured, it should be ignored.

## **Literature Review**

The use of computers in education has changed the way that people learn. In the past, most computers were placed in computer laboratories (Barrett, 1996) where students were sent for self-paced tutorials. Barrett (1996) believed that this was not education and that technology should support the complex private and social activities that make up the learning process. With this in mind, MIT (Massachusetts Institute of Technology) created a fully distributed computing environment to support learners through the provision of electronic mail, access to software, personal file storage and other communications utilities. In this way, computers were used to aid students in the learning process (Barrett, 1996). Hodorowicz (2000) argued that computers and technology had enhanced the educational process in several key ways. The largest benefit of technology is easy and fast access to the Internet. Bengu (1996) notes that the move to on-line education via the Internet is likely to reduce the cost of education, thus it is creating new learning opportunities for students.

## **Computer Functionality**

Ellington and Earl (1998) assert that educational technology is based on what is described as the 'technology in education' models. These models embrace all possible means by which information could be presented, namely hardware and software.

The hardware side is concerned with the actual equipment - overhead projectors, slide projectors, tape recorders, television equipment, computers and all its peripherals, etc. The software side was concerned with the various things used in conjunction with this equipment (overhead transparencies, slides, audiotapes, videotapes and computer programs). Ellington and Earl (1998) also assert that the first phase in the evolution of educational technology was the 'hardware phase'. This concentrated on the development of effective instructional equipment which was reliable, serviceable and within the budgets of schools, colleges and universities. However, when such hardware eventually became generally available, it was found that there was a shortage of suitable software to use with it. This triggered off a subsequent 'software phase', in which particular attention was paid to the development of suitable learning materials, based on the dominant theories of learning and perception. Thus, even within this early development of educational technology, modifications can be identified in the interpretation of the definition 'technology'.

The term hardware (Curtin *et al.*, 1998) refers to the physical equipment in a computing system, usually containing electronic components and performing some kind of function in information processing, input, output, storage and communication. Hardware includes computer devices such as screens, keyboards and printers and also peripherals (any physical equipment attached to computers) and the elements used to tie information systems together. The role of hardware is to enable all the process functions to perform properly.

## **Effective Use**

An organisation can achieve benefits from computerization by automating existing jobs, thus lowering the cost of production and becoming more

efficient. For instance, switching from a manual system of stock accounting to a computerized inventory system, using computer application software, rather than the previous manual methods results in much faster rates and can be efficient methods of processing for the company (Erwin & Blewett, 1996).

## **Service Quality**

To examine service quality in some section of an organisation, large survey samples are needed to verify whether the service lives up to users' expectations. Pitt *et al.*, (1997) point out that service plays an important role in any Information Systems department of organisations, and that most IS assessment measures have a product orientation. The article suggests the use of an IS version of a service quality instrument (modified for context) to assess the quality of service supplied by an information services provider.

## **System Quality**

Measures of system quality typically focus on performance characteristics of the system under study. Some research has looked at resource utilization and investment utilization, hardware utilization efficiency, reliability, response time, ease of terminal use, content of the database, aggregation of details, human factors and system accuracy. This list has hardly changed since having first been introduced a quarter of a century ago. Hamilton *et al.* (1981) already provided one of the first lists of system quality measures (turnaround time, data accuracy, reliability, completeness, system flexibility and ease of use).

## **Response Time**

Functionality refers to the ability of the chosen computer hardware and software package to handle the intended business requirements (Erwin & Blewett, 1996). If the business requires the latest version of hardware and software of computer equipment, it must acquire it. Education or business should evaluate the equipment (hardware) that runs the required software.

Referring to performance again Erwin and Blewett (1996), note that the performance of the computer refers to the 'throughput' (the amount of processing which the computer completes in a given time) and 'response time' (the delay in processing a single transaction from the time the transaction first enters the computer system to the time the transaction begins to produce a result).

The area of information systems reliability assurance is taking on increasing importance as several professional accountancy bodies have adopted standards and criteria for assurance practices. This importance is compounded by the inevitability of a shift in future audit models to an emphasis on information systems reliability. Conflicts occur in attempting to use structured analysis to evaluate development processes that are often dynamic rather than static. Discussion shifts to a consideration of the inexcusable absence, in both assurance models and development processes, of the impact of technology implementations on individuals and society (Sutton, 2000).

## **Networked Education**

Networking technologies provide a data link layer function, thus allowing a reliable connection between one computer and another on the same network. The Internet is a set of interlinked networks (the same principle on a larger scale). Nowadays it links millions of networks, large and small, government and private, commercial and academic throughout the world. Originally, before personal computers, hardware for a mainframe computer was centralized in one room. Anyone wanting computer access had to go to where the computers were located. Today most large computers are decentralized. That is, the computer itself and some storage device may be in one place, but the terminals to access the mainframe computer, or even other computers, are distributed among users. On the Internet these devices are usually connected together by telephone lines (Capron, 1998).

Data communication (also called telecommunications) is the electronic collection and distribution of information from and to remote facilities. Data communication hardware is used to transmit digital information between terminals and computers or between computers. These

hardware components include the modem, the network interface card (NIC), the front-end processor, the multiplexer and the router. There are plenty of hardware devices that provide connectivity to a network. However, all the hardware does not have the same capacity. It depends on their manufacturers' quality and the material. Technology is used for a variety of applications in education. However, there are still some problems that need to be solved.

- What is the need for computer hardware at UKZN?
- What is the understanding of the university community of computer hardware?
- To what extent does the university community use computer hardware?
- How dependent is the university community on the computer hardware provided?

## **Concluding Remarks about Surveyed Literature**

The most overlooked fact is that computers should be used as an educational tool, rather than a means of education. Nothing can replace the interaction between students and teachers. However, even though it is not implemented, some traces of distance education are emerging in UKZN. So, UKZN must learn from the problems they might encounter from the mistakes of others in teaching by distance education. Problems can result from the separation of teacher and learner, the planning and preparation of learning materials, the use of media (often print-based) to carry course content and to unite teacher and student. Some form of two-way communication (this implies interactivity) with students learning as individuals, is necessary.

## **Research Methodology**

### ***Overview***

For the empirical part of this research project, which is intended as a trial survey to be followed by a more comprehensive one, a group of 80

respondents, from among an initial group of 90 prospective respondents that were randomly selected, completed the questionnaire that focuses on various aspects of computer systems usage on the Westville campus of the University of KwaZulu-Natal. Respondents were chosen by simple random selection techniques. This method was chosen as it gave each respondent an equal chance of being selected. The sample included respondents that are differentiated by gender, age, mode of study and level of study (undergraduate / postgraduate), but is not considered to be a fully representative sample. Questionnaire-based research was chosen as it would provide sufficient data cost-effectively in a short time span (Lubbe & Klopper, 2004).

### ***Data Collection***

Data was collected mainly from primary sources. A primary source reflects the individual viewpoint of a participant or observer. It is information that is obtained directly from first-hand sources by means of surveys, observation or experimentation (Lubbe & Klopper, 2004). Observation and survey methods were most applicable in the research method because surveys work best when questions are simple and easily understood by the respondent. A survey is cheaper if the researcher uses questionnaires. In the case of a survey, the observations are typically those of individual respondents and the variables are responses solicited from questions about attitudes, behaviours and traits. Primary data was gathered via a closed-ended questionnaire supplemented by observation and quantitative analysis to verify reported patterns of usage.

### ***The Questionnaire***

The questionnaire was designed to include all questions which would enable the researchers to determine whether the empirical research component would enable them to answer the research questions that were posed at the end of the literature survey. The data was analysed using the application software Microsoft Excel. A small number of partially completed questionnaires were not processed as they would have skewed the results of an already small sample. In a small number of cases where respondents initially made one response and subsequently changed their minds, and it

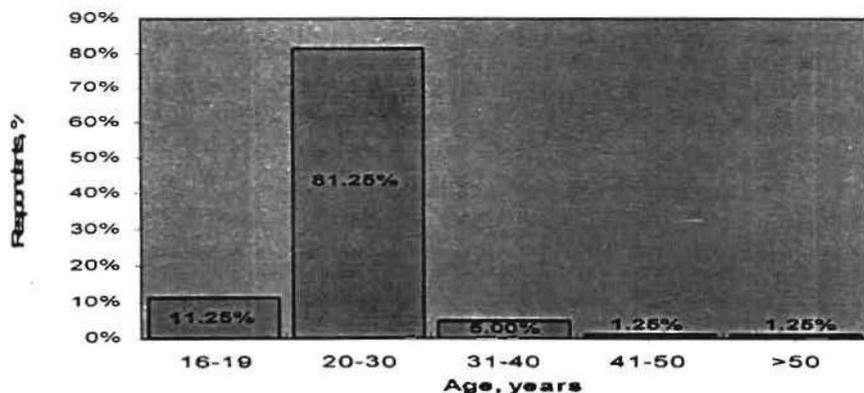
could not be established with confidence what their intended final response was, those questionnaires were also set aside. This process of data sanitation left 80 completed questionnaires with unambiguous responses that were captured, systematised and analysed.

## **Findings**

In this section the researchers present a general demographic analysis of the demographic profile of the respondents that participated in the research project.

Eighty staff members and students on the Westville campus of the University of KwaZulu-Natal were randomly selected and asked to participate in the study. All who were approached participated. Of them 66% were male respondents and 34% were female respondents. The sample is therefore not representative with regard to the gender composition of staff and students.

The distribution of the respondents in terms of age groups is presented in Figure 1. The result indicates that 11 % of the respondents of the questionnaire were between the ages of 16 and 20, 81% were between the ages of 20 and 30% were between the ages of 31 and 40, one percent was between 40 and 50 and the remaining one percent was over 50 years old.



**Figure 1: Age distribution of the respondents**

Roughly more than three quarters of the respondents were young therefore it was anticipated that the understanding of the younger generation of computer technology would be at least on the same level as older respondents. Therefore, the study group can be regarded as reasonably homogenous and the differences in responses could be due to other reasons rather than an age gap.

### ***Information Systems Users***

The research indicated that UKZN IT resource users were students and staff members. The number of respondents who reside on campus is few (16%). Analysis of the data shows that 10 out of the 13 respondents residing on campus (77%) and 33 out of the 67 respondents residing off campus (49%), primarily depend on the IT resources provided by the UKZN. All on-campus residing respondents and 82% of the respondents residing off campus mentioned problems in accessing the IT resources of the University. More than 46% of the respondents residing on campus and 70 % of the respondents residing off campus own a private computer.

There is a need for improvement on the efficiency of access to the university's IT resources. One means toward resolving this potential problem is by extending access times. It is known that the postgraduate computer laboratory facilities on the Howard College Campus of UKZN are open 24 hours a day, seven days a week, with access regulated by means of swipe cards. From the experience of other universities (e.g. Williams *et al.*, 1999) it is possible to increase access to the university's IT resources on the Westville Campus for the students and staff by providing a means of free connection to their respective residences. There are departments giving computer hardware and network connections to their members of staff in their respective residences. Similarly, some campus residences are connected to university servers. It is a good idea to take such initiatives and make them available to the rest of university IT resource users, to minimize access problems. As displayed in Figure 2, 6% were staff members and 9% were both staff members and postgraduate students, the rest (85%) were students. Students are classified according to their year of study. Most respondents were second years (30%), followed by first years (24%), postgraduates

(19%), third years (9%) and fourth years (3%). Respondents were from six different faculties. This shows that almost all faculties use the computer.

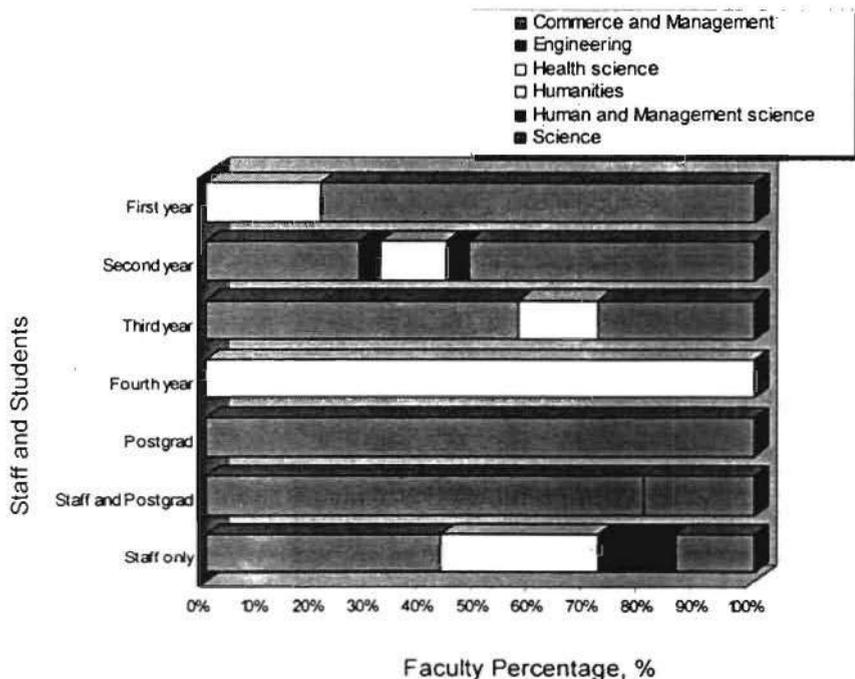


Figure 2: The demographics of the respondents in terms of Faculty

At the Westville campus of the university there are a number of computers available for registered students. Students who are not registered for computer courses might not have access because not all courses require computer access. Nevertheless, there are some centres, which provide computers to all students (engineering, library etc.). However, this would not be adequate to advance current technology. The scarcity of computer resources definitely has an effect on the learning process. Therefore, the university needs to improve computer access in every faculty. This will benefit every individual in the long run.

### **Answers to Research Questions**

The demographic data obtained from the research was presented and interpreted. The first sets of questions asked in the questionnaire were geared toward analysing the correlation between the computer hardware provided by the UKZN and the learning process. The replies of the respondents on three questions asking about the need for computer hardware in the facilitation of the learning process of the university are tabulated in Table 1. Ninety-eight percent of the respondents agreed on the beneficial use of computers in the improvement of the quality of education at the university. More than 10% agreed that was little value in the university computers, due to difficulty of use, 13% agreed, 69% disagreed and the rest 19% neither agreed nor disagreed. Fifty-eight percent of the respondents agreed, 19% disagreed and the rest 24% neither agreed nor disagreed on the insignificance of the computer resources of the university. Most of the respondents agreed that hardware would be a useful tool for education and quality of lectures. However, nearly 40% noted that hardware was not helpful and the authorities should find out why it is not helpful. It could perhaps mean that people should be trained to use the hardware.

Rating	Computers are valuable tools	Computers have little value	Computers are not very valuable tools.
Totally agree	90.0%	7.5%	38.8%
Partially agree	7.5%	5.0%	18.8%
Indifferent	2.5%	18.8%	23.8%
Partially disagree	0%	16.3%	3.8%
Totally disagree	0%	52.5%	15.0%

**Table 1: The need for computer hardware in the University**

Some of the respondents even provided a reason why computers are valuable tools in improving the quality of education, by saying it was a valuable of source for education that uses the Internet to enhance learning.

The use of computers, technology applications and hands-on learning enables each student to make a connection with the global world where they will be working after studying. As the job market tightens, universities are looking to give their students a competitive edge. With computer knowledge becoming a job prerequisite for many positions, hundreds of first world universities have made the purchase of a personal computer a prerequisite for admission. Personal computers are versatile in that they can be used as stand-alone computers or they can be linked to the university's network, the Internet or other personal computers in a classroom (Long, 2000).

### **The Need for Computer Literacy Training at UKZN**

The result from the finding indicates that 100% of the respondents agree that there is a need to learn how to use computer hardware (see Table 2). Ninety percent of the respondents agreed on the usefulness of computer literacy in the university. Most departments include a computer literacy course in their syllabus, where students are familiarized with computer applications software, especially the Microsoft product suite and web surfing. Besides these, there are a number of courses offered by the university based on advanced application software. As most of the respondents agreed, both students and staff members should be given separate hardware literacy courses and workshops to continuously update them with hardware technology and to make them appreciate the ways computers and societies have changed each other (Ryburn, 1997).

### **Frequency of Computer Usage at UKZN**

The research found that 75% often use the computer hardware of the university. Some of the respondents (18%) sometimes use the resource. The students and staff members use the computers because they are mostly on campus during working hours. The students use the free time they have between their lectures to satisfy their academic and non-academic IT requirements. Most staff members need to use computers for their daily work. It is obvious from this, that all the respondents use computer hardware.

The need for general computer literacy in the university.	%
I feel strongly it will be beneficial	61.3
I feel that it may be useful	28.8
I haven't made up my mind	8.8
I'm sceptical that it will be useful	1.3
I am sure it will not be beneficial	0

**Table 2:** The need for general computer literacy in the university

All students and staff should learn how to use computer hardware.	%
Totally agree	95
Partially agree	5
Indifferent	0
Partially disagree	0
Totally disagree	0

**Table 3:** The need for staff computer literacy in the university

### ***Hours of Usage***

Table 3 shows the frequency of hours each respondent makes use of the university's computer systems every day. As given in the table, about 15% of the respondents use them more than 7 hours per day, 44% use them between 4 and 6 hours per day and the rest use them for less than 3 hours. On average, the respondents spend 2.7 hours on the computers of the university.

Usage Hours per day	Frequency	Percentage
0-1	11	13.75
2-3	22	27.50
4-6	35	43.75
7-9	8	10.00
> 10	4	5.00

**Table 4:** Hours of usage of computer of the UKZN

The analysis shows that most respondents use computers between 2 and 6 hours per day. First year students (32%) use them for 0-1 hours, 26% use them for 2-3 hours and 37% use them for 4-6 hours. Second year students who are use them for 0-1 hours are 12%, 2-3 hours - 36% and 4-6 hours - 48%. Of the respondents who are third year, 29% use them for 0-1 hours, 57% use them for 2-3 hours and 14% use them for 4-6 hours. All the fourth year students spend 2-6 hours using the computers. None of the postgraduates or staff members use less than one hour of computer services time. The percentage of postgraduates, staff members and staff who are also students of postgraduates (53%, 57% and 40% respectively) make use of them for between 2 and 6 hours. This may show that the computers are used mainly for academic purposes, as the hours of usage increase with advances in educational level. The higher hour usage in the first year students could either be explained by the fact that the first year is the year where most of the new incoming students take their computer literacy course. It could also be due to the fact that the service they are using is free and most want to use it to the maximum possible for academic and non-academic purposes.

Further analysis shows that those respondents, who use between 2 and 6 hours of the university's computer resources, used them for non-academic purposes [viz. private e-mail (55%), internet (61%), chatting (31%), games (29%), SMS (43%) and pornography (15%)]. For academic purposes the figures are Internet (61%), research (53%), application software (60%), programming (48%) and web design (11%). It is reasonable to assume that the computer service provided by UKZN, is used both for academic and non-

academic purposes. It can be argued that access efficiency to the computers might be improved by restricting the computers only to academics. This argument is debatable, as the whole tertiary learning process is to prepare the students for the working world that will require non-academic practices.

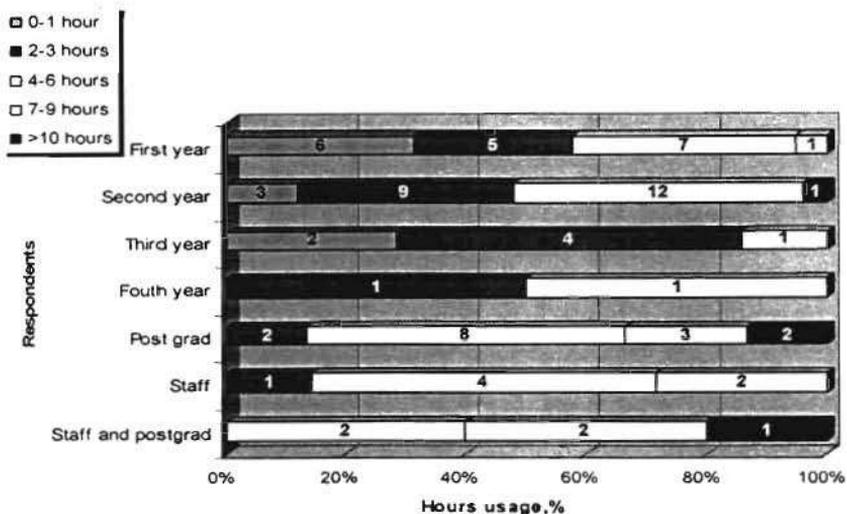


Figure 3 Hours of computer hardware usage

### Personal Computer Resources that Affect On-campus Usage

Regarding the dependency on computer resources of the respondents, 61% own private computers. From those who did not own at the time this research was undertaken 13% are intending to buy in the near future. The rest (26%) do not have any intention of buying for different reasons, non-affordability and the adequacy of UKZN's computer resources were mentioned frequently.

The research showed that 54% of the respondents are entirely dependent on the computers provided by the university for their IT requirements. Of the students who own private computers, 42% still depend on the UKZN IT resource. From those who do not own private computers,

16% are totally dependent on the computers provided by the university. Most of the students and staff members rely on campus resources for different reasons. Even though some have their own computers, they do not have Internet access and rely on campus access. In addition, the university has application software, which they don't possess. Therefore, they depend on the campus's computing resources.

### ***Accessibility***

Of the responses, 85% experienced difficulty accessing the computer resources of the university. The reason is that most of the time the computer labs were fully occupied and there were not enough computers available for use or lack of time. Another problem is that the labs are reserved only for students who study computers. Obviously, there is the need for further research to find out the reasons for the poor access provided by the university and from which a reasonable recommendation should be extracted to better the service. As a number of authors agree (e.g., Ainley *et al.*, 2002) in this computer dominated century, the learning process can only speeded up with the use of well managed and organized IT resources.

### ***Types of Hardware Used***

Nearly 75% of the respondents had an idea about the type of hardware they used. It is promising that the respondents know how to differentiate between computer hardware. It does not necessarily mean that the respondents know enough about computer hardware. The need for computer literacy has been proved. This is supported by the 25% who do know how to differentiate between computer hardware. Among the respondents who know about hardware, 73% specified that they use a Pentium and the remaining 3% respondents mentioned that they use a machine different from Pentium. Therefore, the students and the staff members are using more advanced computer systems. The statistical survey concludes that the majority of the UKZN members use mainly the Pentium product. Thirty seven percent (37%) of the UKZN members use Pentium III and 21% Pentium IV. About 20% of the respondents do not know what type of processor they are using.

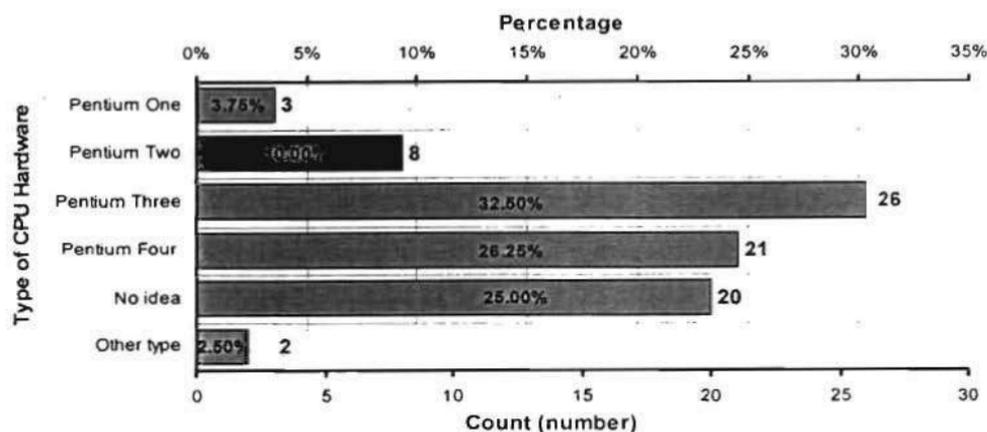


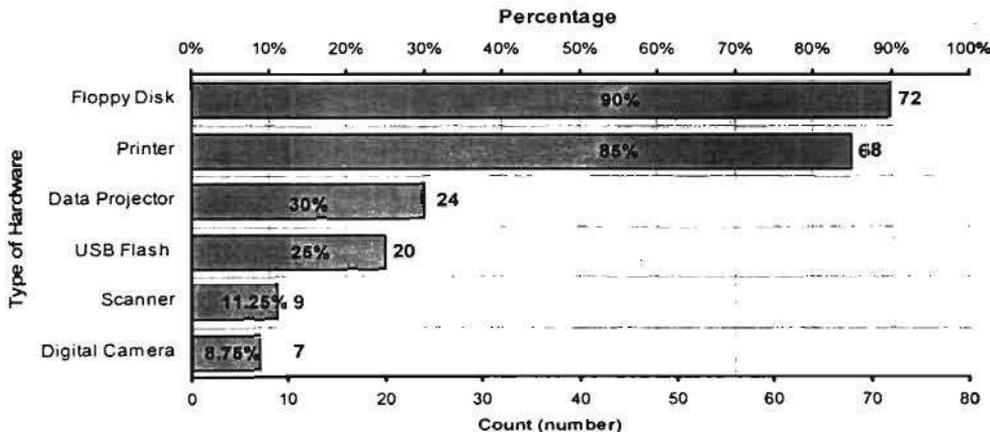
Figure 4 Types of CPU used by the respondents

### Other Types of Hardware Used

The respondents specified that among the different kinds of hardware they commonly use were floppy disk drives, printers, data projectors, USB flash memories and scanner and digital cameras. Out of the hardware disk drive was the most commonly used (90%) followed by the printer (85%), data projector (30%), USB flash memory (25%), scanner (11%) and digital camera (9%), as shown in Figure 4.

Floppy diskette drives and USB flash memories are used as a means of transferring and storing information. The use of a large percentage of floppy diskettes by the respondents might be due to a number of reasons. One reason could be due to the small storage area provided by the university. The other reason is that the storage provided by the university is unreliable. There is also the possibility of using floppy diskettes to transfer information and their work elsewhere. The use of floppy diskette as a means of storing or transferring information is declining, as they are susceptible to damage. Technology provides a reliable and cheap way of storing and transferring information using other removable storage items such as CD disk and USB flash memories. The use of the CD disk at the university is minimal, as the

computer hardware provided lacks CD rewrite-able drives. The other removable storage that does not need any special drive and which is currently becoming popular is USB flash memory.



**Figure 5** Types of hardware provided by the UKZN

USB flash memory, other than solving the storage problems of the respondents, is also reliable and portable. That is the reason why about 25% of the respondents have already started to use this technology, though it is recent (and thus expensive). More than 82% of the respondents who are using USB flash memories are fourth year students, postgraduates and staff members. Respondents, who can afford USB flash memories, are only at 25%, therefore it is suggested that the storage provided by the university for respondents, at this level of education, needs to be increased. The research also tries to analyse or 'pinpoint' the condition (working or not, out of order, faulty) of the computer outlets and peripherals provided by UKZN. As given in the table, 6% of the respondents stated that the provided hardware was excellent, 13% of respondents mentioned that they are great, 23% pointed that they are good, 31% specified that the hardware facilities were fair and the remaining 28% stressed that they were not so good.

## **Main Uses**

It was found that the main uses of the computers are for Internet surfing (85%), software applications (84%), research (76%), e-mail (75%), programming (59%), SMS (48%), chat (38%), games (38%), pornography (21%) and web design (18%). UKZN computer hardware is used both for academic and non-academic purposes. Forty eight percent of the respondents totally disagreed with the use of the university computer hardware for non-academic purposes and considered it abusive. They also disagreed regarding the recommendation of the use of the resources only for academic purposes. Twenty-nine percent (29%) agreed on restricting it to academic use. On the need for regulations that enhance only academic use of the resources, 43% agreed and 38% disagreed and the remaining 20% neither agree nor disagree.

For some time games have been played on personal computers. These were played when the computers were offline. However, with the fast growth of Internet many other games are available. It can be said that the connection between education and games are growing rapidly. There are negative and positive aspects in using computers for games. The negative standpoint is that many students spend their time playing while other students are waiting desperately to do their assignments. The positive standpoint is that it gives a bit of relaxation after busy work and the view that games are not only for entertaining people, but are educational as well (Curtin *et al.* 1998). Forty-nine percent of the respondents stated that the maintenance provided is more than fair, 26% mention that the maintenance is not so good, and the rest 25% respondents agreed that the maintenance is only fair enough. So it is suggested that the IT department of the university improve on the maintenance they provide.

## **Availability of Assistance**

The need for addressing common hardware problems of the UKZN is shown in Figure 6. As shown in the figure, more than 20% of the respondents pointed to the need for a great deal of assistance on all the computer hardware. More than 10% of the respondents stated the need for a fair to very little assistance in the maintenance of computer hardware. More than 30% of the respondents specified that there was no need of assistance.

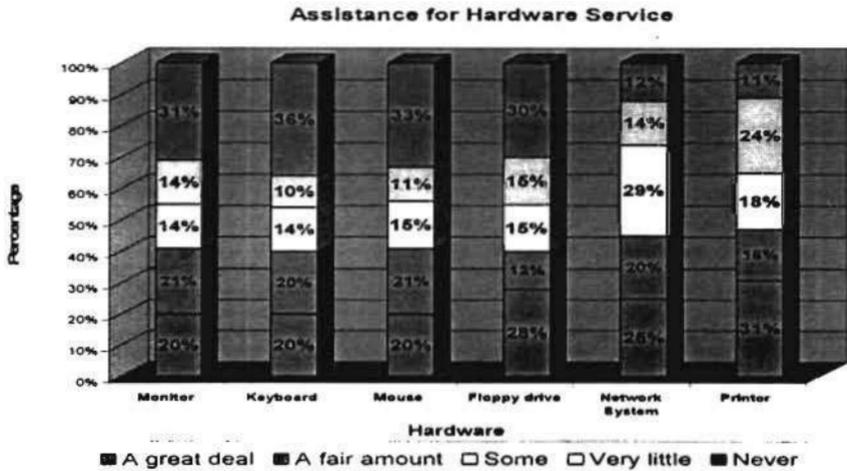


Figure 6 The need for assistance in the different hardware of UKZN.

### *Extended Hours of Computer Access*

To check the extent of satisfaction on the computer access provided, three questions were asked in the questionnaire. Free access to computer hardware resources at universities can be a cause for student to misuse (or abuse) the resource and waste their own time. For instance, students use computers for non-academic purposes such as SMS (48%), chat (38%), games (38%) and pornography (21%). Some of the respondents were not happy about the extended open hours at the computes, probably because of misuse of time (chatting, playing games, looking at pornography and sending SMS's). They are wasting time and money that could and should be used for academic work. Free access and no restrictions cause the students to waste their time unnecessarily. Being unrestricted, students prevent other students from using the computer resources and doing their assignments. Most of the students are happy about the idea of increasing the open hour access as shown in Table 4.8. If they could be given extended access they could work more effectively. Therefore, extended open hours could help to ease the problem of access as students could choose times that suit them. Some students will abuse these privileges. So they should be controlled! University study is

expensive – the taxpayer's money is being used to subsidise lazy students.

### ***Printing Facilities***

Of the respondents, 44% felt that the existing printing systems of the university were not adequate and about 78% of respondents pointed out the need for free printing services in the future. Besides some offices and very few labs, the University of KwaZulu-Natal uses laser printers in providing service to the students. Laser printers are preferable for quality and speed. However, students are complaining about not having enough printers. Besides the small number of available printers, printers that are out of order need technicians to ensure proficiency in this sector. It is a common inconvenience for students to go and join a long queue to pay their printing credit. On some campuses (i.e. Howard College) the university provides outside machines where you can buy your printing voucher any time you wish and load your printing credit through the Internet. This approach should be more widespread throughout the other campuses of the university.

### ***Compatibility***

To assess the comfort and compatibility of hardware provided by the university, the response shows that 89% of the respondents feel that the available hardware is more than fairly comfortable. This shows that the university is considering the ergonomics of its user base while purchasing computer hardware products. This policy should continue for the future as well. Regarding the upgrading provided by the university, 53% of the respondents think it is more than fair. There is almost an equal response from the respondents (48%), in terms of the need for continual upgrading to stay abreast with fast growing computer hardware technology. In terms of the compatibility of the current computer hardware provided by the university, 89% of the respondents think that they are more than fairly compatible with modern technology.

### ***Auditing System***

To assess the auditing system of the university regarding computer

hardware, the given responses are summarized in Table 4. About 41% of respondents believe that the university is doing more than fair, consistent auditing and 31% of the respondents on the other hand believe that the auditing is inadequate. The rest (28%) think the auditing is fair enough. The need for the university to reconsider its auditing system to satisfy the needs of its IT users is obvious. Additionally, 25% of the respondents agree on the adequacy of the provision and administration of the computer facilities provided by the university. Thirty-one percent (31%) of the respondents totally disagree on the adequacy of the management system. This seems to emphasize the need for improvement in management systems to better the IT resources provided by the university.

Rating	Currently IT resources of UKZN have excellent provision and administration.		Rating	How consistent is auditing done on computer hardware as technology changes?	
	Frequency	Percent		Frequency	Percent
Totally agree	4	5.0	Excellent	15	18.8
Partially agree	16	20.0	Great	4	5.0
Indifferent	11	13.8	Good	14	17.5
Partially disagree	24	30.0	Fair	22	27.5
Totally disagree	25	31.3	Not so good	25	31.3

**Table 5: Auditing system for computer hardware in UKZN**

## Conclusion

The respondents use the computer service provided by the university for academic and non-academic purposes. Forty eight percent of the respondents totally disagreed with the use of university computers for non-academic purpose as abusive and 43% disagreed on the need for regulations to force only academic use of the computer resources. This is a disturbing revelation.

Computers that are used for games and access to pornography should not be available to students in an academic setting. Ninety percent of the respondents agreed on the need for computer literacy. The respondents specified that among the different hardware they commonly use are floppy disks, printers, data projectors, USB flash memories, scanners and digital cameras. Forty-four percent of the respondents feel that the existing printing systems of the university are not adequate and 78% stressed the need for free printing services. Regarding the upgrading provided by the university, 53% of the respondents think it was more than fair. In terms of compatibility of the current computer hardware provided by the university, 89% of the respondents think that they are more than fairly compatible with modern technology. About 69% of respondents believe that the university is doing at least fair auditing on checking computer hardware (whether they are functioning properly or not). This means the students are satisfied regarding auditing systems.

## **Recommendations**

Training and more training will be necessary for all students and staff members and especially for novices (first year students) who do not know how to use the computer properly and effectively. Even though there is a course of computer literacy, considering that the computer is used everywhere in education and business, 100% of the respondents agreed that it was important and there should be a compulsory computer literacy course for everyone. But it should not only focus on software. Preferably it should be comprehensive, because software is nothing without hardware and vice versa. There should be a perfect delivery of lessons concerning the use of computer hardware in such a way that every student becomes informed.

This research found that at UKZN some users have problems of access that should be taken seriously. Improvements should eradicate the shortage so that every user will have access when he or she needs it. Therefore, every faculty should have its own computer access point somewhere on campus. After dealing with the computer literacy course, it is not good for faculties to stop using the lab, because even though they are not majoring in computer courses, they need to use computer hardware for their research, access to the Internet, e-mail and research for their faculties. A solution to the access

problem is that the users should be prioritized according to their need. For instance, greater attention should be given to postgraduate students and staff members whose hours of computer usage are higher compared to the rest of respondents. Some first year computer science students pointed out in their recommendations questionnaire that as students of computer science the dept. does not have their own computer lab and it was difficult to get their work done on time. Some measures ought to be taken for them to use the UKZN computer hardware effectively, according to their assignment. Greater emphasis should be placed on managing time and access to university computers.

The computer access times provided by the university should be extended, for example, earlier open times in the morning and at night. On some campuses of the UKZN, like the Howard College and Pietermaritzburg campuses, access is provided 24 hours a day throughout the year. This rule needs to be applied to the rest of the campuses in order to alleviate access problems and improve the learning process.

A university should provide free access to computers for academic and non-academic purposes. According to the response students believe that free access should also be available for non-academic purposes. This remains a moot point if one considers the high cost of the computers, hardware and software and the telephone cost in South Africa. If the university is not capable of providing free access it should give users limited access. If more access is required, the users either need to motivate for it through their departments or users need to be charged more to defray excess costs.

It was pointed out by a number of respondents that there is a need for more efficient printer service. This service should be extended to providing free printing services. If this is impossible for the university, average printing costs should be included in the student fees so that the users can have a free printing service. Those who need unlimited services (more than others) should know that they would have to pay more.

It is a value judgment as to which of the above recommendations are more important and such a judgment must be made in terms of the educational, financial and political aspects of the university. These aspects are not necessarily mutually exclusive, but it might be found that certain

measures that could well improve the quality of learning in a particular situation would also involve an increase in expenditure, so that a decision based on the likely cost-effectiveness of the measures would have to be made. Abuse or misuse of free services needs to be controlled strictly if free services are to be given. No service is entirely free – someone always has to pay so that others can have free goods or services. In this case it is the university and the taxpayer who subsidises the university.

## **Limitations and Recommendation for Further Research**

The present analysis was based on the responses of only from eighty randomly chosen staff members and students. Nevertheless, the results obtained give a clear indication that the planning for future computer systems deployment at UKZN could benefit from a more extensive analysis and more regular analyses. There is a need for a more comprehensive questionnaire and more comprehensive sampling for detailed and dependable research findings. Furthermore, It would be more accurate to generalize if the sample population comes from different campuses. It is difficult to make generalizations from the results obtained from this research.

## **References**

- Ainley, J, D Banks, & M Fleming 2002. The Influence of IT: Perspectives from Five Australian Schools. *Journal of Computer Assisted Learning* 18: 395-404.
- Barrett, E 1996. Collaboration in the Electric Classroom: *Technology Review*. Printed from the Internet at the Electric library. [Available] <http://pgw.org/pw/Pmb96091.htm>. (Accessed: 2004, September 2).
- Capron, LH 1998. *Computers: Tools for an Information Age*. London: Addison Wesley Longman.
- Ellington, HI & SE Earl 1998. How Educational Technology has Evolved since the Second WorldWar. [available at] <http://caret.iste.org/caretadmin/newsdocuments/StudentLearning.pdf> (Accessed: 2004, October 18).
- Erwin, JG & NC Blewett 1996. *Business Computing. An African Perspective*. Cape Town: Juta & Co, Ltd.

- Hodorowicz, L 2000. Computers and Education. [online] Available at <http://www.cs.rpi.edu/courses/fall00/ethics/papers/hodor1.html>. (Accessed: 2004, November 7).
- Hamilton, S & NL Chervany 1981. Evaluating Information System Effectiveness. Part I. Comparing Evaluation Approaches. *MIS Quarterly* 5,3,September: 55-69.
- Jiang, J, G Klein, & M Crampton 2000. A Note on SERVQUAL Reliability and Validity in Information Systems Service Quality Measurement. *Decision Sciences* Summer 2000,31,3:725.
- Klopper, Rembrandt 2002. e-Communication and the Theory of the Optimisation of Human Communication. *Alternation* 9,2: 277 – 298.
- Klopper, Rembrandt 2005. Future Communications: Mobile Communications, Cybernetics, Neuro-Informatics and Beyond. *Alternation* 12,1a: 121-144.
- Lubbe, Sam & Rembrandt Klopper 2004. *Introduction to Research Design in Information Communication Technology*. Durban: Dolphin Coast Publishers.
- Pitt, LF & RT Watson 1997. Measuring Information Systems Service Quality: Concerns for a Complete Canvas. *MIS Quarterly* 21,2, June: 209-222.
- Ryburn, P 2004. COMP 1200. University Memphis [online] available at <http://www.mscl.memphis.edu/~ryburnp/cl/>. (Accessed: 2004, October 17).
- Sutton, SG 2000. Information Systems Reliability Assurance: The Inherent Difficulty in Structured Analysis of Dynamic Processes. *Accounting Form* 24,4: 422.

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# The Attitudes of Educators to Information Technology Adoption in School Settings

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## Abstract

The successful implementation of educational technologies depends largely on the attitudes of educators, who eventually determine how they are used in the classroom. Educators' attitudes are a major enabling/ disabling factor in the adoption of technology. It was also found that educators who have positive attitudes toward technology, feel more comfortable with using it, and usually incorporate it into their teaching. Any successful transformation in educational practice requires the development of positive user attitudes toward the new technology. The development of educators' positive attitudes toward ICT is a key factor, not only for enhancing computer integration, but also for avoiding educators' resistance to computer use. However we need to consider the severance of innovation from the classroom educator and the idea that 'the educator is an empty vessel into which this externally defined innovation must be poured'. The article investigates the attitude of secondary school educators towards the implementation of ICT into their schools and curricula. The study is based upon a large sample of educators in the KwaZulu-Natal province of South Africa. These results may be extrapolated to the South African teacher population at large.

## Introduction

Recent studies (Kersaint *et al.* 2003) have shown that the successful implementation of educational technologies depends largely on the attitudes

of educators, who eventually determine how they are used in the classroom. Bullock (2004) found that educators' attitudes are a major enabling/disabling factor in the adoption of technology. Similarly, Kersaint *et al.* (2003) found that educators who have positive attitudes toward technology, feel more comfortable with using it, and usually incorporate it into their teaching. In fact, Woodrow (1992) asserts that any successful transformation in educational practice requires the development of positive user attitude toward the new technology. The development of educators' positive attitudes toward ICT is a key factor, not only for enhancing computer integration, but also for avoiding educators' resistance to computer use (Watson 1998). Watson (1998::191) warns against the severance of the innovation from the classroom educator and the idea that "the educator is an empty vessel into which this externally defined innovation must be poured". In this article we investigate the attitude of secondary school educators towards the implementation of ICT into their schools and curricula. The study is based upon a large sample of educators in the KwaZulu-Natal province of South Africa. We believe that these results may be extrapolated to the South African teacher population at large.

## Literature Review

According to Rogers (1995 p.161) "peoples'" attitudes toward a new technology are a key elements in its diffusion". Roger's *Innovation Decision Process* theory states that an innovation's diffusion is a process that occurs over time through five stages: Knowledge, Persuasion, Decision, Implementation and Confirmation. Accordingly, "the innovation-decision process is the process through which an individual (or other decision-making unit) passes, namely:

1. from first knowledge of an innovation,
2. to forming an attitude toward the innovation,
3. to a decision to adopt or reject,
4. to implementation of the new idea, and finally
5. to confirmation of this decision".

Owing to the novelty of computers and their related technologies at that time, studies concerning technology diffusion in education have often focused on the first three phases of the innovation decision process. This focus is also because the status of computers in education is, to a great extent, still precarious in most developing countries. In cases where technology was very recently introduced into the educational system - as is the case in most developing countries in Africa - studies have mainly focused on the first two stages; that is, on knowledge of an innovation and attitudes about it.

Rogers' premise concerning individuals' shift from knowledge about technology, to forming attitudes toward it, and then to its adoption or rejection, corroborates the general and widely accepted belief that attitudes affect behaviour directly or indirectly (Ajzen & Fishbein 1980 & Zimbardo *et al.* 1997). Abas's 1995 study (*cited* in Mumtaz 2000) involving Malaysian schools, found educators' attitudes to be a major predictor of the use of new technologies in instructional settings. Christensen's 1998 study in Texas shows that educators' attitudes toward computers affect not only their own computer experiences, but also the experiences of the learners they teach. In fact, it has been suggested that attitudes towards computers affect educators' use of computers in the classroom, and the likelihood of their benefiting from training. Positive attitudes often encourage less technologically capable educators to learn the skills necessary for the implementation of technology-based activities in the classroom (Kluever *et al.* 1994). This has much bearing on the study described here since we have found that educators in KZN have strongly positive attitudes towards technology; however, 68.1% lack core proficiency (basic skills required for an educator to integrate ICT into the school curriculum), and 65.5% have little to no proficiency in the use of technology in the classroom.

Knezek and Christensen's (2002) analysis of several major cross-cultural studies - completed during the 1990s, and related to ICT in education - suggests that educators advance in technology integration through a set of well-defined stages, which sometimes require changes in attitude more than changes in skills. According to Zimbardo *et al.* (1997), changing individuals' behaviour is possible once their attitudes have been identified. Zimbardo and his associates suggest that attitudes are made up of three components: affect, cognition, and behaviour. The affective component represents an individual's

emotional response, or liking to a person, or object. The cognitive component consists of a person's factual knowledge about a person or object. Finally, the behavioural component involves a person's overt behaviour directed toward a person or object. Zimbardo *et al.* (1997:52) contends that "even though we cannot predict the behaviour of single individuals, we should be able to predict that people (in general) will change their behaviour if we can change their attitudes...". The latter assertion explains, to a large extent, the wide interest in the study of attitudes toward technology. This study addresses the affective, cognitive and behavioural components of educators' attitudes towards technology.

Unfortunately, the task of pinning down educators' attitudes has not always been an easy one. Watson (1998) considers educators' attitudes as the most misread impeding force in the integration of computers in educational practices. As Zimbardo *et al.* (1997:53) note, the complexity of attitudes and their interrelationship with behaviour, and many other variables, summons considerations for "the maze of variables and processes that could affect attitudes, beliefs, and action."

## **The Study**

Given the importance of educators' attitudes and the relationship of their attitudes towards technology adoption, as discussed above, the purpose of this study is, therefore, to determine the secondary school educators' attitudes toward ICT in South African education.

## **Methodology**

This is a descriptive study of an exploratory nature. Creswell (2003:30) suggests that exploratory studies are most advantageous when "not much has been written about the topic or the population being studied". The target population in this study is secondary school educators in the Ethekwini Region of KZN. The list of educators is based on the Department of Education's, Education Management and Information Systems (EMIS) list, which is maintained and updated on an annual basis by the Provincial Education Management and Information Systems Department. The total

number of secondary schools in the Ethekwini Region on the Department of Education's EMIS list is 403, as of the 30 March 2004. Of these schools, 382 have staff ranging from 2 to 60, and the balance of 21 schools show 0 staff members. In this study we have chosen every alternate school on the list which yields a sample of 191 schools. The Ethekwini region is made up of three districts viz. Ilembe, Pinetown and Umlazi. The schools in our sample are distributed as illustrated in the table below:

DISTRICT	NUMBER OF SCHOOLS
Ilembe	57
Pinetown	68
Umlazi	66
TOTAL	191

**Table 1: Distribution of Schools**

Questionnaires were distributed to the above 191 schools. A letter of recruitment and a letter indicating that permission had been granted by the Department of Education (KZN) accompanied the questionnaires to the schools. The average number of staff in schools in the Ilembe and Umlazi districts is 15 and the average number of staff in schools in the Pinetown district is 20. Therefore, 15 questionnaires were sent to each school in Ilembe and Umlazi and 20 questionnaires were sent to each school in Pinetown. Some schools received their questionnaires via the circuit office and others received them via post. Most Circuit Managers were cooperative in assisting in the distribution and collection of these questionnaires. However, there were a few who emphatically did not want to assist with this study and this made collection of questionnaires from these schools very difficult.

Of the 191 schools, 18 schools that indicated that they did not receive the questionnaires, 2 indicated that they had misplaced them and another 3 refused to participate in the study. In total 93 schools returned the

questionnaires yielding a 55.4% rate of return. In total, 1237 questionnaires were returned. Of these, 1222 questionnaires were amenable for detailed analysis. This sample size satisfies Leedy and Ormrod's (2005) requirements as the total number of secondary educators in the Ethekwini region stood at 8026 as per EMIS database. The 1222 responses that we used will represent a total of 15.23% of our sampling frame.

Table 2 gives a frequency analysis of respondents according to gender, Table 3 gives a frequency analysis of respondents according to age and Table 4 gives a frequency analysis of respondents according to race.

	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
<b>Female</b>	704	57.6	57.6
<b>Male</b>	512	41.9	99.5
<b>No Entry</b>	6	.5	100.0
<b>Total</b>	1222	100.0	

**Table 5: Gender Distribution**

	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
<b>21&amp;under</b>	7	0.6	0.6
<b>22-30</b>	210	17.2	17.8
<b>31-40</b>	494	40.4	58.2
<b>41-50</b>	395	32.3	90.5
<b>51-60</b>	96	7.9	98.4
<b>61&amp;Older</b>	7	0.6	98.9
<b>No Entry</b>	13	1.1	100.0
<b>Total</b>	1222	100.0	

**Table 6: Age Distribution**

	<b>Frequency</b>	<b>Percent</b>	<b>Cumulative Percent</b>
<b>African</b>	486	39.8	39.8
<b>Coloured</b>	23	1.9	41.7
<b>Indian</b>	573	46.9	88.5
<b>White</b>	123	10.1	98.6
<b>No Entry</b>	17	1.4	100.0
<b>Total</b>	1222	100.0	

**Table 7: Race Distribution**

### **Questionnaire**

The questionnaire was created with items validated in previous research (Davis 1989, Davis *et al.* 1989, Venkatesh & Davis 2000, Vannatta & O'Bannan 2002, Abdulkafi Albirini 2004, and Venkatesh *et al.* 2003) and adapted for this study. A five point scale was used for all of the measurement, with 1 being the strongly negative end of the scale and 5 being the strongly positive end of the scale.

The development of the questionnaire was guided by an extensive review of the literature. The questionnaire (Appendix A) consists of 17 elements and was designed for a larger study. The elements comprise demographic and perceptual data. The instrument was also evaluated by the Department of Education's Research, Strategy and Policy Development unit and the University of KwaZulu-Natal's ethical clearance committee. Feedback was mainly used to ensure that the scales measure the content areas of investigation, and are culturally and technically appropriate for the context of the study. The Cronbach's reliability coefficients for elements 10, 11, 12 and 14 are: computer attitude = 0.87, computer attributes = 0.71, cultural perceptions = 0.77, and computer competence = 0.95.

The data was analyzed using the statistical package SPSS®. Descriptive statistics are used to describe and summarize the properties of the mass of data collected from the respondents (Diamantopoulos & Schlegelmilch 2000). Prior to conducting the analysis, the scoring of all negatively stated items was reversed. For this study only data that was

applicable to our research question was extracted from the larger study and used.

## **High School Educator Attitudes toward the Integration of ICT into Education**

According to Rogers (1995) peoples' attitudes towards a new technology are a key element in its diffusion. As explained above peoples' attitudes are made up of three components namely, affective, cognitive and behavioural. Participants were asked to respond to 20 Likert-type statements dealing with their attitudes toward ICT in education (Appendix A). The items are designed to measure the affective domain of computer attitude (items 1–6), cognitive domain (items 7–15), and behavioural domain (items 15–20). Computer attitudes of KZN educators is represented by a mean score on a 5-point scale, where 5 (Strongly Agree) represents the maximum score of the scale and 1 (Strongly Disagree) represents the minimum score. A zero indicates no entry.

For each of the above categories (affective, cognitive and behavioural), a variable is computed to represent an individual's average score. The polarity for negative statements are reversed to achieve a correct and meaningful score when using SPSS®

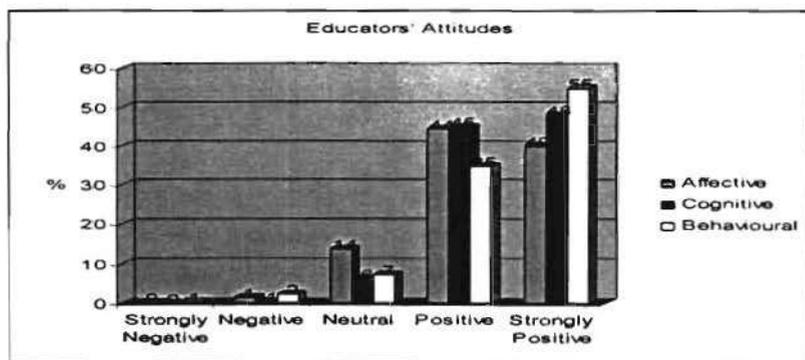
	<b>Affective</b>	<b>Cognitive</b>	<b>Behavioural</b>	<b>Average Score</b>
<b>Mean</b>	4.162	4.367	4.376	4.301
<b>Median</b>	4.333	4.444	4.600	4.459
<b>Mode</b>	5.000	5.000	5.000	
<b>Standard Deviation</b>	0.7175	0.5533	0.7348	0.668

**Table 5: Educators' attitudes towards ICT in Education**

Table 5 illustrates the distribution of mean, median, mode, and standard deviation (SD) scores on the attitude toward ICT scale. As Table 5 illustrates, educators' overall attitudes toward ICT are very positive, with an

overall mean score of 4.3 (SD = 0.66). The respondents' positive attitudes are evident within the affective (mean = 4.16), cognitive (mean = 4.37) and behavioural (mean = 4.38) domains. This augurs well for enhancing computer integration and avoiding educators' resistance to computer use in the classroom as noted by Watson (1998). These positive attitudes will encourage the less technologically capable educators to learn the skills necessary for the implementation of technology based activities in the classroom (Kluever *et al.* 1994).

Figure 1 represents the attitudes of educators towards ICT within the affective, cognitive and behavioural domain. Within the affective domain, eighty-four percent (84%) of the respondents have a positive affect toward computers. These respondents report that they have no apprehension of computers, are glad about the increased prevalence of computers, consider using computers enjoyable, feel comfortable about computers, and like to talk with others about computers and to use them in teaching. The "increased prevalence of computers" receives the most favourable responses in this category (affective). The affective component, which represents an individual's emotional response or liking to a person or object, is very positive for our respondents. That is, they seem to have an affinity towards computers.



**Figure 1: Educators' Attitudes**

Within the cognitive domain, 93% of the respondents are of the opinion that computers save time and effort, motivate learners to do more study, enhance learners' learning, are a fast and efficient means of getting

information, must be used in all subjects, make schools a better place, are worth the time spent on learning them, are needed in the classroom, and, generally, do more good than harm. "Schools will be a better place" receives the most favourable responses in this category (cognitive). This tells us that respondents do have factual knowledge of computers.

In the behavioural domain, 90% of the respondents express positive behavioural intentions in terms of buying computers, learning about them, and using them in the near future. The behavioural component represents a person's overt behaviour towards a person or object (Zimbardo *et al.* 1997). Ninety five percent of our respondents are very positive towards the statement "I would like to learn more about computers" as expressing their opinion. This supports the need for retraining of these educators to acquire technology proficiency. This is lacking in the present environment.

### **Discussion of Above Results**

The study investigates the attitudes of secondary school educators in a large region of the KwaZulu-Natal province, toward ICT and the relationship of educators' attitudes to a selected set of independent variables. Educators' attitudes toward ICT have been universally recognized as an important factor for the success of technology integration in education (Rogers 1995, Watson 1998, Woodrow 1992). Findings from this study suggest that participants have positive attitudes toward ICT in education. The respondents' positive attitudes are evident within the affective, cognitive and behavioural domains. Such optimism cannot simply be attributed to the novelty of computers in South African education. The participants seem to have totally accepted the rationale for introducing ICT into schools and are able to base their judgments on understandable reasons. The majority of respondents (90%), therefore, consider computers as a viable educational tool that has the potential to bring about different improvements to their schools and classrooms.

Educators' positive attitudes show their initiation into the innovation-decision process (Rogers 1995). It seems that educators have already gone through the Knowledge and Persuasion stages (Rogers 1995) and are probably proceeding to the Decision phase. As many theorists have

indicated, attitudes can often foretell future decision-making behaviour (Ajzen & Fishbein 1980). Having formed positive attitudes toward ICT in education, participants are expected to be using ICT in their classrooms once computers become more readily available to them. However, it must be noted that participants in this study must also obtain the core proficiency in order to use computers. In fact, the behavioural subscale of the computer attitude scale shows that the majority of educators (93%) have the intention to learn about computers and to use them in the near future. This relationship between attitudes toward ICT, and its use in the classroom, has been widely reported in the literature (for example, Blankenship 1998, Isleem 2003).

## **Conclusion**

Given the recent presence of technology in their schools, developing countries have the responsibility not for merely providing computers for schools, but also for fostering a culture of acceptance of these tools among the end-users. Hence, the study of educators' attitudes becomes indispensable to the technology implementation plans. As Sheingold (1991, cited in North Central Regional Educational Laboratory, 2003) notes, the challenge of technology integration into education is more human than it is technological. The findings of this study may be specific to KZN educators in South African education, but the implications are significant to other educators as well. Educators' positive attitudes in the current study have a special significance given the limitations characterizing the current status of ICT in South African schools: insufficient computer resources and educators' lack of computer competence. It is, therefore, essential for policy-makers to sustain and promote educators' attitudes as a prerequisite for deriving the benefits of costly technology initiatives. Since positive attitudes toward ICT usually foretell future computer use, policy-makers can make use of educators' positive attitudes toward ICT to prepare them better for incorporating ICT into their teaching practices.

## **References**

- Abdulkafi, A 2004. 'Teachers' Attitudes toward Information and Communications Technologies in the Case of Syrian EFL teachers. *Computers & Education* (In-press).

- Ajzen, I & M Fishbein 1980, *Understanding Attitudes and Predicting Social Behavior*. Englewood Cliffs: Prentice-Hall, Inc.
- Blankenship, SE 1998. Factors Related to Computer Use by Teachers in Classroom Instruction. Doctoral thesis, Virginia Polytechnic Institute and State University, ProQuest Digital Dissertations.
- Bullock, D 2004. Moving from Theory to Practice: An Examination of the Factors that Pre-service Teachers Encounter as they Attempt to Gain Experience Teaching with Technology during Field Placement Experiences. *Journal of Technology and Teacher Education* 12,2: 211-237.
- Christensen, R 1998. Effect of Technology Integration Education on the Attitudes of Teachers and their Students. Doctoral thesis, University of North Texas. ProQuest Digital Dissertations, Available: <http://www.tcet.unt.edulresearch/dissert/rhondac>, Accessed: 03 July 2004.
- Creswell, JW 2003. *Research Design: Qualitative, Quantitative and Mixed Methods Approaches*. Beverley Hills: Sage Publications.
- Davis, FD 1989. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly* 13,3:319-339.
- Davis, FD, RP Bagozzi & PR Warshaw 1989. User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science* 35,8: 982-1002.
- Diamantopoulos, A & BB Schlegelmilch 2000. *Taking the Fear Out of Data Analysis*. London: Thomson Learning.
- Isleem, M 2003. Relationships of Selected Factors and the Level of Computer Use for Instructional Purposes by Technology Education Teachers in Ohio Public Schools: A Statewide Survey. Doctoral thesis, Ohio State University, ProQuest Digital Dissertations.
- Kersaint, G, B Horton, H Stohl & J Garofalo 2003. Technology Beliefs and Practices of Mathematics Education Faculty. *Journal of Technology and Teacher Education* 11,4: 549-577.
- Kluever, RC, TC Lam, ER Hoffman, KE Green & DL Swearinges 1994. The Computer Attitude Scale: Assessing Changes in Teachers' Attitudes toward Computers. *Journal of Educational Computing Research* 11,3: 251-261.

- Knezek, G & R Christensen 2002. Impact of New Information Technologies on Teachers and Students. *Education and Information Technologies* 7,4: 369-376.
- Leedy PD & J Ormrod 2005. *Practical Research-Planning and Design*. New Jersey: Pearson Education.
- Mumtaz S 2000. 'Factors Affecting Teachers'. Use of Information and Communications Technology. *Journal of Information Technology for Teacher Education* 9,3: 319 – 341.
- North Central Regional Educational Laboratory (NCREL) 2003. Technology Connections for School Improvements. Available: <http://www.ncrel.org/tplan/tplanB.html>, Accessed: 16 July 2004.
- Rogers, EM 1995. *Diffusion of Innovations*. New York:: The Free Press.
- Vannatta R & B O'Bannon 2002. Beginning to Put Pieces Together: Technology Infusion Model for Teacher Education. *Journal of Computing in Teacher Education* 18,4: 112-123.
- Venkatesh, V & FD Davis 2000. A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies. *Management Science* 46,2: 186-204.
- Venkatesh, V, MG Morris, GB Davis & FD Davis 2003. User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly* 27, 3: 425-478.
- Watson, DM 1998. Blame the Technocentric Artifact! What Research Tells Us about Problems Inhibiting Teacher Use of IT'. In Marshall, G & M Ruohonen (eds): *Capacity Building for IT in Education in Developing Countries*. London: Chapman & Hall.
- Woodrow, JE 1992. The Influence of Programming Training on the Computer Literacy and Attitudes of Pre-service Teachers. *Journal of Research on Computing in Education* 25,2: 200-219.
- Zimbardo, P, E Ebbesen & C Maslach 1997. *Influencing Attitudes and Changing Behavior*. Reading: Addison-Wesley Publishing Co.

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# **Tacit Design Issues Regarding the Use of Visual Aesthetics for Web Page Design**

**Kirstin Krauss**

## **Abstract**

The development of broadband Internet and emerging and converging technologies are enabling designers to incorporate more high quality video and visual sensations as part of the persuasive appeal on their websites. This paper investigates the use of visual aesthetics as communication medium on web pages and specifically subconscious tacit principles designers apply when designing for these online visual interfaces. Issues addressed in this study include principles of conceptual blending, introspection, existing literature on visual aesthetics, the relevance of visual aesthetics and possibilities of applying it in web design. Some multivariate correlations between themes and topics arising from the data collection are highlighted and discussed. Lessons for academia and management are highlighted as conceptual blending is applied to assist in interpreting results.

## **Introduction**

The research presented in this paper constitutes part of a greater study on the topic of visual aesthetics and its impact on online communication. It is also a follow-up paper on a further facet of visual aesthetics for web pages published in this journal in 2005 (see Krauss, 2005). Aspects related to subconscious tacit strategies that web designers use when applying visual aesthetics and other elements where visual communication is of importance, are highlighted in this paper.

This research supports the relevance of visual aesthetics for web interfaces. It also highlights the need for designers to understand the subconscious nature of the process of visual aesthetics and subconscious tacit strategies designers use when they develop online visual interfaces. Designers from three different web design companies were interviewed during data collection regarding the issues mentioned above. Interviews were analysed using content analysis and the results are presented and interpreted. In addition, correspondence analysis is applied in order to understand possible multivariate correlations between themes identified in the content analysis.

### **Problem Statement and Rationale**

Central to the problem that this study pursues is that until recently web design literature mostly focused on efficiency considerations, neglecting dimensions like aesthetic quality (Preece *et al.*, 2002: 143) and alternate ways in which people engage in online activities (Lavie & Tractinsky, 2003: 3,11; Park *et al.*, 2004: 352). Human Computer Interaction (HCI) literature expresses "only passing interest in the aesthetic dimension of interaction" (Lavie & Tractinsky, 2003: 11). In terms of heuristic evaluation, Preece *et al.* (2002: 412) highlight various heuristics for websites of which many resemble Nielsen's heuristics (Nielsen, 1994). None of them, however, adequately incorporate aesthetics as an integral element of the visual interface. There is therefore a lack of knowledge and guidance on the topic of visual aesthetics for websites. Although authors such as Preece *et al.* (2002) and Lavie and Tractinsky (2003) identify aesthetics as a contributor to HCI success, they still fail to relate aesthetics to successful communication. Literature generally disregards visual aesthetics which is about improving the communication situation (Zettl, 1999: 4) and impacting user perceptions (Lavie & Tractinsky, 2003: 29).

Krauss (2005: 308) explains visual aesthetics as a process by which people examine various media elements and their perceptual reactions to them. Zettl (1999: 123) states that applied visual aesthetics can improve the communication situation through clarifying, intensifying and interpreting a message. Addressing these objectives becomes especially important in the context of recent developments in broadband Internet (Park *et al.*, 2004: 351), emerging possibilities to use the Internet in different ways and the increasing importance of stimulating appropriate aesthetics responses in website users (Park *et al.*, 2004: 351; Lavie & Tractinsky, 2003: 3).

A problem associated with the general disregard of visual aesthetics in web design is the difficulty to measure the impact of aesthetics on perception (Lavie & Tractinsky, 2003: 29), attitudes and behaviour (Fishbein & Ajzen, 1975, cited by Van Der Heijden, 2003: 542) and users' subconscious understanding of visual messages (Fauconnier & Turner, 2002: 5,6). Visual aesthetics mostly operates subconsciously and unknowingly (Zettl, 1999: 13; Sternberg, 1998: 167) while persuasion (which may be a product of visual aesthetics) is more successful when it affects subtle and subconscious understanding (Baron & Byrne, 1991:151). Relating to design, Crilly *et al.* (2004: 574) note that designers and experts often apply introspective and persuasive abilities subconsciously during the design process and "are not able to formulate what they know", hence this enquiry into tacit design strategies. Crilly *et al.* (2004: 550) note that designers communicate through their designs using their "skills, training and experience to produce products that induce a positive aesthetic impression". "Designers' tacit understanding of perception and visual composition often guide their intuitive judgments" (Crilly *et al.*, 2004: 558). The "visual form of products is often determined by designers' intuitive judgments and educated guesses" (Crilly *et al.*, 2004: 574). In addition, Krauss (2005: 312) portrays the subconscious cognitive process of conceptual blending as a plausible explanation of the process of visual aesthetics. In this follow-up study the author attempts to support Krauss' (2005: 312) reasoning by determining whether conceptual blending is also a subconscious element of the design process.

This study will, therefore, aim to identify and study tacit and subconscious design strategies for developing visual communication for websites. The study will also aim to establish whether principles of conceptual blending (Fauconnier & Turner, 2002) and introspection can explain these hidden processes. Parallel to that the study will confirm whether principles of visual aesthetics are relevant to web design (according to Krauss, 2005), whether designers apply and see the need for applying these principles and whether there is a need for a better understanding of visual aesthetics for web pages in general. Although understanding the impact of visual aesthetics on actual users will provide an important perspective in the study of visual aesthetics for web pages, it falls outside the scope of this investigation. Authors such as Krauss (2005) and Zettl (2005) shed more light on this aspect of visual aesthetics.

## Literature Review

According to Alben, 1996 (cited by Lavie & Tractinsky, 2003: 11), in general aesthetic criterion is an integral part of effective interaction design, especially when it is about effective communication. In the area of film and video, much has been done on visual aesthetics and how to get people involved in the message (e.g. Zettl, 2005 & Zettl, 1999). Relating these principles to web pages, Krauss (2005: 320) shows that principles of visual aesthetics used in video and film editing (e.g. Zettl, 2005) have much relevance in certain online visual contexts. Krauss (2005) highlights various principles of visual aesthetics for the web interface. These include colour temperature (Krauss, 2005: 322), psychological closure (Krauss, 2005: 327), the use of vectors (Krauss, 2005: 325), the predictive effect of visual aesthetics (Krauss, 2005: 323), the use of lighting (Krauss, 2005: 325), horizontal arrangement (Krauss, 2005: 325) and so forth. The detail regarding these principles of visual aesthetics is a separate study area and discipline and consequently falls outside the scope of this paper. For the reader it is necessary, however, to understand that the major function of visual aesthetics is based on the original meaning in Greek<sup>1</sup> which has the same root as that of perception (Zettl, 1999: 4; Lavie & Tractinsky, 2003: 5). Principles of visual aesthetics collectively aim to affect human perception and support communication intent. According to Zettl (1999: 7,8) the purpose of visual aesthetics is to build an event that will influence and guide the human mind to construct meaning. Sufficient consistency exists in human perceptual processes so that one can predict with reasonable accuracy how people will respond to specific aesthetic stimuli and contextual patterns (Zettl, 1999: 8). It is therefore expected that understanding human perceptual processes, the role of experience and the impact of these variables on attitudes and behaviour, will aid designers to develop successful websites. Knowledge on how to apply visual aesthetics correctly will assist designers in making visual prompts to support the intended message and ultimately communicate better.

An aspect of visual aesthetics that is an important consideration in the process of manipulating and impacting people's perceptions is the fact that it often occurs subconsciously and unknowingly (Zettl, 1999: 13; Sternberg,

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<sup>1</sup> *Aisthanomai* = "I perceive"; *aisthetike* = "sense perception" (Zettl 1999: 4).

1998: 167). A description of the subconscious impact of visual aesthetics therefore requires an investigation beyond explicit design principles and user experiences. This study therefore, focuses on tacit and subconscious issues regarding the use of visual aesthetics as visual communication medium.

The process of conceptual blending can be applied to many areas (Fauconnier & Turner, 2002: vii). Krauss (2005: 315) describes how the theory of conceptual blending relates to the process of visual aesthetics and website design. Fauconnier and Turner (2002) cited by Krauss (2005: 312), argue that a person builds a scenario of understanding or perception by blending or integrating different events (which may include existing experience or known events) and supplied inputs (e.g. a picture on a computer screen) through the abilities of *identification*, *integration* and *imagination*. A blend forms the creation of a new event in the viewer's mind that communicates meaning. Citing Fauconnier and Turner (2002), Krauss (2005: 312) relates conceptual blending to visual aesthetics as follows:

How humans see one thing as one thing is regarded as a central problem of cognitive neuroscience, called the binding problem (Fauconnier & Turner, 2002: 6). One thing is constructed from various inputs, e.g. what we see, (colour, shape, position), what we smell, hear, etc. Binding these various inputs to one thing is the work of conceptual blending and we are not aware of its workings. We do not ask ourselves how we can see one thing as one thing and assume that the unity comes from the thing itself and not from our mental work, just as we assume that the meaning of a picture is in the picture rather than in our interpretation of its form. This shows that building a screen event is not that simple process as originally supposed. It is rather a complex process by which a number of visual elements are selected to act as visual inputs to the user with the same goal which is to work together to construct meaning in the mind of the user and facilitate the cognitive process of building an event.

Krauss (2005: 313,328) concludes that conceptual blending does occur in the minds of people who experience things, and that through the effective use of visual aesthetics one can take advantage of this human ability to create meaning or intensify a visual message. A website should be designed in such a

way that elements of visual aesthetics create input spaces in the minds of users and that it collectively intensifies the message and creates the blends of new understanding of what the site wants to communicate. In this study conceptual blending assists in explaining the workings of visual aesthetics and the subconscious design processes designers use to develop visual communication for websites. The theory of conceptual blending, furthermore, supports the validity of using various introspective abilities such as analogy, identification, integration and metaphor to study and use visual aesthetics.

An issue that interrelates with conceptual blending is introspection<sup>2</sup> or introspective abilities. Messaris (1997: xiv), Large (2001: 81) and Engholm (2002: 196) acknowledge that drawing from their intuitive understanding and a growing body of research on the relationship of emotion and vision, visual communicators are able to elicit strong and primal reactions in users. The subconscious nature of these abilities is acknowledged (Crilly *et al.*, 2004: 574) in that design is a creative activity that seems not to be understood except by designers, and “they have not formulated what they know”. Klopper (2003: 292) shows that viewers use introspection in order to make sense of what they perceive. Klopper furthermore explains that experts in different fields use introspective abilities to gain access (mostly subconsciously) to their own expertise, trained skills and knowledge in order to apply it in their respective areas, confirming the role of experience.

## Research Design and Methodology

As shown in the previous section a study of visual aesthetics implies that the combined impact of elements of visual aesthetics should be investigated since they operate in concert with each other and various other website elements. Furthermore, many of the design strategies under investigation are tacit and subconscious issues and in-depth discussions and interviews are necessary to

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<sup>2</sup> According to Encarta (1999) **introspection** is the detailed mental self-examination of feelings, thoughts, and motives. **Intuition** (Encarta, 1999) on the other hand is the state of being aware of or knowing something without having to discover or perceive it, or the ability to do this. It is something known or believed instinctively, without actual evidence for it. Although many authors and interviewees use these constructs interchangeably, the correct interpretation is in fact **introspection**.

excavate these forms of knowledge from designers' conceptualisation and thinking<sup>3</sup>. Case study research appears to be most appropriate to investigate these issues since it is suitable for learning more about little known or poorly understood situations (Leedy & Ormrod, 2005: 135). During interviews elements of subconscious and tacit design issues were not explicitly mentioned by interviewees obviously due to the nature of these issues. The investigator therefore had to make inferences from interviewees' responses to case study questions. This could be seen as a subjective process and is indeed so. However, in qualitative research inferences are a natural part of discovery (Krippendorff, 1980: 26,33; Leedy & Ormrod, 2005: 133) and should be treated as such. Furthermore, according to Leedy and Ormrod (2005: 147) the researcher can be considered part of the data collection instrument. The investigator, using the literature as orientation, looked at the evidence in as many ways as possible and thus attempted to reduce bias.

	Interview Question	Purpose of the Question
i	What is your training and experience in the field of web and graphic design and how long have you been working in this field?	This question involves an enquiry to prior training and experience in web and graphic design. Where required interviewees will be presented with more specific and prompting follow-up questions to ascertain their knowledge of specific disciplines associated with web design as indicated by literature. The reason for this is to determine whether interviewees' exposure to these disciplines might possibly influence their perceptions and web design strategies. Although not explicitly stated, these prompting questions will furthermore assist in reminding them about their

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<sup>3</sup> Many of the issues involve metacognition. **Metacognition** is knowledge about one's own thoughts and the factors that influence one's thinking (Encarta, 1999).

		possible involvement in certain areas. It also aims to establish how knowledge of these areas was obtained, i.e. through formal training, experience or other means.
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ii	<b>Which design strategies do you apply to get your users involved in the websites that you design?</b>	<b>This question is to identify principles or guidelines that designers use intentionally (consciously) or unintentionally (subconsciously) to develop their websites. Where required more specific questions will be asked to prompt interviewees for further and more specific information. This can be seen as a strategy to assess to what extent they use tacit knowledge in web design activities and to identify the types of subconscious/unintentional design strategies interviewees use, such as principles of conceptual blending. It is also a strategy to determine if they apply visual design principles such as visual aesthetics to involve their users in their designs and communicate an online message. Although not explicitly stated, these prompting questions are posed to access interviewees' metacognitive knowledge and assist them to think deeper than the explicit or obvious.</b>
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iii	The development of broadband Internet will encourage people to use the Internet in new and alternate ways and also affect the way in which you design web pages. What is your opinion on this?	This question aims to gain understanding on how broadband Internet and emerging and converging technologies might impact web design strategies and the way people use the Internet. It aims to obtain a view on the perspective of web designers on the impact of broadband Internet on web design and online activities and whether they see an opportunity to apply principles of visual aesthetics more extensively.
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**Figure 1: Interview questions**

For this study, three small web design companies were approached as sources of data. These companies are not necessarily representative of the total population and were selected based on convenience and access. The data collection instrument is unstructured interviews with open-ended non-leading questions regarding the concepts uncovered in the literature. Interviews were held with all available web designers working in each company's environment. Designers from these companies were interviewed as three different cases in order to compare the results in the correspondence analysis and possibly generalise some of the findings to other situations (Leedy & Ormrod, 2005: 136). Uniformity of recording is sought for facilitating comparative analysis (Lubbe, 1998: 62). The interview questions are shown in Figure 1 together with the purpose of each question. The questions are reminders or prompts to the investigator regarding the information that should be collected. During interviews and where necessary follow-up questions and discussions occurred to gain better understanding of interviewees' metacognition. Although only three questions are shown here, the reader must be cognisant that this paper presents part of the results of a greater study on visual aesthetics and only the relevant parts of the data collection instrument is included here.

Content analysis is used to identify frequencies and intensities with which themes and concepts appear in interviewee responses. Themes and concepts are identified in the literature and refined during data analysis. A content analysis matrix is used to summarise the concepts that arise from the case study data (see Figure 2). Content analysis is by nature a subjective process

that relies on content categories (referred to as Themes in this paper and numbered A1 to A8) being set up and the researcher then counting the number of occurrences of these categories (Lubbe, 1998: 95). The establishment of the manifest themes is one of the main areas of possible subjective bias. Further areas where bias may occur in this research are the process of counting the occurrences of concepts and relating these concepts to the respective themes. Individual concepts are listed in Appendix B to give the reader an idea of what emanated from case study interviews. However, the themes and concepts in Figure 2 and Appendix B may be meaningless to the reader without the interpretations and context provided in the discussions thereof.

Correspondence analysis was used to help corroborate the findings of the content analysis and interpret the data. Since correspondence analysis provides a perceptual map of the data, it can provide a deeper insight into the multivariate nature of the data. Associations between variables can be seen and therefore be more easily interpreted (Greenacre, 1984 cited by Lubbe, 1998: 112; Bendixen, 1996: 22). Content analysis revealed that the case study participants are concerned about eight major themes. The next step in the data analysis was to establish how these themes related to each other and to the different participating companies or cases. Correspondence analysis was used for doing so.

## **Interpretation of Content Analysis Results**

Although Figure 2 displays related themes in order of frequency it should be viewed in conjunction with the discussions of the various themes in order to gain the correct perspective and understanding. The frequencies should therefore not be seen as some order of importance but rather as a point of departure for discussion. In the following sections the author explains themes as well as the context in which they appeared in interviewee responses. The detailed distribution of frequencies per company and individual are shown in Appendix A. Concepts furthermore could relate to more than one theme and therefore may appear more than once under the themes in Appendix B.

	Themes	Theme Code	Total	%	Accum%
1.	Using intuition / introspection / experience (of self & others) / understand own thinking	A3	57	23	23
2.	Reference to principles of conceptual blending used during design	A2	48	20	43
3.	Using principles of visual aesthetics (using specific elements of visual aesthetics)	A4	36	15	58
4.	Conscious awareness of principles of visual aesthetics and its effect on users	A5	33	13	71
5.	Design is multi-modal / multi-functional / multi-disciplinary	A8	25	10	81
6.	Alternate uses of the Internet / different surfing objectives for users / the possible impact of broadband on Internet usage	A1	20	8	89
7.	Design interactive sites / design to get the user involved in the process in general	A7	15	6	96
8.	Limitations of current design courses / literature	A6	11	4	100
	<b>Total scores</b>		<b>245</b>		

**Figure 2:** Content analysis showing relative frequencies and percentages for design approaches used by designers

Figure 2 shows that in the transcript of the case study interviews, there are 57 major references to *using intuition, introspection or experience (of self and others) during the design process or the need and ability to understand one's own thinking* (Theme A3), there are 48 references to *the use of principles of conceptual blending as part of the design process* (Theme A2), and so forth.

### **Using Intuition / Introspection / Experience (of self & others) / Understand Own Thinking (Theme A3)**

Theme A3 groups concepts that relate to the use of intuition, introspection and experience. As indicated in the literature introspective abilities are an intricate part of the design process. This is confirmed by the theme. Concepts relating to the use of introspection in web design, i.e. understanding one's own thinking

and relying on the introspective abilities of one-self and others are all grouped under this theme. Results of this grouping confirm that designers rely on introspective abilities during the design process. It shows that these introspective processes often operate subconsciously or tacitly and that one should be aware of these introspective abilities that operate during thinking and design. The theme also shows that designers tap into the introspective abilities (or experience) of colleagues by asking their feedback and by looking at examples and work of each other. This theme, furthermore, confirms that introspective abilities are based on experience and may develop through experience. It confirms that by knowing about and developing introspective abilities, designers are able to elicit strong and primal reactions in their users i.e. if designers understand their own thinking they will be able to persuade and communicate better.

Learning and experience are important facets of Theme A3. Designers learn from each other, they learn from examples and they learn from understanding their clients. This theme therefore closely relates to the next theme (Theme A2), because designers need to identify design elements that are useful and integrate it in their own environments using their imagination and creative ability, confirming the process of conceptual blending (see Section 3, Literature review).

### **Reference to Principles of Conceptual Blending Used During Design (Theme A2)**

Concepts grouped under this theme relate to principles of conceptual blending that designers use (consciously or subconsciously) during the design process. Theme A2 shows that designers use metaphor and analogy to describe their design approaches. They also use analogy and metaphor in their designs for their users to associate and relate to. The theme confirms that imagination plays a pertinent role during design and that designers rely on both their own and their users' abilities to identify and integrate concepts. It shows that although designers are not aware of conceptual blending, they subconsciously apply it by using visual and other elements on their website to create input spaces that function together to create units or blends, sometimes using various sensory inputs. Concepts also show that conceptual blending operates subconsciously as expected from the theory. Although many researchers may

argue that design principles are explicit and formalised, this theme shows that tacit and subconscious strategies do exist in the process of design and that the theory of conceptual blending may assist in explaining some of these strategies.

### **Using Principles of Visual Aesthetics (Using Specific Elements of VA) (Theme A4)**

Concepts grouped under this theme show that designers apply various principles of visual aesthetics in their design activities. These are, for example, the use of graphics or visual aesthetics to attract attention, lead the eye and entice the user to get involved. It also shows that graphic design (which implies the use of visual aesthetics) is a concept or an argument rather than just for the purpose of making beautiful. Principles of psychological closure and colour desaturation (Krauss, 2005: 321, 327) have been implied and some functions of lighting, colour and motion (Zettl, 2005) have been mentioned. The specific use of elements of visual aesthetics, however, is much less compared to its use in film and video. The notion that the principles applied in film and video production will be used more and more in the future has been expressed a number of times, for example in the comment that “the lines between TV and the Internet is blurring”. Many of these comments are made in context of the impact of broadband Internet and emerging and converging ways in which people use the Internet (see interview question iii, Figure 1).

### **Conscious Awareness of Principles of Visual Aesthetics and its Effect on Users (Theme A5)**

Although Theme A5 overlaps to a large degree with the previous theme, the investigator sought out concepts that show that designers are consciously aware of principles of visual aesthetics. This theme shows that to a certain degree, designers are aware of elements of visual aesthetics. Their knowledge, however, is fairly limited compared to that portrayed in Zettl (2005) and Krauss (2005). It shows that there is a need to address visual aesthetics as part of web design training and to treat video editing knowledge as a necessity for the current web design milieu. In fact, in Appendix A (Theme A5), the reader will observe that in general company 2 has shown considerably more conscious knowledge of elements of visual aesthetics. When posed with the question of how the company acquired this knowledge, participant 2.2

remarked that it was through the video editing course that he had done. Being the director as well, this participant consequently influenced his employees in this area. Formal training in video editing and visual aesthetics could therefore be a valuable asset for web designers.

### **Design is Multi-modal / Multi-functional / Multi-disciplinary (Theme A8)**

Under Theme A8 the author sought out concepts regarding the multi-disciplinary nature of the Internet with specific reference to current and future developments. This theme confirms that established web design guidelines (e.g. Nielsen, 2000; Nielsen, 1994; Preece *et al.*, 2002: 412) are inadequate for the evolving and versatile nature of the Internet, especially where it concerns graphic and communications design. Knowledge of human factors in HCI will become increasingly important for web design as well. It shows that web design is gradually becoming a multi-disciplinary and multi-functional process in which designers need knowledge of various areas. According to participants these include graphic design, knowledge of video editing, advertising, latest technological developments and marketing. Knowledge of Flash™ as a graphic design tool was mentioned several times. Some participants hinted towards knowledge of psychology, noting that it would be useful to have some background in that in order to know their users better. It seems that ultimately design teams need to consist of experts in a number of areas in order to appropriately address these multi-disciplinary issues.

Designers interviewed stated that in general they seldom design only a website for their clients. Normally they have to address their clients total design portfolio, which may include for example printed media and a marketing concept. A website is therefore seldom considered in isolation and forms part of a client's total marketing strategy, hence the need for knowledge on marketing. The investigator noted that the type of website or design determines the skills needed. A database driven website, for example, requires more programming and technical knowledge. Here usability and functionality plays an important role. In general the first company interviewed is more involved in these types of websites and some of their perspectives on graphic design and visual communication reflect this (see Appendix A). The second company, on the other hand, has stronger opinions on visual communication

and generally stated that web design is normally a small percentage of their client's total design portfolio.

### **Alternate Uses of the Internet / Different Surfing Objectives for Users / The Possible Impact of Broadband on Internet Usage (Theme A1)**

Against the background of current technology developments and broadband Internet, Theme A1 aimed to identify whether there are emerging and alternate uses for the Internet. This theme also aimed to identify alternate reasons why people use the Internet. The notion was expressed that broadband Internet and new developments may render current design principles limited. Based on their experience designers made some predictions regarding alternate uses for the Internet and how it will impact the way people interact online. These include new design methods and trends, more interactive sites, more businesses and people using the Internet, more video based web pages, more entertainment, more graphics and Flash, and so forth (see Appendix B). These concepts imply extensive use of visual aesthetics in web pages.

### **Design Interactive Sites / Design to Get the User Involved in the Process in General (Theme A7)**

Concepts under Theme A7 relate to the fact that an important aim of most sites according to participants is to get the user involved and the role that graphics plays in this process. Concepts that describe this include that a site must entice a person to explore further and that one needs to design interactive sites so that people want to be there. Concepts that specifically point to the use of graphics or visual elements are that the purpose of graphics is to entice and that interaction is more important (against the background of emerging and converging technologies and broadband Internet) in a playful sense, like gaming even on corporate sites. Interviewees noted that broadband will enable more interactive sites, new possibilities and sites that "talk back". According to one participant the purpose of graphics is to entice.

Although designers do not explicit refer to visual aesthetics as such but rather use the general term "graphics", this theme confirms the literature that increasingly there is a need for designers to advance their users from being passive communicators into active communicators. It confirms that visual

aesthetics seems to be a vehicle to achieve this and that knowledge of visual aesthetics will assist designers to be more successful in their communication objectives.

## **Limitations of Current Design Courses / Literature (Theme A6)**

Theme A6 groups concepts related to the value of literature and design courses for current and expected future uses of the Internet. Although it was not a major topic of discussion during the case study interviews, interviewees generally noted that although design courses provide a valuable point of departure they are generally limited and teaches only the basics, and that it will probably be inadequate for designing for many broadband based websites. Some participants argued that according to their experience, books on web design are not useful and are outdated quickly, and that they do not really use books in their day to day design activities. One could deduct from this that there are considerable limitations to available literature and established guidelines for web page design. This could confirm that websites increasingly contain multiple elements due to new developments (see the discussions on themes Theme A7 and Theme A1 in the previous sections) and that web developers find it difficult to properly interpret web design heuristics (e.g. Nielsen, 1994; Preece *et al.*, 2002: 412) in specific online contexts. Most interviewees stated that they would rather gather examples from which they can collect ideas while learning from co-designers and colleagues. This confirms that to a large extent designers rely on their own introspection and experience as well as that of their colleagues. Responses from participants indicate that there seems to be a need to understand which specific visual principles have what effect on its viewers highlighting the need for knowledge on visual aesthetics. Some participants investigated aspects such as the psychology of colour in order to design better. None of them investigated visual aesthetics per se.

## The Use of Correspondence Analysis

THEMES	Theme Code	Company 1	Company 2	Company 3	TOTALS
Alternate uses of the Internet / different surfing objectives for users / the possible impact of broadband on Internet usage	A1	1	16	3	20
Reference to principles of conceptual blending used during design	A2	13	23	12	48
Using intuition / introspection / experience (of self and others) / understand own thinking	A3	22	23	12	57
Using principles of visual aesthetics (specific use of elements of VA)	A4	10	22	4	36
Conscious awareness of principles of visual aesthetics and its effect on users	A5	7	18	8	33
Limitations of current design courses / literature	A6	1	6	4	11
Design interactive sites / design to get the user involved in the process in general	A7	0	9	6	15
Design is multi-modal / multi-functional / multi-disciplinary	A8	1	22	2	25
<b>Total</b>		<b>55</b>	<b>139</b>	<b>52</b>	<b>245</b>

**Figure 3: Summary results for design approaches used by designers**

Total Inertia=.15465 Chi<sup>2</sup>=38.044

Degrees of freedom=14

No of dimensions	Singular Values	Eigen-Values	Perc. of Inertia	Cumulatv Percent	Chi squares
1	0.324657	0.105402	68.15461	68.1546	25.92898
2	0.221922	0.049249	31.84539	100.0000	12.11537

**Figure 4:** Eigenvalues and Inertia for all dimensions

Figure 3 shows the result of the content analysis detailed by participating company. All sections of Figure 3, i.e. rows 1 to 7 for all columns, were extracted for processing using the correspondence program STATISTICA version 7.1 by StatSoft, Inc. STATISTICA produces a number of tabular reports and one graph. For the purpose of this research the tables presenting the row and column coordinates and contributions to inertia as well as the eigenvalues and inertia for all dimensions were used to assist in the interpretation of the graph (see Figure 4 and Tables 1 and 2 in Appendix C).

Inertia may be explained as a measure of the total variability in the original data set (Lubbe, 1998: 114; Garson, no date: 4). There is one eigenvalue for each dimension, sometimes labelled inertia for that dimension. Each eigenvalue is the amount of inertia (variance) a given factor explains in the correspondence table. Eigenvalues reflect the importance of the dimensions (Garson, no date: 4). The first dimension always explains the most inertia (variance) and has the largest eigenvalue, the next the second-most, and so on. The sum of eigenvalues is the total inertia (Garson, no date: 4). The maximum number of eigenvalues that can be extracted from a two-way table is equal to the minimum of the number of columns minus 1 and the number of rows minus 1 (StatSoft, 2003: 3). Therefore, since three cases are presented in Figure 3, only two dimensions are reflected in Figure 4 as produced by STATISTICA.

Figure 4 shows that one dimension explains 68.15% of the total data variability and two dimensions explain 100% of the total variability. Figure 5 is a perceptual map with the axes defined and perceived groupings of points. It shows the relative positions of the different themes and the different participating design companies. As mentioned before A1, A2, A3, etc. represent the various themes that emanated from the case study data. The participating companies are indicated by the word "Company" and numbers 1,



According to StatSoft (2003: 4) and Bendixen (1996: 26) the distances between row variables and the distance between column variables is meaningful and may be interpreted, but the distance between row and column variables can not be interpreted. However, it is appropriate to make general inferences about the nature of dimensions based on which side of the origin particular points fall (StatSoft, 2003: 4). A row point or grouping of row points may point out a tendency of a column point that finds itself within the same area on the perceptual map. The perceptual map is the primary product of correspondence analysis and it shows how row and column variables may be grouped. It is, however, up to the analyst to attribute meaning to the axes.

The first step in this process is to decide, based on the research context, whether to interpret the axes in terms of rows or columns. Against the background of this study it seems more appropriate to interpret themes in company context. Secondly, axes are interpreted by way of the contribution that each element (in this case themes) makes towards the total inertia accounted for by the axis. There are eight themes, thus in general, any contributions greater than 12.5% ( $100/8 = 12.5\%$ ) would represent a significant association which is greater than the expected and would consequently determine the various axes (Bendixen, 1996: 28). The squared correlation presented for any variable or theme measures the degree of association between that variable and a particular axis (Bendixen, 1996: 30). Examining the detailed report in Table 1 in Appendix C and specifically the Cosine<sup>2</sup> columns (also labelled squared correlations) for dimensions one and two (StatSoft, 2003: 7 & Bendixen, 1996: 28), one can see that Themes A1, A2, A3 and A8 “determine” or are more closely associated with the first axis. Themes A4, A5, A6 and A7 on the other hand are more closely associated with the second axis. In the first dimension, Theme A1 and A8 have negative coordinates, while Themes A2 and A3 have positive coordinates. Themes A1 and A8 therefore are related, while A2 and A3 are related. In the second dimension Theme A4 has a positive coordinate while Themes A5, A6 and A7 have negative coordinates.

The reader should keep in mind that this is qualitative research and that the process of understanding the meaning of axes explained above and the grouping of themes should be thought of as a general guideline for interpretation and explanation rather than a strict mathematical rule. The

degree of the association ( $\text{Cosine}^2$ ) between themes and axes should be treated as a guide to understand the grouping of themes rather than the other way round (Bendixen, 1996: 30). A relatively weak association ( $\text{Cosine}^2$ ) between point and axis should therefore be treated with caution during interpretation. Furthermore, the quality of representation of row and column in the number of dimensions presented in this study will be 100% for all points since there are only two dimensions explained in the correspondence analysis. Therefore, the sum of row and columns  $\text{Cosine}^2$  and quality of representation present the same values in this study (see Appendix C Table 1).

### **Interpretation of Correspondence Analysis Results**

The variables to the left of the vertical axis (Figure 5) have the common theme of current and future design trends. Themes with positive coordinates on the horizontal axis generally address design principles used by designers during the design process where the focus is on how to communicate successfully using graphics and other elements. On the vertical axis, points with negative coordinates group design issues where the effect or impact on the user is considered. Variables with positive coordinates on the vertical axis seem to be the opposite in that it groups general design considerations other than those where the impact on the user is considered. As mentioned earlier many of the concepts mentioned by participants relate to more than one theme and therefore the logical distinction between variables and axis could be vague in some cases. The proposed meaning of the various axes should be seen as a general guideline for discussion. Furthermore, variables grouped on opposite sides of an axis do not necessarily refer to logical opposite topics or themes (Bendixen, 1996: 29). The groupings of points in the various quadrants of the perceptual map are the main product of the correspondence analysis.

Considering the description of the themes in Section 5, it is evident that the grouping of Themes A1 and A8 address future and alternate uses of the Internet and how to design for this environment. A relatively strong association (see the  $\text{Cosine}^2$  values in Table 1 Appendix C) between both Themes A1 and A8 and the first dimension shows that these two points present a prominent grouping. From this association one can infer that in order to design for the alternate ways in which people use the Internet, designers need to be multi-functional and multi-disciplinary, having knowledge of more than just usability and basic web technologies. One could infer that alternate ways in which

people use the Internet are related to a multi-disciplinary multi-modal design approach. Against the background of the literature one may deduct that in order to take full advantage of the possibilities of emerging and converging technologies, designers need to have training and experience in various disciplines or areas. This confirms the interpretation of the content analysis (Section 5). Since Company 2 is in proximity of the grouping of A1 and A8 (especially A1 in terms of the vertical axis) it could be inferred that this company shows relatively strong awareness of alternate uses of the Internet and the impact of broadband. It also seems that Company 2 has a multi-disciplinary and multi-functional approach to web design while current and future trends tend to direct their design approaches.

Themes A6 and A7 are not closely associated to the horizontal axis but rather to the vertical axis according to the Cosine<sup>2</sup> columns in Table 1 Appendix C. They are, however, on the same side on the horizontal axis as Themes A1 and A8 and on the opposite side on the vertical axis (see Figure 5) in relation to Themes A1 and A8. They form part of the general theme of current and future design trends (i.e. they have negative coordinates in terms of the horizontal axis). The A6 and A7 grouping shows that participants consider Themes A6 and A7 related and one could conclude that design courses and literature are limited in that they do not address the need for designers to know how to get users involved in the websites that they design. One can also infer that according to participants, design courses and literature are inadequate to address design approaches for future and alternate ways in which people use the Internet. This association furthermore points out that design courses and literature do not address the multi-disciplinary nature of the actual web design process. It confirms the notion highlighted in the content analysis stating that existing design courses and literature provide a point of departure rather than a comprehensive design approach (see Section 5.8). Theme A7 in the grouping on the horizontal axis seems to point out that alternate, future and multi-modal web design approaches entail the design of interactive websites or sites that aim to get the user involved in the communication process; it shows that broadband will enable more interactive websites and that design courses and literature in general are limited in showing designers how to achieve this. The A6 and A7 grouping seems to explain the general design point of view of Company 3 which is in proximity of the grouping.

The mention of graphics in Themes A1, A8, A6 and A7 seems to show that the use of visual aesthetics may be a vehicle to address the needs and limitations that emanated from these themes. One may deduct from this that visual aesthetics, or graphics, as participants loosely referred to it, is a way to get people involved in the communication process and that it will become more prominent in future through broadband developments. Design courses and web design literature should incorporate knowledge of visual aesthetics and topics such as video editing, marketing, photography and social psychology supporting multi-disciplinary design.

Based on the perceptual map (see Figure 5), Themes A2, A3, A4 and A5 are associated with each other. Themes A2 and A5 are related more closely while A3 and A4 are somewhat detached. As mentioned earlier these themes generally address principles that designers use (knowingly or unknowingly) to design their websites. The grouping of A5 and A2 shows that when designers are consciously aware of principles of visual aesthetics, they seem to simultaneously refer to principles of conceptual blending to describe their use of visual aesthetics. In context of the discussions of Themes A2 and A5 in Section 5, it could support that to a certain degree principles of visual aesthetics are in fact also principles of conceptual blending. It seems to support the reasoning in the theory that conceptual blending can be used to explain the workings of visual aesthetics (Krauss, 2005: 315), that elements of visual aesthetics create blends in the minds of its viewers and that knowledge of conceptual blending will assist designers in applying various visual and other elements more successfully in their web design environments. The proximity of Theme A3 to the grouping of A2 and A5 could reveal that the use of introspective abilities and experience plays a role in the application of visual aesthetics especially where the impact on the user is considered. It also shows that conceptual blending and visual aesthetics are applied introspectively and subconsciously by designers and the ability to use it improves through experience.

Although Theme A4 could be seen as being in relative proximity of the grouping of A2 and A5 it is also somewhat detached. This association could imply that when designers use specific elements of visual aesthetics, they tend to do it intuitively (or introspectively), using conceptual blending while considering the impact it has on the users. They do not consciously follow

specific guidelines when designing. This could emphasise the need for knowledge on principles of visual aesthetics in order to apply it more constructively and consciously. In context of the explanation of the themes in Section 5 designers determine the possible impact that elements of visual aesthetics will have on their viewers by considering the impact it has on their own perceptions. They will also rely on their own experience (e.g. what did this visual association mean in other contexts) and on the experience and perceptions of colleagues. During interviews, many designers mentioned that they would ask a colleague if they understand their designs. However, on the perceptual map the association between Theme A4 and the A2, A3 and A5 grouping is not prominent and further research might be needed to confirm this. Company 1 finds itself in proximity of A3 and therefore seems to have these tendencies in their design approaches.

In general the results of the correspondence analysis should not be considered in isolation but in context of the content analysis and the literature review. Additional research will shed more light on the associations between variables. However, the analysis of literature, the content analysis and the correspondence analysis in general confirm one another and therefore the research results may be relevant to other contexts.

## **General Observations Regarding Designer Training**

In general interviewees found it difficult to explain their own thinking, perceptions and metacognitive knowledge, for example explaining their perceptions of the impact of elements of visual aesthetics and explaining how they design to get their user involved in the communication process. It is as if designers either design intuitively or do not explicitly think about effective communication at all during design. This difficulty was anticipated before data collection and the investigator therefore asked follow-up and prompting questions where necessary. It was furthermore noted that individuals with training in visual communication such as graphic design and video editing are more able to explain their design strategies and thinking regarding the aspects mentioned above. Designers from a programming background or who were self-trained rely more on introspective abilities and “gut feel”. Some designers from a programming background explicitly argued against the need for using visual aesthetics in websites. This tendency could be the result of their training (or lack of training in visual communication) and subsequent work experience.

All designers interviewed apply principles of visual aesthetics to some degree in their designs. Those with training and a background in areas related to visual communication tend to do it more consciously and constructively. One can therefore conclude that training in visual aesthetics will assist designers in applying visual aesthetics more successfully to support communication objectives.

## **Summary of Conclusions**

In general the discussions of the various themes show that designers learn from other media forms, that in terms of graphic design the borders between various media forms tend to merge, conceptual blending is subconsciously applied during design and various principles of visual aesthetics are used in the design process. These principles include the contextual nature of visual aesthetics, some functions of colour and the subconscious impact of visual aesthetics. Specific functions of colour, lighting, shape and on-screen arrangement (such as vectors, size and psychological closure) are not identified or consciously applied by designers. This is probably because the Internet does not lend itself to applying all principles of visual aesthetics yet as is the case in video editing. Visual aesthetics is not exploited to the same degree as in film and video production and therefore designers seem not aware of its potential and how to apply it. From the interviews it seems that visual aesthetics is not adequately addressed in web design training courses and literature and that these limitations are especially critical against the background of emerging and converging technologies. One interviewee noted that when trainers do address visual aesthetics they tend to use random examples mostly based on their experience. Confirming Fauconnier and Turner (2002: 14), trainers probably disregarded visual aesthetics in the past due its lack of form and difficulty to measure (Krauss, 2005: 318). This study concludes that introspection and experience as tacit abilities are applied in web design and that conceptual blending is a tacit process used by designers for the development of visual communication.

## **Limitations and Scope**

This study is primarily a qualitative, interview-based investigation of the perspectives of website design practitioners. According to Leedy and Ormrod (2005: 133) qualitative research is not necessarily about the discovery of a

single ultimate truth, but rather a study of the nature of multiple perspectives held by different individuals, with each of the perspectives having equal validity or truth. Representivity is therefore not an issue.

This study does not highlight all tacit design strategies for web page design. It highlights some limitations of web design literature such as that it does not consider tacit design strategies and visual aesthetics adequately.

This study furthermore focuses mainly on visual design principles and visual aesthetics and not for example on website usability or other sensory inputs. As mentioned in the statement of the problem, the intention of the study is to identify and highlight some subconscious tacit design strategies for visual communication for websites. It therefore lays the foundation for further studies in visual aesthetics for web pages by presenting the subjective perspectives of some web designers.

### **In Retrospect – Using Conceptual Blending to Interpret Findings**

Results show that designers use metaphors to describe some of their designs and concepts. They learn from others by looking at their designs and by asking for their colleagues' feedback on their own designs. In context of converging and emerging technologies, according to designers, it becomes necessary to learn from other media forms such as video. Consequently it becomes necessary to apply principles of conceptual blending to identify and relate design ideas in these media forms to the changing web design milieu. Since designers are often involved in a client's total design portfolio (which includes marketing, printed media, radio, TV, etc.) it is necessary to consider the design of a website in context of other forms of communication. As stated by one interviewee, a website is often supported by printed and other media. Design teams have to decide on a theme or a brand image that can be carried through to other media forms. A website should, however, be able to communicate independently supporting a company's corporate image. It is here where the ability of conceptual blending assists in creating unity and context.

According to Morrison (2003) the process of conceptual blending assists in contextualising various related concepts in the visual communication environment. Designers therefore not only develop independent concepts or visual elements that communicate facts and content but apply conceptual

blending to synthesise ideas and concepts and create meaning (Morrison, 2003). Learning is an integral part of interacting with a website. Integration of information, constructs and concepts enable users "to make sense of and create meaning from divergent streams of data and non-linear links to ideas" (Morrison, 2003). This confirms the role of conceptual blending.

Regarding multi-disciplinary teams such as design teams, conceptual blending enables users and also web project facilitators to understand and synthesise ideas drawn from various disciplines and dissimilar units of knowledge. Turner (2001: 151) cited by Morrison (2003) states that:

The theory of conceptual integration [blending] is an attempt to provide substance to the intuition that meaning descends through elaborate, perpetual, and distributed processes of modification, inheritance, and selection, to develop richness, diversity, and nuance that characterize cognitively modern human beings and the complex societies they make.

From this one can infer that web development project managers, applying and exercising knowledge of conceptual blending, will be able to more constructively facilitate the various skills and personalities in their design teams so that a webpage integrates and blends previously divergent units of information. The ability to apply conceptual blending in this context develops mainly through experience while conceptual blending provides substance to or an explanation of these subconscious abilities.

Furthermore, converging and emerging technologies such as broadband and its consequences provide opportunities to enhance the richness of information and content. Visual, audio and haptic possibilities of multimedia will assist in providing context, trigger reflection (introspection or further blends<sup>4</sup>) and facilitate possibilities that produce association and the capacity to deal with issues from various disciplinary sources (Morrison, 2003).

Although it is not tested empirically in this study the author observed the role of the project manager or facilitator during the initial phases of

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<sup>4</sup> Blending is recursive, in that products of prior blending can themselves become inputs to further blends (Sinding, 2001).

brainstorming and design idea development to be the person that constantly focuses ideas and suggestions. It involves contextualising and interpreting isolated ideas to the general aim and focus of the business objectives. The facilitator often provides additional perspectives during design on issues such as budget, client personality and needs, website audience, marketing strategies and the role of other forms of communication. Morrison (2003) confirms this reasoning stating that the building of teams relies on the team having a “core story” that expresses shared values. Kenney and Leggiere (2003) state that “conceptual blending can help the team derive new, related sub-stories to tackle various business and technical questions”; furthermore, that “through trial and error teams then map elements from one input space to another”, which provides the answer to the questions brainstormed. It shows therefore that conceptual blending explains how multi-disciplinary projects such as web page design take shape.

## References

- Baron, Robert A & Donn Byrne 1991. *Social Psychology: Understanding Human Interaction*. Boston, MA: Allyn and Bacon.
- Bendixen, Mike 1996. A Practical Guide to the Use of Correspondence Analysis in Marketing Research. *Marketing Research On-Line* 1:16-38.
- Crilly, N, J Moultrie & PJ Clarkson 2004. Seeing Things: Consumer Response to the Visual Domain in Product Design. *Design Studies* 25,6:547-577. Accessed 8 February 2005 at [www.ScienceDirect.com](http://www.ScienceDirect.com).
- Encarta 1999. *Encarta World English Dictionary*. Developed for Microsoft by Bloomsbury Publishing Plc. CD-ROM.
- Engholm, Ida 2002. Digital Style History: The Development of Graphic Design on the Internet. *Digital Creativity* 13,4:193–211. Accessed 14 March 2005 at EBSCOhost online research database.
- Fauconnier, G. & M Turner 2002. *The Way we Think: Conceptual Blending and the Mind's Hidden Complexities*. New York: Basic Books.
- Garson, David. Undated. *Correspondence Analysis*. Accessed 26 October 2005 at <http://www2.chass.ncsu.edu/garson/pa765/correspondence.htm>.
- Kenney, C. & P Leggiere 2003. *Across the Chasm*. Accessed 10 August 2006 at <http://www.intelligententerprise.com/030320/605feat32.jhtml>.

- Klopper, R 2003. Yesterday is Another Country ... Image Schemas in Conceptual Blending to Optimize Human Scale Thinking. *Alternation* 10,2: 292-320.
- Krauss, Kirstin 2005. Visual Aesthetics and its Effect on Communication Intent: A Theoretical Study and Website Evaluation. *Alternation* 12,1a: 305-329.
- Krippendorff, K 1980. *Content Analysis: An Introduction to its Methodology*. Beverly Hills, CA: Sage Publications.
- Large, Michael 2001. Communication among all People, Everywhere: Paul Arthur and the Maturing of Design. *Design Issues* 17,2: 81-90. Accessed 16 August 2005 at EBSCOhost online research database.
- Lavie, T & N Tractinsky 2003. *Assessing Dimensions of Perceived Visual Aesthetics of Web Sites*. Israel, Negev: Ben Gurion University. Accessed 26 May 2004 at <http://burdacenter.bgu.ac.il/publications/finalReports/1999-2000/TractinskyLavie.pdf>.
- Leedy, Paul D & Jeanne Ellis Ormrod 2005. *Practical Research: Planning and Design*. New Jersey: Pearson Education.
- Lubbe, Sam 1998. *IT Investment in Developing Countries: An Assessment and Practical Guideline*. London: Idea Group Publishing.
- Messaris, Paul 1997. *Visual Persuasion: The Role of Images in Advertising*. California: Sage Publications.
- Morrison, JL 2003. Conceptual Integration in Online Interdisciplinary Study: Current Perspectives, Theories, and Implications for Future Research. *The International Review of Research in Open and Distance Learning* 4,2. Accessed 5 August 2006 at <http://www.irrodl.org/index.php/irrodl/article/viewArticle/154/235>.
- Nielsen, Jakob 1994. *Nielsen's Heuristics*. Accessed 11 April 2005 at [www.useit.com/papers/heuristic/heuristic\\_list.html](http://www.useit.com/papers/heuristic/heuristic_list.html).
- Nielsen, J 2000. *Designing Web Usability: The Practice of Simplicity*. Indianapolis, IN: New Riders.
- Park, S, D Choi & J Kim 2004. Critical Factors for the Aesthetics Fidelity of Web Pages: Empirical Studies with Professional Web Designers and Users. *Interacting with Computers* (pp. 351-376). Accessed 18 February 2005 at [http://hci.yonsei.ac.kr/non/e01/04\\_aesthetic%20fidelity.pdf](http://hci.yonsei.ac.kr/non/e01/04_aesthetic%20fidelity.pdf).
- Preece, J, Y Rogers & H Sharp 2002. *Interaction Design: Beyond Human-Computer Interaction*. New York: John Wiley & Sons, Inc.

- Sinding, M 2001. *Assembling Spaces: The Conceptual Structure of Allegory. Proceedings of the American Comparative Literature Association*, University of Colorado. Accessed 7 August 2006 at <http://www3.sympatico.ca/knight.sinding/acla/sinding.htm>.
- StatSoft, 2003. *Correspondence Analysis*. Accessed 25 August 2005 at <http://www.statsoft.com/textbook/stcoran.html>.
- Sternberg, Robert J 1998. *In Search of the Human Mind*. Orlando, FL: Harcourt Brace & Company.
- Van der Heijden, Hans 2003. Factors Influencing the Usage of Websites: The Case of a Generic Portal in the Netherlands. *Information & Management* 40,6:541-549. Accessed 16 August 2005 at [www.sciencedirect.com](http://www.sciencedirect.com).
- Zettl, H 1999. *Sight, Sound, Motion: Applied Media Aesthetics*. Belmont, CA: Wadsworth.
- Zettl, H 2005. *Sight, Sound, Motion: Applied Media Aesthetics*. Belmont, CA: Wadsworth.

## Appendix A – Summary of themes including frequencies of individual participants

Theme code	THEMES	Participant 1.1	Participant 1.2	Participant 1.3	Participant 1.4	Company 1	Participant 2.1	Participant 2.2	Participant 2.3	Company 2	Participant 3.1	Participant 3.2	Company 3	TOTALS
A1	Alternate uses of the Internet / different surfing objectives for users / the possible impact of broadband on Internet usage	1	0	0	0	1	4	6	6	16	1	2	3	20
A2	Reference to principles of conceptual blending used during design	6	3	0	4	13	5	9	9	23	8	4	12	48
A3	Using intuition / introspection / experience (of self and others) / understand own thinking	5	4	4	9	22	7	9	7	23	7	5	12	57
A4	Using principles of visual aesthetics (specific use of elements of VA)	7	0	0	3	10	7	8	7	22	3	1	4	36
A5	Conscious awareness of principles of visual aesthetics and its effect on users	4	0	1	2	7	2	8	8	18	4	4	8	33
A6	Limitations of current design courses / literature	1	0	0	0	1	2	2	2	6	2	2	4	11
A7	Design interactive sites / design to get the user involved in the process in general	0	0	0	0	0	4	2	3	9	3	3	6	15
A8	Design is multi-modal / multi-functional / multi-disciplinary	0	0	0	1	1	8	11	3	22	2	0	2	25
	<b>Total</b>	<b>24</b>	<b>7</b>	<b>5</b>	<b>19</b>	<b>55</b>	<b>39</b>	<b>55</b>	<b>45</b>	<b>139</b>	<b>31</b>	<b>21</b>	<b>52</b>	<b>245</b>

## Appendix B – Detailed concepts for themes analysed

### Theme A1 – Alternate uses of the Internet / different surfing objectives for users / the possible impact of broadband on Internet usage

	CONCEPTS
1	Different website have different objectives / the way you design depends on website objectives
2	There are new design methods / new trends / new developments
3	Broadband: new technologies - new possibilities - more interactive - more impressive
4	Broadband: more business / people use the Internet more / save time
5	Everything is moving towards the Internet
6	Broadband will change design - more video based / less text
7	Interaction is more important in a playful sense (like web gaming)
8	Broadband: more gaming, more entertainment
9	Broadband: you'll have people talking, less text
10	Broadband: more graphics & Flash

### Theme A2 – Reference to principles of conceptual blending used during design

	CONCEPTS
1	Placing of elements is important – layout (text, form, graphics)
2	A site needs to create a unit / graphics must support content & objectives / everything must work together / context is important
3	Experience is an important contributor in design process
4	Use the idea of a visual breather in terms of layout
5	Use metaphor to describe design approaches
6	Get client input
7	Look at & identify examples on the Internet
8	Use a combination of things

	<b>CONCEPTS</b>
9	Design skills is subtle / unintentional / subconscious
10	Intuition is based on experience
11	Uses metaphor / analogy for people to associate things
12	Rely on user experience to design & know what to put on a website / rely on user background & education to understand design
13	Use examples to access the clients needs
14	Try & learn from success stories
15	Use imagination / imagination plays a role in design
16	Buy brilliant magazines as examples
17	Learn from examples / teach self / ask questions
18	People associate with the human factor/people
19	Smiling people may communicate satisfaction
20	Learn from others / pick up ideas from others
21	See if communicate works by looking at the reactions of others/independent people
22	Design for people to associate
23	Notices the role of imagination in completing an event

**Theme A3 – Using intuition / introspection / experience (of self and others) / understand own thinking**

	<b>CONCEPTS</b>
1	Experience is an important contributor in the design process
2	Design skills is subtle / unintentional / subconsciously
3	Intuition is based on experience
4	Rely on user experience to design & know what to put on a website / rely on user background & education to understand design
5	Try & learn from success stories
6	Buy brilliant magazines as examples

	<b>CONCEPTS</b>
7	Learn from examples / teach self / ask questions
8	Learn from others / pick up ideas from others
9	See if communicate works by looking at the reactions of others/independent people
10	Use experience & own perceptions (introspection)
11	Use intuition / goes on what feels right / goes on gut feel / uses common sense
12	Uses introspection - "if I understand it & find it useful then it must work"
13	Get independent input from an external person or company / a person that they trust / an experienced person
14	Use talent / its something natural
15	Graphic design is a creative process
16	Will challenge a design principle to come up with a new idea/principle/trend - to stand out
17	Learn to know client/market / think about who the client might be / think about how the client might use it
18	Diagonal arrangement creates uneasiness / you're going to fall off / difficult
19	Design site that uses colour, lines, & layout to focus attention on important areas
20	Has the ability to explain how the eye moves

**Theme A4 – Using principles of visual aesthetics (specific use of elements of VA)**

	<b>CONCEPTS</b>
1	Design skills is subtle / unintentional / subconsciously
2	Placing of elements – layout (text, form, graphics)
3	A site needs to create a unit / graphics must support content & objectives / everything must work together / context is important
4	Use the idea of a visual breather in terms of layout

	<b>CONCEPTS</b>
5	Use a combination of things
6	Create confrontation – get attention – hard edge graphics
7	Placement of graphics is important
8	Eye is lazy – design should lead the eye
9	Use tools to design efficiently – e.g. line / colour
10	A site must arise a person at first glance / entice to explore further
11	The purpose of graphics is to entice
12	Design is an argument / concept
13	Uses psychological closure - give an idea to the user
14	Use Flash, motion, video, sound (various sensory inputs)
15	Attention is attracted by bright foreground / bright light
16	Attention is attracted by colour
17	Attention is attracted by motion
18	Use desaturation of colour to create mood
19	Look at desaturation / B&W to determine whether something will look ok in colour
20	Desaturation communicate calmness
21	Desaturation more status cue
22	Psychology of colour is important – read books about it
23	Use desaturation of colour to emphasise something else

**Theme A5 – Conscious awareness of principles of visual aesthetics and its effect on users**

	<b>CONCEPTS</b>
1	Attention is attracted by bright foreground / bright light
2	Attention is attracted by colour
3	Attention is attracted by motion
4	Use desaturation of colour to create mood

	<b>CONCEPTS</b>
5	Look at desaturation / B&W to determine whether something will look ok
6	Desaturation communicate calmness
7	Desaturation more status cue
8	Psychology of colour is important - read books about it
9	Use desaturation of colour to emphasise something else
10	Use knowledge of video edition / observations based on video editing experience
11	Aware of the persuasive ability of advertising
12	Diagonal arrangement creates uneasiness / you're going to fall off / difficult
13	Site uses colour, lines, & layout to focus attentions to important areas
14	Sceptic about website information: its easy to put something on the Internet
15	Movement on general makes you curious about the site
16	Diagonal arrangement would be more energetic
17	Shadows may lead to distrust mysterious / sombre / frustration / appeal to your emotions
18	Aware of artists ability to persuade people – not sure to believe the message
19	Observation on lighting is based on video editing background & photography
20	Shadows & darkness: people get irritated with anything less than normal
21	People are attracted to a bright area / desaturation is more like background
22	Grey desaturated area is depressing

### **Theme A6 – Limitations of current design courses / literature**

	<b>CONCEPTS</b>
1	Design courses is limited / design literature limited / teaches only the basics
2	Usability literature & web evaluation methods provides a point of departure
3	Books are outdated to quickly / books are limited - not useful

### **Theme A7 – Design interactive sites / design to get the user involved in the process in general**

	<b>CONCEPTS</b>
1	A site must arise a person at first glance / entice to explore further
2	The purpose of graphics is to entice
3	Broadband: New technologies - new possibilities - more interactive - more impressive
4	Interaction is more important in a playful sense - like web gaming
5	Broadband: You can design sites that talk back
6	You need to design interactive sites so that people want to be there
7	Build stuff that want to make them click

### **Theme A8 – Design is multi-modal / multi-functional / multi-disciplinary**

	<b>CONCEPTS</b>
1	Uses knowledge of video edition / observations based on video editing
2	Uses a combination of things
3	Use Flash, motion, video, sound (other sensory inputs)
4	Everything is moving towards the Internet
5	Broadband will change design - more video based / less text

	<b>CONCEPTS</b>
6	Design principles stay the same no matter the canvas
7	Graphic designers must be multi-functional
8	Designers must know technology
9	Designers must know print & illustration skills
10	Can design conceptually for any media
11	The lines between graphic design/advertising/marketing is blurring
12	Internet & TV is merging due to the development of broadband
13	Like to learn from filmmakers
14	Connection between the client/market & designer
15	Psychology is a subconscious part of the design process
16	Part of design is consultation: give advise; what & why
17	Video design is a different concept / with Flash you need to think differently
18	Observations on lighting is based on video editing background & photography
19	Have done video editing to use the Internet better

## Appendix C – Correspondence analysis figures

Column No / Themes	Coordin. Dim.1	Coordin. Dim.2	Mass	Quality	Relative Inertia	Inertia Dim.1	Cosine <sup>2</sup> Dim.1	Inertia Dim.2	Cosine <sup>2</sup> Dim.2
A1	-0.490375	0.099089	0.081301	1.000000	0.131576	0.185482	0.960771	0.016208	0.039229
A2	0.154603	-0.078692	0.195122	1.000000	0.037970	0.044248	0.794233	0.024534	0.205767
A3	0.402631	0.044883	0.231707	1.000000	0.245903	0.356373	0.987726	0.009478	0.012274
A4	0.038089	0.251017	0.146341	1.000000	0.060996	0.002014	0.022506	0.187229	0.977494
A5	0.001435	-0.076305	0.134146	1.000000	0.005052	0.000003	0.000353	0.015859	0.999647
A6	-0.182977	-0.394446	0.044715	1.000000	0.054666	0.014204	0.177081	0.141264	0.822919
A7	-0.337702	-0.592813	0.065041	1.000000	0.195759	0.070372	0.245006	0.464107	0.754994
A8	-0.582639	0.261699	0.101626	1.000000	0.268078	0.327305	0.832123	0.141321	0.167877

Table 1: Column Coordinates and Contributions to Inertia

	Row Number	Coordin. Dim.1	Coordin. Dim.2	Mass	Quality	Relative Inertia	Inertia Dim.1	Cosine <sup>2</sup> Dim.1	Inertia Dim.2	Cosine <sup>2</sup> Dim.2
Company1	1	0.560180	0.156223	0.223577	1.000000	0.488940	0.665629	0.927839	0.110793	0.072161
Company2	2	-0.246437	0.097645	0.565041	1.000000	0.256726	0.325569	0.864307	0.109390	0.135693
Company3	3	0.066248	-0.426248	0.211382	1.000000	0.254334	0.008802	0.023586	0.779816	0.976414

Table 2: Row Coordinates and Contributions to Inertia

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# **A Framework of Factors for Determining e-Readiness in Emerging Societies**

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## **Abstract**

During the last decade, leaders in government, business, and social organizations around the world have considered how best to harness the power of Information and Communication Technology (ICT) for development. Experts have pointed out that in order for developing countries to put ICT to effective use, they must first be "e-Ready" in terms of ICT infrastructure, the accessibility of ICT to the population, and the legal and regulatory framework. Developing-country leaders have been urged to use e-Readiness assessment to measure and plan for ICT integration, focus efforts from within, and identify areas where external aid is required. Several e-Readiness initiatives have been launched to help developing countries in this area, and numerous e-Readiness assessment tools have been created and used by different groups, each looking at various aspects of ICT, society, and the economy (Bridges.org, 2005). The underlining focus of the study was to look at the potential of being e-Ready in conjunction with the social and economic success that the society can achieve in sustaining ICT initiatives. It also includes a comparative analysis of the economic and social statistics of KwaZulu-Natal and South Africa with the statistical calculations of the data collected from the questionnaire (to analyse the e-Readiness capacity of honours students). The researchers agree with the International Telecommunication Union (2003) when they recommend that to measure the ICT picture in full, new multi-stakeholder partnerships will be required involving not only the statistical agencies that are traditionally responsible

for conducting surveys, but also policy-makers, the private sector, civil society, multilateral organisations and others involved in the ICT arena. The potential of being e-Ready in conjunction with the social and economic success that the society can achieve in sustaining ICT initiatives seems to be a difficult but a worthwhile achievement.

## **Key Concepts**

e-Readiness, e-Readiness definition, e-Readiness Rankings, e-Commerce, e-Business, ICT Initiatives, Digital Divide and Information Communication and Technology in South Africa.

## **Introduction**

The results reported in this contribution are presented as prolegomena for an empirical of e-Readiness in South Africa. The framework may also be useful for research regarding the degree of readiness of other emerging economies to use information communication technologies to transform their economies from regional to globally integrated economies.

The technological gains of the last several decades lie at the core of surges of wealth and wellbeing in the most prosperous countries of the world. Electronic commerce and related applications of ICTs have become engines for economic growth and productivity and are changing the shape of the world in which people live. Yet the developed world is reaping the majority of these gains. The divide between rich and poor countries, long observed with regard to economic wealth and social conditions, is equally prevalent and troublesome in the realm of ICT. While the growth of the Internet and the continuing “digitalisation of society” are much-heralded events in more developed countries, many leaders in developing nations are left wondering how they can participate in the rapid changes going on around them (Information Technologies Group, 2000).

The transformative power of ICTs as a tool for poverty reduction and wealth creation are well documented. Gillis & Mitchell (2002) explains that ICT can be framed and applied as a potent tool in reducing poverty, extending health services, expanding educational opportunities and generally

improving the quality of life for many of the world's disadvantaged. However, it is critical that such framing recognizes that these desired outcomes are only plausible when ICT deployment is accompanied by concurrent public policies supporting equitable access to social institutions such as health care, education, government, and other benefits potentially available through the application of digital tools and telecommunications. ICT is an important tool, but not a solution in itself for economic or social problems. ICT has been identified as a key enabler in the achievement of regional and rural success, particularly in terms of economic and business development. ICT has more effectively supported the development and implementation of community driven strategies to boost employment, education, training, and enterprise development; also by revitalising a sense of community, building regional capacity, enhancing democracy and increasing social capital.

## **Literature that Relates to e-Readiness**

The past decade has seen the worldwide adoption of electronic forms of communication via the Internet, mobile phones, the convergence of mobile communication and computing by means Smart PDAs and Smart Phones, and their use in e-Commerce, e-Government, e-Research and e-Entertainment enabling end users it to be connected anywhere/anytime (Information Technology Group, 2000). CSPP (2000) describes this as the networked world, which entails a transformation in the nature of economies, societies and governments, as well as interpersonal and international relations. The World Bank claims that to put ICT to effective use, a country must be “e-Ready” in terms of infrastructure, the accessibility of ICT to the population at large, and the effect of the legal and regulatory framework on ICT use. If the digital divide is to be narrowed, all of these issues must be addressed in a coherent, achievable strategy that is tailored to meet the local needs of particular countries (Bridges.org, 2001).

The researchers employed the following terms to identify the appropriate references for the electronic literature review presented in this section: e-Readiness, e-Readiness definition, e-Readiness Rankings, e-Commerce, e-Business, ICT Initiatives, Digital Divide and Information

Communication and Technology in South Africa. Only six articles indexed on those terms were identified on Science Direct and EBSCO host with relevancy to e-Commerce Adoption, e-Readiness Assessment, and e-Business. Keyword searches on Google Suggest and Vivisimo in May and August of 2005 for information about e-Readiness and the above-mentioned terms yielded approximately 138,298 results. The number from Google Suggest, Vivisimo and Science Direct indicates that e-Readiness is an emerging research topic and that there are not many resources available. Other websites such as the digitaldivide.net and bridges.org were used more continuously when searching for information about ICT and e-Readiness, as these websites specialise in the mentioned terms.

### ***Definition of e-Readiness***

The definitions for e-Readiness vary in scope, depending on the study done. Most took a general view of e-Readiness as the extent to which the country is prepared to integrate into the global information society/ networked world/ digital economy (Bridges.org, 2005). McConnell International (2000) argues that e-Readiness measures the capacity of nations to participate in the digital economy. The Bridges.org (2003a) defines e-Readiness as the ability of the ICT networks to successfully adapt to the social and economic advancement.

E-Readiness is generally defined as the degree to which a society is prepared to participate in digital economy with the underlying concept that the digital economy can help to build a better society (Krull, 2003). Finally, the researchers conclude that e-Readiness is generally defined as the degree to which a society is prepared to participate in this so-called networked world (Information Technology Group, 2000) with the underlying concept that the Networked Economy can help to build a better society (see also Choucri, 2003).

### ***E-Readiness Attributes***

Other readiness guides have used different categorised attributes as tools of measurement depending on the type of study conducted, which will be discussed later. Depending upon the objective for Assessment, an Attribute is chosen and Indicators under the same worked out for the Assessment. The wide range of Indicators under each main attribute category can be classified in the following:

- **Network Access:** What are the availability, cost and quality of ICT networks, services and equipment?
- **Networked Learning:** Does the educational system integrate ICTs into its processes to improve learning. Are there technical training programs in the community that can train and prepare an ICT workforce?
- **Networked Society:** To what extent are individuals using ICTs at work and in their personal lives. Are there significant opportunities available for those with ICT skills?
- **Networked Economy:** How are businesses and governments using ICTs to interact with the public and with each other?
- **Network Policy:** To what extent does the policy environment promote or hinder the growth of ICT adoption and use? (Information Technology Group, 2000).

CSPP (2000) notes that there are many criteria that could be used to assess readiness for the networked world, but selected five key categories that represent the elements that need to be in place to capture the benefits of the networked world. (1) The Network (infrastructure) - the backbone technologies and infrastructure that connect you to the Network. (2) Networked Places (access) - where you spend your time and need to be connected. (3) Networked Applications and Services - how you use your connectedness to make it meaningful and purposeful. (4) Networked Economy - the role of the network in driving the economy. (5) Networked World Enablers (policy, privacy, security, ubiquity) - key levers to expediting the networked world.

### ***E-Readiness Rankings***

The Economist Intelligence Unit (2005) has published annual e-Readiness rankings of the world's largest economies since 2000. Most recently 65 countries were assessed on their ability to promote and support digital business and ICT Services. The e-Readiness rankings of the Economist Intelligence Unit are a weighted collection of nearly 100 quantitative and qualitative criteria, organised into six distinct categories measuring the various components of a country's social, political, economic and of course

technological development. These categories are in turn, weighted according to their assumed importance as influencing factors and will be discussed later by the researchers.

In 2005, the Economist Intelligence Unit's ranking methodology has undergone modification (i.e. criteria that no longer accurately reflect the shape of the digital economy have been removed, and many criteria have been re-weighted to reflect their increasing importance in determining e-Readiness). The latter include broadband access and Internet security, as both fast and secure Internet connectivity are proving to be the key enabling qualities for effective e-Business. They added new metrics such as the penetration of public-access wireless "hotspots", due to their belief that Internet connectivity has to be not just mobile but ubiquitous. Also new, more precise means of measuring performance in some criteria have been developed, including in the areas of Internet security, ICT spending and education.

The Economist Intelligence Unit 2005 notes that ICT infrastructure sparks a virtuous cycle, because as country's citizens become more connected to the Internet, their increased usage shifts the country's economy towards building technologies and businesses to exploit the Internet. Therefore, such countries become more competitive not only because their citizens and corporations are online, but also because being online jumpstarts growth in high-value technology businesses. This is why e-Readiness rankings measure a country's accumulated telecoms and computer infrastructure, and accord it the heaviest weight of all e-Readiness determinants. They have also increased the importance of broadband (both fixed and mobile), which is why many e-Ready leaders (including the resurgent US) have seen their rankings rise. They have also refined the measurement of some other aspects of connectivity, such as the security of Internet servers, and the amount of Gross Domestic Product (GDP) that goes into ICT spending. In conclusion the Economist Intelligence Unit (2005) has also measured the knock-on effect that "boxes and wires" have on a country's digital economy, and due to this introduced they have introduced quantitative measures of innovation and qualitative measures of entrepreneurship.

The six categories (and their weight in the model) and criteria are as follows:

- Connectivity and Technology Infrastructure (Weight in overall score: 25%)
- Business Criteria (Weight in overall score: 20%)
- Consumer Business Adoption (Weight in overall score: 20%)
- Legal and Policy Environment (Weight in overall score: 15%)
- Social and Cultural Environment (Weight in overall score: 15%)
- Supporting e-Services (Weight in overall score: 5%), (The Economist Intelligence Unit, 2005).

The researchers repeatedly tried to contact the Economist Intelligence Unit about how the indices for the e-Readiness Index are constituted, but they never responded to our queries. The researchers therefore concluded that they did not want to share this information due to confidentiality or competitive intelligence.

### ***Regional Patterns of e-Readiness and Country Highlights***

Silicon Valley in the United States is not the only high-tech enabler of ICT, because Switzerland and Denmark also score highly in all e-Readiness categories due to their respective IT service and biometrics industries (Economist Intelligence Unit, 2005). Denmark maintains its number one position in the e-Readiness rankings due to its superiority in both infrastructure and innovation. In second place was the United States, which fell to 6th place largely because its broadband development lagged other global leaders. In fourth place was Switzerland, who climbed upward in the rankings owing to its steady growth in broadband, which included WiFi as one of the new connectivity categories introduced this year and healthy ICT investment. Due to faster ICT progress of other countries and refinements in the Economist Intelligence Unit measurement model, West European countries have dwindled a bit, compared to the US, Switzerland, Hong Kong (6th) and Australia (10th). The UK (5th) previously was second in 2004, continued to enjoy high levels of connectivity and benefits from substantial government commitment to achieving information society objectives, but

was weak in the educational area. Norway (9th) remained a global leader in ICT infrastructure but has not leveraged these physical assets into intellectual property assets. South Korea's (18th) investment in IT is low and they have not really prioritised their security infrastructure investments compared to other e-Readiness leaders.

E-Business plays a role in some countries, but not enough to transform parts of their economy. Examples include India (49th) and China (54th) who according to the Economist Intelligence Unit (2005) consume close to one-third of the world's ICT investment, and both countries continue to attract the large share of the world's technology-earmarked foreign direct investment. India's outsourcing industry is continually fuelled by large ICT skills base and China's phenomenal technology manufacturing sector, both of which are fundamental to the global ICT economy. However, both countries continue don't improve in terms of e-Readiness (three places down in 2005 for India, two places for China), due to the fact stated by the Economist Intelligence Unit (2005) that the billions of dollars in ICT investment and revenue are tiny compared to their overall economy. Considering that, such ICT usage does not even represent enough of the population penetration. Countries like India are profiting from a global arbitrage opportunity, supplying lower cost information technology (IT)-enabled skills to their more wired peers.

Some countries lack in their e-Readiness rankings due to their lack of e-Leadership. Examples are the regional leaders of Central and Eastern Europe and Latin America, Estonia (26th) and Chile (31st) respectively. The Economist Intelligence Unit (2005) notes that \ these markets score higher than the global average in its respective core competencies of E-Government and online services. However, they still lack in infrastructure and E-Business adoption.

### ***South African e-Readiness View***

The e-business forum (2005) noted the following Statistics of South Africa. South Africa has a Population (m) of 46.8; Working population (m) of 30.8; Nominal GDP US\$ 237.6 billion, US\$ 522.8 billion (at PPP); GDP per head US\$ 5,080.0, US\$ 11,170.0 (at PPP), Inflation at 4.3%; Average Wage (monthly) US\$ 1,070; National corporate tax rate 30%; Indirect tax 14% (VAT) and Currency is the Rand. South Africa's 2004 Connectivity

Statistics were: Number of telephone main lines (per 100 people) - 9.1; Number of mobile subscribers (per 100 people) - 39.9; Number of Internet users (per 100 people) - 8.1; and Number of personal computers (stock per 1,000 pop) – 109.

Of all the regions McConnell International (2000) notes that the Middle East and Africa presents the greatest, challenge to e-Business, even when taking into consideration the cultural tendency to share ICT access among multiple users, the thin infrastructure remains an enormous barrier to improvements in other areas. They state that this region has nearly 15 % of the world's population; but the African continent possesses just 2 % of the world's total number of telephones and less than 0.1 % of all Internet users regions. McConnell International (2000) notes that South Africa needs slight improvement with e-Leadership and Information security and shows improvement with regards to the province of Gauteng, which has approved plans to begin construction on an "Innovation Hub" (an incubator and training centre for rising high-tech enterprises). Docktor (2002) notes medium levels of PC penetration, medium-high levels of bandwidth quality, medium-high levels of e-Leadership, and medium-high levels of information security concerning South Africa.

#### **SOUTH AFRICA**

**Digital Access Index (2003): 0.45; (78)**

- Fixed telephone subscribers per 100 inhabitants: 9.5
- Mobile cellular subscribers per 100 inhabitants: 30.4
- Internet access tariff as % of Gross national Income (GNI) per capita 15.4
- Adult literacy 85.6%
- Combined primary, secondary and tertiary school enrolment level: 78%
- International Internet bandwidth per capita: 12.4 (kbit/s)
- Broadband subscribers per 100 inhabitants: 0
- Internet users per 100 inhabitants: 6.8

World Telecommunication indicators (2005)

- Main telephone lines per 100 inhabitants: no data
- Mobile cellular subscribers per 100 inhabitants: 43.1
- Internet users per 100 inhabitants: 7.9

**Figure 1: Digital Access Index of South Africa (Maplecroft.Net, 2005)**

The Digital Access Index (DAI) of South Africa is an index value of 0.45 and an index ranking of 78 – as seen in the above figure according to Maplecroft.Net (2005). The DAI forms part of International Telecommunication Union's (ITU's) 2003 edition of the World Telecommunication Development Report published to coincide with the first World Summit on the Information Society (WSIS). The index measures the overall ability of individuals in a country to access and use ICTs. The DAI embraces eight indicators grouped into five categories (in brackets – note the specific DAI data for South Africa): infrastructure (0.23), affordability (0.85), knowledge (0.83), quality (0.26) and usage (0.08). The above figure 2.3 also features three single indicators obtained from the ITU World Telecommunication Indicators Database (2005): main telephone lines (no data), mobile cellular telephone subscribers (43.1) and internet users (7.9) per 100 inhabitants. This 2004 data is intended as a supplement to existing DAI data and not a replacement, despite presenting information that is more recent to equivalent DAI indicators. The DAI is presented as a composite measure of access to ICTs and is still viewed as the most comprehensive and recent overall measure of digital inclusion.

Bridges.org (2003a) describe that there was evidence of growth in the e-Commerce sector, notably in South Africa, which is forecast to generate \$ 0.5 billion worth of business in 2002 and to grow to \$ 6.1 billion by 2006. However, they concluded that if this level of growth of Africa's share of global e-Commerce in 2006 would only be 0.05% of the world's total. They have noted that South Africa has shown a commitment towards the integration of ICT as an essential part of their economy, and for social and academic advancement and that it has begun to introduce legislation that helps, rather than hinders, the growth of, access to and the affordability of ICT. Bridges.org (2003a) state that it is important to remember that there

remains a digital divide, usually based on geographical (e.g. rural/urban), socio-economic or cultural factors, or even gender. South Africa, have already enacted legislation designed to facilitate the growth of e-Commerce, and all have high rates of fixed and mobile teledensity. However, there remains a challenge in terms of the deregulation and liberalization of the telecommunications sector, as well as the establishment of an independent and effective regulator.

South Africa was also 32<sup>nd</sup> in 2004 and 2005, even though as stated by the Economist Intelligence Unit (2005) that the government failed to enforce competition in its fixed-line market effectively, which has seriously impaired broadband and online services development. This ineffective government policing of the liberalisation process has prevented the introduction of a new telecom carrier to compete against the de facto state monopoly - Telkom, which enjoys its monopoly of the fixed-line market after partial privatisation in 2003 and ownership of half of Vodacom, a mobile-phone provider (ebusinessforum, 2005). However the Economist Intelligence Unit (2004) states that Internet services has been modest in South Africa, at 7% of the population. Due to the high cost and inadequate coverage of high-speed connections, which can be blamed partly on the lack of market competition, despite the government's decision to license a second national operator, it has turned down numerous bids.

The ebusinessforum (2005) states that there is fierce competition in the IT industry (Microsoft, Hewlett-Packard and IBM (all US) are among the foreign companies with offices in South Africa), with price, service reliability, and a high demand for after-sales and value-added service South Africa is a middle-ranking country in terms of how conducive the market is to Internet-based opportunities. South Africa now ranks in the world's top 20 countries in terms of the number of Internet sites. In addition to the global technology giants that have moved into the country in recent years, two local companies have grown rapidly, not only in South Africa but worldwide as well. The largest South African technology company is a software systems integrator, Dimension Data. Datatec, a networking and services group, is South Africa's second-largest IT Company. Like Dimension Data, the company has operations throughout Europe, North America, South America, Africa, the Middle East and the Asia and Australasia region, and generates

more than 95% of its revenue outside South Africa. In the competitive mobile market, the dominant firm, Vodacom, targets both the low-end and high-end markets, whereas the focus of the new entrant, Cell C, is on the large low-end market. Caught in the middle, MTN is focusing on subscriber quality and reduction. Despite the size and relative sophistication of the South African telecoms market, the ebusinessforum (2005) argues that, newer services such as the third-generation (3G) universal mobile telecommunications service (UMTS) are not likely to take off in the near future.

Telkom being the only national telecommunications operator is stifling the potential of broadband and low-cost access through a monopolistic stranglehold on the sector. Vosloo (2004) concludes that a number of issues (listed below) should be addressed to improve e-Readiness on a country level.

- The ICT industry should be liberalised.
- South Africa should prepare for the rollout of a second national operator.
- Greater telephone and Internet access should be provided to rural areas through jumpstarting and supporting rural connectivity projects.
- The government should work on ICT cost reduction for the consumer.
- The government should work on universal access and services for the underprivileged.

### ***E-Readiness Recommendations and Next Steps***

McConnell International (2000) noted that no nation will become e-Ready overnight and nations who are e-Leaders today are not guaranteed to be tomorrow's. However, due to the nature of the new economy, those nations and businesses that can adapt quickly to new technology, seize new opportunities, and take strategic risks will prosper. Less prepared economies have an opportunity to learn from the global community and leap to higher levels of preparedness. Docktor (2002) lists Institutions, Change Management, Transformation in terms of Efficiency, Effectiveness, Endorsement, Empowerment, Economic & Social Development as

preconditions necessary for Success with regards to where to act with - e-Readiness Capacity.

Bridges.org (2005) deduces that it was time to stop identifying gaps and setting priorities at a high level, if e-Readiness assessment is going to remain useful as a tool, it needs to become far more focused and action-oriented. They note that it was a waste of time in terms of money, writing papers and holding conferences, as anyone working in ICT and development in the country will already know these things. Action plans that say, Capacity in ICT needs to be built in year X by the Government and the Private sector are essentially useless, especially when consultants without any input or buy-in have drawn up the plans from representatives of the government or private sector in the country concerned. Bridges.org (2005) concludes that it is important that we build upon previous work and draw together current efforts in the field of e-Readiness.

Southern African Development Community (SADC) countries have three powerful means of directly improving e-Readiness and harnessing ICT for social and economic advancement within the SADC region: (1) establishing the policy framework for action, (2) building the necessary infrastructure, and (3) undertaking ground-level projects. Beyond direct interventions itself, the government can also act indirectly by creating a favourable environment for the private sector and NGOs to engage. SADC governments are urged to promote ICT through dialogue with all stakeholders, and by setting a leadership example through e-government initiatives. The World Economic Forum (2002) noted that a sound ICT policy framework creates a reliable environment within which business and social programmes can thrive (key issues include trade agreements and tariff standardization, enterprise and entrepreneurship development, e-Commerce promotion and telecommunication liberalization). ICT infrastructure is the broad foundation upon which business and social programmes are built. It includes basic infrastructure like electricity and transportation, and technical infrastructure like network connections and hardware (key issues include: physical access to ICT, standards setting and interoperability, and country code top-level domains). Ground level initiatives spread the benefits of technology throughout society and provide a critical connection between policy considerations and the grassroots community. Ground-level initiatives

are often driven by national policies, such as in the fields of education, entrepreneurship and healthcare (key issues include: public access to ICT in disadvantaged and/or rural communities, e-Government services, and local economic and enterprise development). The World Economic Forum (2002) recommended that South Africa should do the following: With (1) Policy Framework: liberalize ICT industry; implement empowerment policies in line with RDP objectives. (2) Infrastructure: prepare for rollout of second national operator and utilize universal service fund for rural connectivity and Telecentre sustainability. (3) Ground Level Projects: provide more e-Education and training, as well as entrepreneurship development projects in rural areas.

### ***E-Readiness Policies, Initiatives and Strategies***

Bridges.org (2003a) notes that the framework for the analysis of e-Readiness policy issues first presented in the World Economic Forum-SADC report has been the basis for examining key issues with an African perspective and drawing comparisons between NEPAD countries. In addition, the template can help policy-makers and stakeholders frame a dialogue on issues that apply to groups of countries at comparative levels, so they can learn from relevant experience and best practice.

The Framework template is as follows – e-Readiness policy issue (title, and brief description of issue under consideration):

(a) Widely agreed policy recommendation: description of the general consensus on how this issue should be addressed, generally taken from the international perspective

(b) Key proponents of this recommendation: list of the main institutions and organizations that recommend this agreed position on the issue

(c) Issues affecting application in developing countries: explanation of why the way forward recommended by the general consensus at the international level may prove to be tricky given the ground level realities in developing countries; the point is to demonstrate an understanding of the challenges that developing countries face which can limit their ability to effectively implement this policy recommendation

(d) Recommended way forward: a suggestion of where a developing country should start once it has decided that it wants to implement the widely agreed policy recommendation described in (a), despite the fact that it faces the challenges outlined in (c) (Bridges.org, 2003a).

The Bridges.org (2003a) summarises the South African Policies as follows:

- ICT regulatory framework: Has an independent regulator – ICASA. Progressive ICT policy process.
- ICT liberalization + privatization: Managed liberalization of state assets, including ICT. Incumbent (Telkom) is being privatized. Second network operator expected in 2002.
- Macro economic policy: One of the most liberal, free-market supporting policy-GE AR.
- Foreign direct investments: FDI incentives by the DTI (tax holidays and reduced tariffs - WTO member).
- e-Commerce: Electronic Communications and Transactions Act 25 of 2002/6/20 and an advanced e-commerce practice. Interception and monitoring Bill seeks to enable investigation of cyber-crime.

### ***E-Readiness Initiatives***

McConnell International (2001) notes that countries with high levels of impact and innovation are developing quicker, enabling businesses, governments and citizens to flourish in the networked economy. They deduced that today's leaders in impact and innovations are the places where business opportunities are more likely to develop in the future. While partnerships are the strongest way to progress, they are not the only significant actions underway to improve e-Readiness. McConnell International (2001) examined over 500 initiatives across all attributes and countries to determine which are making a real difference in e-Readiness - sound, sustainable programs, reforms, and policies that increase Connectivity, strengthen e-Leadership, improve Information Security, develop Human Capital and enhance the e-Business climate.

The actions that McConnell International (2001) evaluated include projects and opportunities, which are initiatives, in which companies can still, get involved to shape legislation or participate in funded programs. For some of these projects, such as digital signature laws or privatising telecommunications, implementation is ongoing. The report examined two key aspects of these actions:

- **Impact:** To create change in society, multiple actions must be taken and many people involved. Actions that would affect larger portions of the population or were more comprehensive in scope and effect are favoured.
- **Innovation:** New technology and new business models supported by these technologies affect the cost, speed and transparency of service delivery and final product in ways recently unimaginable. Projects and opportunities that use new technology or have a new model or approach that will yield greater benefits are assessed more favourably (McConnell International, 2001).

### ***E-Readiness Strategies***

Docktor (2002) equates a definition concerning Strategic Action by saying that to put e-Readiness to work, you will compare - Your Goal + Your Assessment with Global and Future with Global and Future Realities.

The International Telecommunications Union (ITU) e-Strategy Unit (2003) founded four basic pillars for their e-Strategy projects:

- **Technology implementation:** fostering development of a wide range of technologies, from leading-edge Internet Protocol (IP) infrastructure and multipurpose communication technologies (MCTs) to new applications in the areas of commerce, health, education, agriculture, government and online security
- **Capacity building:** enabling local people to develop and manage their own projects through effective human resources development
- **Policies and strategies:** helping governments draw up and implement policies and legislation conducive to stimulating ICT deployment and uptake

- **Partnerships/alliances:** bringing public and private sector partners together to develop projects that benefit all stakeholders, including the community at large

The Southern African Development Community (SADC) e-Readiness Task Force (2002) noted that relevant and viable strategic recommendations can only be made with a clear understanding of the current realities within each country, in respect of ICT infrastructure, policy and regulatory frameworks, whether ICT is seen to be a national priority, the diffusion and usage of ICT in all the sectors of the country, including government, the financial sector, education, health and others.

### ***Analysis of e-Readiness Assessment Guides and Tools***

As indicated before, the e-Readiness definition and e-Readiness Attributes vary, depending on the study that is consulted. An e-Readiness Assessment, when properly applied in a larger process of evaluation, is a first step towards converting good intentions into planned actions that bring real changes to people's lives. E-Readiness assessments are meant to guide development efforts by providing benchmarks for comparison and gauging progress. This is an old process adapted to today's technology realities; determining the current situation in order to plan and advocate specific changes (Budhiraja & Sachdeva, 2002). Electronic Readiness assessment can also be a vital tool for judging the impact of ICT, to replace wild claims and unreliable evidence about the role of ICT in development with concrete data for comparison.

### ***E-Readiness Objective when Conducting a Study***

If the objective is e-Governance then the focus of the e-Readiness research should be on Government Process Reengineering and faster and more transparent means of delivering government services to the citizens. Here e-Readiness equals computers, access, and effective usage of computers (hardware and access are not enough for real e-readiness, there must be extensive training programs, locally relevant content, and a local ICT sector). If the objective is on e-Infrastructure then the focus of the study should be on institutions/organisations, hardware and software. Here e-Readiness refers to computers and access. If the objective is on e-Commerce then the focus should be on ICT Business. Here e-Readiness refers to

computers, access, and economy. If the objective is on the society then the focus should be complete population. Here e-Readiness requires basic literacy, poverty, health and other social issues to be addressed first. This can be summarised as follows:

STUDY	FOCUS
1. APEC (Asia Pacific Economic Cooperation)	E-Commerce Readiness
2. CID (Center for International Development)	Society
3. CSPP (Computer Systems Policy Project)	Existing Infrastructure
4. EIU (Economist Intelligence Unit)	E-Business Readiness
5. NRI (CID, Harvard)	Infrastructure, E-Society, Policies, Digital Economy, Education and Government
6. MI (McConnell International)	Infrastructure, Digital Economy, Education and Government

Table 1: Objective when conducting a study

### **Parameters and Weightings**

As discussed previously every e-Readiness attribute is further split up into its relative indicators or parameters. The identification of Parameters can be deduced from previous studies done or adapted to suite the changing conditions. Along with defining parameters a base needs to be ascertained. For example, when comparing with different States of the USA a researchers does not look into the number of PCs in the State; the researchers will look into the Number of PCs per total population of the State (Budhiraja & Sachdeva, 2002). The parameters that will be configured will then be categorized as primary and secondary and the sources for the same identified. The secondary sources of data can be the published reports, documents, and data on web. Primary data will be collection of information by conducting surveys etc (Budhiraja & Sachdeva, 2002).

The determination of weights for a parameter can be arrived by the following three methodologies according to Budhiraja & Sachdeva (2002):

- **Equal Weights:** The parameters evolved can be assigned equal weights for the purpose of coming out for a Ranking. However, in most cases the same is not advisable for the parameters are not having equal level of importance.
- **Subjective Weights:** Another approach will be to assign subjective weights based on perception of experts and taking an average of the same. Processes like the Analytical Hierarchical Processes (AHP) can also be used. Again, these processes are based on individual perceptions and can be questioned.
- **Objective Weights:** Another approach is to use the statistical techniques of analysis. These techniques will assign weights to parameters based on the observed values. Principal Component Analysis is one such technique of assigning objective weight ages to the parameters.

### ***Towards a More Comprehensive Ranking Tool***

Bridges.org (2001) deduces two lessons from comparing assessment models: First, the chosen e-Readiness assessment tool must fit the user's goal. The second lesson is that there is a wide range of e-Readiness assessment models available, but each has limitations. Every model evaluated would require re-designing to make it a comprehensive assessment tool. They concluded that the ready-to-use tools are either limited in scope or lack detailed description on how to use the tool in practice. What would a more comprehensive, flexible tool include?

Drawing together the perspectives of the existing tools Bridges.org (2001) deduce the following: The tool should provide (optional) measurements for the range of factors that influence e-Readiness such as existing technology infrastructure; information technology policies (trade, encryption, digital signatures, privacy, etc.); distribution, pricing, and usage of the technology in schools, business, government, and throughout society; basic 'enablers' in society (basic literacy, quality of educational system, political stability, etc.); social and cultural factors the influence technology's diffusion and use; and market conditions (monopolies, regulation, etc.). The tool should describe how these measurements could be used for: economic growth; wide social use of technology; and economic growth in the context of social issues such as consumer protection, privacy, etc. The tool should

clearly describe how to use the tool: when a policy assessment is needed; how the information is to be gathered, and what standards are to be used; who is needed to complete the assessment (diverse range of experts knowledgeable about issue, oversight of process to make sure accurate, etc); how long it should take; what the outcome should look like, including a narrative assessment of the policies, guided by or directly answering the survey questions, with recommendations on what to change; how to recognize majority and minority opinions and leave room for dissent; and what factors are usually under government control, and which are not. Finally, the tool should indicate how to use the results, including identifying potential difficulties with implementation, such as balancing consumer rights, business and labour issues.

### ***ICT in South Africa***

Vosloo (2004) notes that South Africa has an environment that is conducive to ICT Growth:

- It has a progressive ICT policy and legislative process.
- e-Government is fully functional.
- Market conditions are supported by a liberal, free market economic policy.

After the first democratic elections, South Africa's challenge was to balance sustainable economic growth with social empowerment. This was addressed by several related ICT initiatives including the South Africa IT Strategy Project (SAITIS) - how to make South Africa regionally and globally competitive and, at the same time, use ICT as an enabler of social equity. This project was developed by the Department of Trade and Industry and the Department of Communication, in consultation with the private sector and other stakeholders. SAITIS has four fundamental objectives: (1) to create a robust, growing and sustainable ICT sector; (2) to increase use of ICT as an enabler for socio-economic development; (3) to create a knowledgeable and growing ICT workforce; and (4) to create a world-class culture of ICT innovation. The specific initiatives sponsored by SAITIS included: providing Internet access in schools; creating an academy for software development training; providing community Internet access points;

and installing public information terminals for access to government services. The SAITIS strategy recognized that the development of the local market could act as a powerful stimulus to the ICT sector and could have substantial socio-economic benefits for other sectors. To do this, the extension of ICT usage needed to take place in four areas - local market development, applications development, information infrastructure development, and achieving ubiquity of access (Accenture Markle Foundation (AMF), 2001).

AMF (2001) notes that the 1996 Telecommunications Act had an important objective - promotion of universal service and affordable provision of telecommunication services. The government therefore organized a number of ministerial clusters: Efficient Governance, Investment and Employment, Human Resource Development, Poverty Eradication and International Affairs, to try to control the cross-sector benefits of ICT. This was done so that they could try to reduce the potential waste of resources and to create reinforcing strategies through coordinated deployment of resources, visible sponsorship and wider stakeholder involvement. The South African ICT sector has been able to build on a relatively good infrastructure and a small, but highly skilled, IT professional base. However, AMF (2001) conclude that most of the development has been limited to small-scale local projects or within foreign-owned companies. South Africa has been able to extend its base of ICT usage with the development of infrastructure and applications made available through government community initiatives, as well as by the private sector, which extended both usage as well as training to its employees. Moreover, that not every citizen is enabled to use ICT because access and technology are only available in primary and secondary towns and not in remote and rural areas. ICT education is improving in some instances but not all schools have infrastructure and computers, and even when they do, they fall into disrepair without maintenance due to a shortage of IT-literate staff to use and maintain them.

Vosloo (2004) notes that there are two major influences on South African Government policies and programmes (including ICT-related ones), namely Batho Pele and the New Partnership for Africa's Development (NEPAD). Batho Pele – meaning “people first” – is a policy framework and

practical implementation strategy for the transformation of public sector delivery. It is made up of a number of principles, two of which are to “provide more and better information” and “increase openness and transparency” - DPSA (as cited in Vosloo, 2004). NEPAD is a pan-African pledge by African leaders to eradicate poverty in their countries through sustainable growth and development. It is a comprehensive and long-term programme, which has identified ICT as a major contributor to achieving its goals.

Due to South Africa’s lively ICT policy environment the SA Government encourages healthy debate and the policy-making process, which allows for generally consultative and forward thinking. A variety of legislation covers a range of issues such as e-Commerce transactions between citizens, businesses and government; ICT security issues such as online privacy and the regulation of the ICT market. These ICT policies are generally conducive to the growth of the ICT sector, except for the slow implementation of a second national telecommunications operator, required to alleviate the dampening monopoly of Telkom (Vosloo 2004).

## Conclusion

This study has presented a framework of factors to determine the degree of e-readiness of emerging economies. It has been shown that the framework includes the following factors: network access, networked learning, networked society, networked economy, and network policy that are weighted to establish global comparative rankings of countries according to six categories of criteria, namely connectivity and technology infrastructure, business criteria, rate of consumer business adoption, the legal and policy environment, the social and cultural environment, and supporting e-Services.

McConnell International (2000) notes that no nation will become “e-Ready” overnight; and nations that are today’s e-Leaders are not guaranteed to be tomorrow’s leaders. However, due to the nature of the new economy, those nations and businesses that can adapt quickly to new technology, seize new opportunities, and take strategic risks will prosper. Less prepared economies have an opportunity to learn from the global community and leap to higher levels of preparedness. Maplecroft.Net (2005) acknowledges that – whilst there is no ‘one size fits all’ approach, experiences of successful

projects suggest a need to avoid over-ambitious top-down initiatives and ensure multi-stakeholder involvement. ICT can trigger a 'development dynamic' that gains momentum as targeted steps are taken in key areas such as policy, infrastructure, human capacity, entrepreneurship and development of locally relevant content and applications.

The following broad conclusions can however be made - Development initiatives need to be more equitably spread across all sectors (e-Learning, e-Health, e-Government, etc.); Development initiatives need to be coordinated; Private-public partnerships are encouraged; Appropriate research and development is encouraged and Workshops are encouraged to enhance stakeholder consultation (Bridges.org, 2003b).

As concluded by the SADC e-Readiness Task Force (2002), South Africa is at the forefront of the SADC region with regard to ICT development, although further development in the ICT, as well as the economic arena, must take place before South Africa can be compared to the developed countries, or some developing countries in Asia and South America. It can, however, immediately provide a role model to, and render assistance to, fellow member states in the SADC region. Moreover, Africa's leaders recognize the part that ICT has to play. Indeed, it is seen as the cornerstone on which many of the solutions to the problems facing Africa will be built. However, ICT has to be more available to people in terms of physical access, affordability, appropriate technology and locally relevant content. Achieving e-readiness across Africa will require bold and ambitious steps. Legal and regulatory frameworks will need to be overhauled, sometimes in the face of opposition. Innovative uses of technology will need to be found to deliver ICT where it is needed most. Content that is relevant to local needs must be produced and distributed. Governments and policy-makers will need help and advice to make tough decisions. Understanding the problems, and having a range of recommendations and solutions that are in a local context, will help Africa's current and future leaders and administrators to achieve their aims (Bridges.org, 2003).

With the recent introduction of a Second network Operator (SNO) and 3G services in South Africa - huge changes in affordability and access (newer technologies such as wireless do not depend on installed infrastructures) due competition will be experienced and will also cause

developments and opportunities. The researchers recommends that South Africa should take on the following activities – such as responding to development needs, by deriving and delivering services that directly influence targeted populations and improve their standard of living, demonstrating innovative, tailored solutions by identifying local conditions and constraints, working in close partnership with stakeholders (international institutions, carriers, governments, local authorities and communities), and Developing win-win approaches to ensure lasting commitment from all stakeholders (Maplecroft.NET, 2005).

The solutions to Africa's problems must come from within the continent, and Africa evidently is ready to rise to the challenge (Bridges.org, 2003). The potential of being e-Ready in conjunction with the social and economic success that the society can achieve in sustaining ICT initiatives seems to be a difficult but a worthwhile achievement.

## References

- Accenture Markle Foundation, United Nations Development Programme. 2001. July. *Creating a Development Dynamic: Final Report of the Digital Opportunity Initiative*. Retrieved May 13, 2005 from <http://www.opt-init.org/framework.html>
- APEC Readiness Initiative. 2000. *e-Commerce Readiness Assessment G*. Retrieved September 25, 2005 from [http://www.ecommerce.gov/apec/docs/readiness\\_guide\\_files/readiness\\_guide\\_5.pdf](http://www.ecommerce.gov/apec/docs/readiness_guide_files/readiness_guide_5.pdf)
- Bridges.org. 2001. 14 March. *Comparison of E-Readiness Assessment Models*. Retrieved August 9, 2005 from <http://www.bridges.org/ereadiness/comparison.html>
- Bridges.org. 2003a. 7 January. *World Economic Forum-NEPAD e-Africa Commission e-Readiness Policy Programme: Building Capacity to Narrow the Digital Divide in Africa from Within*. Retrieved August 9, 2005 from <http://www.bridges.org>
- Bridges.org. 2003b. October. *Inventory and Analysis of South African ICT Initiatives: Government, Private Sector and Civil society*. Retrieved August 9, 2005 from <http://www.bridges.org>

- Bridges.org. 2004. *Spanning the Digital Divide: Understanding and Tackling the Issues*. Retrieved August 9, 2005 from <http://www.bridges.org>
- Bridges.org. 2005, 11 May. *E-Ready for What? E-Readiness in Developing Countries: Current Status and Prospects toward the Millennium Development Goals*. Retrieved August 9, 2005 from <http://www.bridges.org>
- Budhiraja, R & S Sachdeva 2002. *e-Readiness Assessment*. Retrieved September 25, 2005 from <http://www.bridges.org/resources/ereadiness.html>
- Choucri, N, V Maugis, S Madnick & M Siegel 2003, May. *GLOBAL e-READINESS - for WHAT?*. Retrieved September 25, 2005 from <http://ebusiness.mit.edu>
- Colorado State University. 2005. Overview: Reliability and Validity. Retrieved October 6, 2005 from <http://writing.colostate.edu/guides/research/relval/index.cfm>
- CSPP. 2000. *The CSPP Readiness Guide: For Living in the Networked world*. Retrieved August 23, 2005 from <http://www.cspp.org/readinessguide/intro.cfm>
- Doktor, R 2002. *Accelerating E-Government...E-Readiness at Work*. Retrieved July 29, 2005 from <http://www.mcconnellinternational.com>
- ebusinessforum. 2005. *Doing e-Business in South Africa*. Retrieved August 9, 2005 from <http://www.ebusinessforum.com/index.asp>
- Electronic Communications and Transactions Act 25 of 2002/6/20
- Formby, H Rival at last for Telkom. *Sunday Times – Business Times*, 11 December 2005: 3.
- Gates, B & M Mitchell 2002. 9th August. *Can ICT Stimulate Economic Development?* Retrieved March 10, 2005 from <http://digitaldivide.net/articles/view.php?ArticleID=186>
- Gillis, B & M Mitchell 2002. 9 August. *Can ICT Stimulate Economic Development?* Retrieved March 10, 2005 from <http://www.digitaldivide.net/articles/view.php?ArticleID=186>
- Herselman, M 2005. *ICT Policy for South Africa: New Developments*. Retrieved May 13, 2005 from <http://www.actapress.com/Abstract.aspx?paperId=11463>

- Information Technologies Group. 2000. *Readiness for the Networked A Guide for Developing Countries World*. Retrieved May 13, 2005 from <http://www.readinessguide.org>
- International Telecommunications Union 2003, December. *World Telecommunication Development Report 2003 - Access Indicators for the Information Society*. Retrieved November 14, 2005 from [http://www.itu.int/ITU-D/ict/publications/wtdr\\_03/material/WTDR2003Sum\\_e.pdf](http://www.itu.int/ITU-D/ict/publications/wtdr_03/material/WTDR2003Sum_e.pdf)
- International Telecommunications Union. 2004. *ITU Indicators – Digital Access Index (DAI)*. Retrieved November 14, 2005 from <http://www.itu.int/ITU-D/ict/dai/html>
- ITU E-Strategy Unit 2003. *Empowering Development*. Retrieved August 9, 2005 from <http://www.itu.int/ITU-D/e-strategy>
- Krull, A. 2003. *ICT Infrastructure and E-readiness Assessment Report – ESTONIA*. Retrieved September 25, 2005 from <http://www.google.com>
- KZN DEDT. 2002. *The Department of Economic Development - Core Business*. Retrieved October 21, 2005 from [http://www.kzndeat.gov.za/over\\_dedt/core.html](http://www.kzndeat.gov.za/over_dedt/core.html)
- Maplecroft.Net. 2005. *Global Map of Digital Inclusion*. Retrieved November 14, 2005 from <http://maps.maplecroft.net/digital>
- McConnell International. 2000. August. *Risk E-Business: Seizing the Opportunity of Global E-Readiness*. Retrieved May 5, 2005 from <http://www.mcconnellinternational.com/ereadiness/EReadinessReport.htm>
- McConnell International. 2001. May. *Ready? Net. Go! - Partnerships Leading the Global Economy*. Retrieved May 5, 2005 from <http://www.mcconnellinternational.com>
- Mukhopadhyay, D & Venkataramana, Y. 2003. 21 July. *E-Readiness Assessment of States*. Retrieved May 5, 2005 from <http://www.google.com>
- Nua Internet Surveys. 2002. *How Many Online? – Africa*. Retrieved November 8, 2005 from [http://www.nua.ie/surveys/how\\_many\\_online/index.html](http://www.nua.ie/surveys/how_many_online/index.html)
- Pearlman, B 2002. 9 April. *Inside the Digital Divide: Connecting Youth to Opportunities in the New Economy*. Retrieved March 10, 2005 from

<http://www.digitaldivide.net/articles/view.php?ArticleID=259>

- The Southern African Development Community (SADC) e-Readiness Task Force 2002. *SADC e-Readiness Review and Strategy - Recommendations of the SADC e-Readiness Task Force*. Retrieved July 29, 2005 from [http://www.weforum.org/site/knowledge\\_navigator.nsf/Content/\\_S7144](http://www.weforum.org/site/knowledge_navigator.nsf/Content/_S7144)
- The Economist Intelligence Unit. 2004. *The 2004 e-readiness Rankings A White Paper from the Economist Intelligence Unit*. Retrieved May 5, 2005 from <http://www.eiu.com/2004eReadinessRankings>
- The Economist Intelligence Unit. 2005. *The 2005 e-readiness Rankings A White Paper from the Economist Intelligence Unit*. Retrieved May 5, 2005 from <http://www.eiu.com/2005eReadinessRankings>
- Turner, R 2002. 12 March. *Extending the Information Revolution – IT Utilization by Non-profits and Community*. Retrieved March 10, 2005 from <http://digitaldivide.net/articles/view.php?ArticleID=227>.
- Twist, K 2000. 4 December. *Addressing the Demand for an Information Age Workforce*. Retrieved March 10, 2005 from <http://digitaldivide.net/articles/view.php?ArticleID=156>
- Vosloo, S 2004, September. *e-Government and the e-Readiness of Non-Profit Organisations in the Western Cape*. Cape Town : Department of Information Systems -University of Cape Town.
- World Economic Forum 2002, January. *Better, Faster, Cheaper: Developing and Leveraging World Class ICT Networks for Social and Economic Advancement*. Retrieved August 9, 2005 from [http://www.bridges.org/e-policy/sadc\\_wef/sadc\\_wef\\_ereadiness.pdf](http://www.bridges.org/e-policy/sadc_wef/sadc_wef_ereadiness.pdf)

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# Information Heaven: Online Information Access for Rural Communities

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## **Abstract**

This article addresses the needs for a community computer centre (Telecentre) for the community of Emkhambathini. This study was part of the Information Systems research exercise that was conducted by students. The problem that the researchers experienced was that Emkhambathini has no access to information and a need exists to ensure that this community joins the 21<sup>st</sup> century. The Telecentre will also serve as a community upliftment tool. The data was collected using a questionnaire, it was collated and analysed using SPSS. The conclusion was that gender or employment does not play a role when there is a real need to access information.

## **1. Introduction**

There is evidence that important support for the Millennium Development Goals can be achieved with the use of ICTs. Internet offer extensive development opportunities, particularly for people in rural areas and living in poverty. Wireless Internet technologies can allow developing countries to leapfrog generations of telecommunications. Connecting local communities in developing regions to the Internet will have a positive impact on education and their health system [6], [14]. The Internet complements locally available

information, improves and accelerates knowledge flows, and can be used to deliver innovative education models to remote areas [5].

Support should therefore be given to start, maintain and run Telecentres because they perform a primary development function for information and education, which is considered a basic and important human right [2]. Telecentres are to information what schools are to education and health centres to health and bodily well being [7].

Telecentres still appear to be a good idea [8]. Market-based mechanisms may be penetrating, but it is questionable that they are sufficient to address social inequities and maximize the potential of ICTs for rural development. While current research hasn't produced any easy-to-follow instructions on how Telecentres are done, it has found broad support and validation for the idea amongst rural and other disadvantaged populations [11]. Amongst these communities, access to communication tools is highly valued. However, implementing Telecentres successfully in Africa remains a rare art mastered to-date only by a very few skilful social entrepreneurs. Creating access for all through Telecentres remains a distant goal and the passage to reach it, a mystery [1]. The next section will discuss the research questions.

## **2. Research Questions**

Although the literature attempted to solve all the problems as described, certain issues still need attention. These are:

1. Why does the South African government take such a long time to create computer centres?
2. How will the community benefit from such a computer centre?
3. What other benefits are there for the community?
4. Can this help in other terrains?

## **3. Research Methodology**

In this section the researchers discuss the choice of methodology that was used in this study. It will also cover issues like sampling, questionnaire administering and data analysis.

## **4. How this Study was Conducted**

A quantitative research approach was adopted for this study because the aim of the study is to find solutions relevant to the people in rural areas. This approach will help in the understanding of rural areas in their context [9].

The motivation for doing quantitative research is that quantitative research methods are designed to quickly help researchers understand people and the social and cultural contexts within which they live. Kaplan and Maxwell (1994) argue that the goal of understanding a phenomenon from the point of view of the participants and its particular social and institutional context is an important feature of research. For this study the need to collect quality data from different people and the fact that reliable results should be found before any Telecentre project can be started has necessitated this choice of approach.

## **5. The Questionnaire**

A questionnaire was designed to accomplish two main objectives: one was to maximise the proportion of subjects answering the questionnaire - that is, the response rate; and the other was to obtain accurate information for the survey. The questions were also divided into personal questions like age and gender, and knowledge questions like "How would you rate your level of computer competency?" The questionnaire was also made available in IsiZulu as rural people do not speak English fluently.

## **6. Sampling**

The research was conducted from a sample of 125 randomly selected rural people residing in a rural area of Emkhambathini (Camperdown) outside Pietermaritzburg. This sample is taken from one district with the population of about 180 people according to municipal records. Respondents were chosen in no particular order to allow diversity in their responses. This was done by visiting them in their homes and in other public places such the tribal authority offices and clinics. Random sampling was adopted for its ability to allow every member of the community to get an equal opportunity of being selected for participation.

## **7. Data Analysis**

After completion of this processes all questionnaires were analyzed using SPSS and graph plotters to derive possible conclusions from answers given by users. Graphs and charts were used for the purpose of presenting the findings in a user friendly and understandable format. The associations between the different variables measured will only be determined in a follow-up study by computing correlations and ANOVA. This information and all data gathered from other sources such as popular press articles helped to finalize the results. The literature review also formed part of the data analysis process. Upon completion of the data analysis the researchers derived answers to the research questions.

## **8. Discussion of Results**

The aim of this section is to provide a detailed explanation on all responses gathered by using questionnaires. The analysis also utilise other existing literature to support (validate) the findings of this research study. 125 questionnaires were distributed to the Emkhambathini community. Of the 125 questionnaires, 123 questionnaires were collected and 2 questionnaires were never returned to the researcher. Of the 123 questionnaires returned, one was considered unusable as the respondent had ticked more than one response and in some cases left the response blank. The following analysis is therefore based on the 122 responses that the researchers consider usable. The return rate is therefore 98%.

Fifty nine percent of the participants were females and this is attributed to the nature of rural life as women are still expected to remain at home and take care of the house and children while men go to the cities to find employment. This is supported by a study conducted by Ryan (2004) in African countries. He argues that old traditions have led men to believe that it is their duty to be responsible for income generating while women look after children. Lack of employment opportunities in the rural areas is a problem. Nearly all (97%) of the respondents are African, 2% Coloured and only 1% White. The Emkhambathini area is a deep rural area and the researchers could not find people of other races in the area except for those who came to work on government projects.

## Age of Respondents who Participated in the Study

The Table below reflects the age groups of the respondents. The biggest age group is 20 years to 29 years (30%) followed closely (29%) by the 0 years to 19 years group. A further explanation of these figures would be the fact that older rural people are mostly uneducated and usually avoid participating in things they perceive to concern education [7]. They referred the researchers to their children who attend school.

Table 1: Age distribution

	Respondents	Percentage
0 - 19	36	29
20 - 29	36	30
30 - 39	27	22
40 - 49	18	15
above 50	5	4

The results show that of the 122 responses gathered, 60 went to secondary school and that 45 respondents had gone to tertiary institutions. The educational level measured was taken as the highest level of education reached which means that it also took into account the people who have dropped out of school. The pass rate at matric level in rural schools is low which has led to rural students not being able to go beyond secondary education. Another problem facing rural students is that tertiary education is expensive for them. Six respondents ignored this question possibly because they had no formal education to select.

## Employment

Table 2: Employment

	Respondents	Percentage
Yes	57	47
No	65	53

Of the 122 responses, 57 (47%) respondents answered that they were employed. This consists mostly of teachers and people working as unskilled workers (like construction). Epodoi (2002) made a similar finding that more employed people in rural KwaZulu-Natal were engaged in the teaching

profession than in any other type of paid employment. In bringing ICTs to this community people will benefit as this will provide them with tools to gather new knowledge. Also, the integration of services like youth portals and government information give them the opportunity to access services like internships and skills development initiatives. Telecentres also provide them with the opportunity to learn new skills that they could have not afforded to go to educational centres to learn. They access information to help them start businesses through government grants. All respondents answered this question showing interest in issues of employment.

Only 37% of the respondents have reached tertiary levels of education which presently is the only level a rural student can learn computing as rural schools do not offer these facilities. Due to the complexity of computers most people in Africa will never own a computer [11]. Campbell (1995) states that by their very nature, rural communities do not produce economies of scale that make it less expensive to provide an advanced telecommunications infrastructure, powerful computers, and well developed networks. Etta (2004) agrees that the need for basic literacy, computer skills and training in the use of ICT applications remains a challenge for rural areas. The low level of computer literacy presents a challenge in the implementation of Telecentre projects as it requires that expertise be imported from urban areas which might increase the cost of implementation.

## **Training to Use the Computer**

Of the 25% respondents who stated that they can use a computer 21% have received formal training at University, Technikon or College. None of the respondents indicated that they have obtained an IT related Diploma or degree but stated that they have learned the basics of computing as part of their studies. Others have taken computer courses at private colleges but these institutions are not available in rural areas. The results agree with the statement made by Campbell (1995) which states that in urban areas, single organizations such as large corporations, school systems, and city government can operate systems that are beyond the reach of any single entity in any rural community. Access remains an obstacle to rural participation in the ICT arena. Only 3 respondents had access to computers at school.

## The Level of Computer Literacy

More than 50% respondents indicated that they are completely illiterate and 6 respondents ignored this question. Only 41% of the respondents indicated that they have some knowledge of computers. Twenty one percent specified they their knowledge is limited. Most of them only know word processing and are not able to use tools like the Internet effectively. Rural people have not been able to access these tools because of the disadvantaged background and due to the lack of infrastructure. Benjamin (2000) argues therefore that the legacy of apartheid is as strong in the telecommunications as other parts of life.

Table 3: Computer Literacy level

	Respondents	Percentage
Beginner	35	21
Medium	12	10
Expert	3	2
None	66	54
No response	6	5

It appears from this table that rural people think it is important to get a certain level of computer training. Twenty five percent of the respondents indicated they are prepared to up to R150.00 for their training. These people chose the minimum amount and there are several reasons for this. Firstly most rural people don't know how much computer training is worth in practice. Adverts usually promise free training with participants required to pay around R75.00 for administrative costs. This has led these rural people to believe that computer training is cheap.

Not having enough information on service fees is a concern in the deployment of ICT solutions and the need to grow awareness arises [4]. Secondly they might believe that computer training is for the rich and they don't have enough money to afford it or they do not see its importance in a rural setting. This is supported by Campbell (1995) who states that when payment is involved to access information, people at rural information centres are less likely to have disposable income to spend. They hesitate to

use family food, education, and clothing money for information. Twenty percent might pay up to R250.00 which is enough money in many cases to cover essentials of basic computing like word processing, spreadsheets, e-Mail and Internet.

### **Money Available for Computer Training**

More than 15% of the respondents are prepared to pay more than R350.00 to receive computer training. This number probably consists of people who have already received basic training and feel they need advanced training like programming. They have been exposed to computer training and know it can be an expensive exercise. Telecentres can help them in areas such as education, health care, local democracy and small business support [2]. On the other side these people might be coming from the group that has never used a computer before and have always regarded computers as expensive equipment that are only available to the urban communities. This has made them believe it is more expensive to learn anything about computers. This is an area that must be addressed in the establishment of Telecentres in rural areas. There is a need to develop subsidised services, group rates (e.g. for women, students, or members) [7].

**Table 4: Money for training**

	<b>Respondents</b>	<b>Percentage</b>
100.00 – 150.00	31	25
150.00 – 250.00	24	20
250.00 – 350.00	16	13
Above 350.00	20	16
Nothing	30	25
No response	1	10

The last group of respondents is not willing to pay anything for training. Their reasons can range from the fact that the unemployment rate in rural areas is very high and people do not have money to use on training. There is also a belief that Telecentres are for the elite educated [7]. The results confirm the fact that rural people are falling behind in the advances in technology. Only 9 respondents own a computer at home indicating that rural people do not know about computers or cannot afford computers. Ryan

(2004) agrees that most people in Africa will never own a computer in their lifetimes.

Telecentres provide a solution to introduce them to the information society and bridge the digital divide and will enable the community to share resources and information. This will allow the people who already have a certain understanding of computers to help the community members who do not know how to use computers. Rural people and organizations must be organized to work together and pool resources and demand [3]. Telecentres also provide an alternative to buying a computer and refrain from spending maintenance costs allowing this to become the responsibility of the centre authorities. Ninety percent of the respondents would like to own a computer. This figure corresponds to the previous discussion of people who do not have a computer at home. People show an interest in owning their own computers and believe that having computers will improve their standard of life in terms of skills. It enables them to access the Internet. They want to use the Internet for job searching and learning about opportunities on the Internet. It shows they understand that ICT are a condition for freedom in the modern world [5].

### Amount of Money to Spent on an Own Computer

Table 5: Monetary value spent on PCs

Response	Respondents	Percentage
500 – 1000	28	23
1001 - 2000.	15	12
2001 - 4000.	21	17
Above 4000	40	33
No response	18	15

A number of respondents are prepared to pay amounts above R4000.00 to buy computers. This confirms that some rural people understand the value of computers and the contribution they have in development. More than 85% of the respondents are prepared to buy computers for their personal use. Computers have the potential to help leapfrog the development process and empower communities [6].

Table 6: Access to PC

	<b>Respondents</b>	<b>Percentage</b>
Local School	17	14
Public Library	3	2
Internet café	5	4
At Work	19	16
Other	5	4
No response	73	60

Lack of infrastructure has been the biggest threat to the implementation of Telecentres in rural areas. Nearly 60% of the respondents do not have an alternative place to access computers. This number indicates that rural people are still living outside the information society. Telecommunications connectivity in developing countries is usually available only within the capital and in major centres. Yet the majority of the population lives outside these cities [11]. To find out the kind of alternative places available to this community the researchers asked them to explain where they can alternatively access computers. Nearly 40% responded to the question.

Most respondents only use computers at work [12]. Second largest is that of users at a local school with 17 responses. The people who have access to a computer at the local school are teachers and other people doing administrative work at these schools. If the schools can be used in the establishment of Telecentres more people will be able to access computers. This view was supported by Benjamin (2000) who proposes that existing institutions be used to establish Telecentres. In the Northern Province a secondary school has been used to establish a Telecentres and they are control of this facility [11].

The majority of the people do not have an alternative place to access computers which confirms that the alternative places mentioned above are not available to the whole community. Sayed (2003) argues that there are two views in the public about Telecentres and ICTs in general. In this community of Emkhambathini the optimistic view is that the establishment of a community computer centre will bring advantages to the community. It

will bring development and open up opportunities that never existed before. This is particularly encouraging to the researchers as it indicates community readiness for ICT implementation. According to CINSA (2004) establishing a shared vision around measurable goals is an important part of the implementation process. Fuchs (2000) agrees that the first step is often to demonstrate how the facilities in a Telecentres can be made to work for community. In this community this task looks simpler as most people support the establishment of a Telecentre.

The responsibility of who will finance community initiatives like computer centres has been a key theme in the debate around Telecentres [2]. The majority of the people (84%) thought it is the government's responsibility to build community computer centres. This was influenced by the background that rural people come from which has made them dependent on the government for their needs. These people often think the government is the only institution that can afford these services. Their view is supported by Fuchs (2000) who argues for public funding of centres just like the funding given to schools and public libraries. About 10% of the respondents suggested that business people are the ones who should finance this initiative. Although there are no big businesses in the rural areas the new movement of popular government officials to the business sector has made rural people to think these people are rich and can finance any project in the community. Benjamin (2000) also supports that Telecentres must be run by profit focused organizations to encourage quality service.

## Use of the Computer Centre

Table 6: Uses of Telecentres

	<b>Respondents</b>	<b>%</b>
<b>Community Empowerment</b>	37	30
<b>Computing business</b>	9	7
<b>Education</b>	53	44
<b>Internet and E-mail</b>	13	11
<b>No response</b>	10	8

Responses were collected into four categories. The first was community empowerment where 30% of the respondents indicated that they will use the computer centre to teach youth life-skills and starting community projects. The projects mentioned ranged from HIV/AIDS awareness, Adult Basic Education and youth empowerment. This can go a long way in improving lives and governance in the rural community [5]. Only 9 respondents wanted to start their own businesses in the computer centre (e.g. typing assignments and curriculum vitas).

Some respondents already had businesses and believe the Telecentre would give them added advantages. Also, access to government information like business registration records and tax records will be of benefit to small rural businesspeople. More than 40% of the respondents view the establishment of the computer centre as an opportunity for them to improve their education, learn skills like computer literacy skills, e-mailing and also take courses online. ICTs are known to bring about distance shrinking possibilities [3]. The computer centre is therefore seen as a tool to promote information literacy and provide access to information.

## **9. Conclusion**

In this section a discussion of the results collected from the respondents was presented by means of tables and charts. In examining the results of this study it was found that the majority of the population of Emkhambathini is characterised by high illiteracy rate, high unemployment, high level of male absenteeism and poverty. The results indicate a negative level of readiness in the community for ICT initiatives. More programmes aimed at the reduction of poverty and unemployment must be started to address the problems faced by rural people in accessing ICTs. Government and private sector programmes must also be focused in the provision of necessary infrastructure like electricity, water and roads as these might hinder the supply of ICTs to rural areas. Festa (2003) made similar remarks in his study.

## **10. Recommendations**

Information access in the lives of rural people around the world has become important and this study focused on their use for rural development. The

advancements in technology must be used to help rural communities take advantage of the digital opportunities. The need to bridge the digital divide between the urban and rural communities has encouraged many researchers to investigate the implementation of ICTs in rural communities. This study makes a contribution by investigating the establishment of a computer centre for a rural community of Emkhambathini (Camperdown).

The study investigated the feasibility of establishing a community Telecentre for a rural community and the overall result of this study found that the centre can be established in this community. The area studied had access to electricity which plays an important role in the implementation of ICTs in rural areas.

The study established if any rural people have computer knowledge and what they would best use the computers for. The finding was that the level of computer literacy in the community was very low in that only thirty one respondents know how to use computers. This indicates that the project must focus on the training of the community to use computers and that other service that does not require computer knowledge must be offered. These projects include a government information centre where leaflets can be given to the community to read. This will improve government understanding in the community. The community was interested in using the Telecentre for educational purposes. These include distance learning, Adult Basic Education and computer studies. The community computer centre must also address issues of community empowerment like Life Skills, youth development and small business development. This can be achieved by the provision of information to the community and connecting them to government departments and other organisations offering help to small businesses.

### ***Business Model***

The study focused on the question of a business model that should be adopted for Telecentres. The popular view on the business model for Telecentres is that the government in partnership with the private sector must be responsible for establishing Telecentres. For this study the researchers find that the community of Emkhambathini would like the government to take responsibility for Telecentres. Taking into account that

this rural community is poor and cannot afford the costs of running a Telecentre, the researchers agree with this view. The fact that more than 80% of the community stated that the government must provide support similar to that given to public schools and libraries helped to make this conclusion.

### ***Policy***

Realising the importance of the role played by policy makers in the establishment of community computer centres the researchers reviewed literature by other authors in the theory. This study has found that South Africa already has a policy on Telecentres which is the Telecommunications Act of 1996 (this act specifies guidelines on the how to establish Telecentres). The Reconstruction and Development Programme also addressed the issue of Telecentres but unfortunately both these policies still fail to achieve their goals because of a lack of funds and information on the part of the local governments who are the ones to drive these initiatives. The researchers conclude that local councillors who are in daily contact with the people do not understand the different policy documents of the government.

Government involvement must also contribute to other projects like electricity, water and sanitation as these are important infrastructural requirements for Telecentres. This means that the South African government must start drafting other policy documents to address the rural Telecentre situation.

These policies must consider the following:

1. The role of the private sector;
2. What kind of software and hardware will be used; and
3. How will the running costs be recovered?

### ***Services***

The research found that people would most use the Telecentre for educational purposes. It was discovered that the level of education in the community was low and people wanted to improve their education and

acquire more knowledge through the Telecentre. Services that are aimed at improving the conditions of living for the community must be provided. These include Telehealth, distance education facilities, youth portal to house organisations like Umsobomvu Youth Fund and the Youth Commission for the people to get information that can help address the high levels of unemployment and illiteracy.

The Telecentre should also be used to provide information for small businesses as this is an alternative to unemployment. For the success of these services the Internet plays a crucial role to provide a platform for communication and information sharing. It must also be used to help school children in their assignments as there is no local library in the community. This will improve the quality of assignments the students complete as they normally have limited information for this purpose.

### ***Training and Skills***

In any rural community computer literacy levels are low because of limited resources to learn these skills. Training is therefore needed in this community as 75% of the community cannot use computers. The study found that the rural community of Emkhambathini will need training before the Telecentres project can succeed.

### ***Infrastructure***

The findings supported the fact that the infrastructure in this community is not as bad as in most other communities studied before. The community already have access to electricity, water and tar roads. Although only a few individuals have access to their own telephone lines but the community has access to phone shops which means providing Internet is possible.

## **11. Research Questions**

*Why does the South African government take such a long time to create computer centres?*

According to the findings of this study the South African government does have a programme at national level to create computer centres but slow delivery shows the lack of commitment by the provincial and local governments. This can be a result of a lack of information and funds for these projects. The rural communities are facing other problems such as limited electricity, clean water, health facilities, education facilities and limited tar roads. The local governments prioritise these neglecting Telecentre projects which are viewed as a luxury and people should be better educated as only 26% of secondary people are employed.

*How will the community benefit from such a computer centre?*

As discussed previously, the community will use the computer centre to improve their education and acquire new knowledge. Information about child nutrition, agriculture and tertiary institutions application procedures will be provided by use of leaflets or through the Internet. For a rural community this information is important as they do not have access to experts like the urban communities. For local business, the computer centre will enable them to obtain information on stock prices and free business training on the Internet. The government departments will find a place to make available information about grants, bursaries and other useful services. More people should have access to information and could impact on the association figure between gender and ownership. Computer literacy in the community will be improved through the provision of computer classes at cheaper rates. This will also help in creating employment opportunities for the local trainers who have an understanding of computers.

*What other benefits are there for the community?*

The Telecentre can be used as an incubator for small business and youth will have a chance to form co-operatives and take advantage of the governments youth empowerment programme. For teachers and health workers in the community this centre will give them a chance to improve their knowledge which will in turn ensure that the quality of service is kept in line with developments in their fields. It also emphasises that more money should be made available for training to increase this figure to at least 70% and not below 50% as was shown.

### *Can this help in other terrains?*

The study did not only focus on the use of computers in the Telecentre but also looked at other fields that might benefit from the Telecentre. Apart from the fields of education, business and health which have been discussed in the previous pages the Telecentre can be used by government to train municipal councillors and staff on local government policies and update them on the policies being adopted at national level. This will help speed government service delivery and address the slow creation of computer centres as the information will easily get to the local government. Training on computer repairs, call centre and science and technology are other terrains that will benefit (Table 6).

## **12. Recommendations**

### ***Training***

The researchers recommend that computer skills training be incorporated into the normal school curriculum to address the problem of high illiteracy in the community. The Telecentre must as its first priority offer training to the community at low rates so that they are able to use the services offered effectively.

### ***Infrastructure***

As rural schools do not have modern facilities to house a computer centre the Telecentre must be built as a separate building that is reachable and accessible to the whole community. This involves taking into consideration disabled people, children and female needs.

### ***Government Involvement***

The government must, in addition to drafting policy documents, set up a formal committee to lead the establishment of Telecentres. The committee must be allocated a budget similar to that given to other departments for this purpose. The government must also embark on a fundraising programme to attract big business to sponsor Telecentres. This has been achieved in the Mogalakwena Hewlett i-Community project. Government supported companies like Telkom, Transnet and others must also be encouraged to sponsor Telecentres.

### **Staff Requirements**

The researchers recommend that the governments SETA learnership project must be used to recruit Information Technology graduates to work at the Telecentres while they receive experiential training. This will decrease staff costs and help give unemployed graduates work experience which will help them in applying for employment.

## **13. Conclusion**

The advantages that come with the use of ICTs in the lives of ordinary people have started to show in South Africa. Although the South African government is determined to improve the lives of rural people more support is still needed from the communities, the private sector and international investors to address the imbalances of the past.

This research study has shown that the rural communities are disadvantaged in terms of accessing Technology and information. The digital divide that exist between the urban and rural communities has played a contributory factor in deepening the crisis of poverty, malnutrition, high unemployment, high illiteracy and other social ills in these communities. The lack of information can be easily addressed through the establishment of Telecentres that will provide a single point of information and its sharing. It has been shown that information is an important part of a human's life and its unavailability isolates one from the progresses in real life. Telecentres are possibly a cheaper way of speeding rural development. It is the conclusion of this study that it is possible to establish a Telecentre for the rural community of Emkhambathini.

## **References**

- [1] Balancing Act 2004. The Road to Telecentre Success Remains Mysterious. Retrieved: May 11, 2004, <http://www.cinsa.info/portal>
- [2] Benjamin, P 2000. Telecentre 2000. Retrieved: 14 May 2004, <http://www.communitysa.org.za/docs/intafrika.doc>
- [3] Campbell C 1995. Community Technology Centres: Exploring a Tool for Rural Community Development. Retrieved: 02 July 2004 [http://www-unix.oit.umass.edu/~ruralma/CTC\\_ToC.html](http://www-unix.oit.umass.edu/~ruralma/CTC_ToC.html)

- [4] Cinsa 2004. Lessons on Sustainability from Alaskan Villages. Retrieved: 04 May 2004 <http://www.cinsa.info/portal/index2.php?option=content&task=view&id=129&pop=1&pag>
- [5] Eggers I 2000. Mali's Centres of Information. Retrieved: 04 May 2004, [http://www.findarticles.com/p/articles/mi\\_m1309/is\\_2\\_37/ai\\_66579838](http://www.findarticles.com/p/articles/mi_m1309/is_2_37/ai_66579838)
- [6] Epodoi R 2002. Bridging the Gender Gap: Women in the Information Society. Retrieved: 20 March 2004, [http://www.findarticles.com/p/articles/mi\\_m1309/is\\_4\\_40/ai\\_114007090](http://www.findarticles.com/p/articles/mi_m1309/is_4_40/ai_114007090)
- [7] Etta F 2004. The Experience with Community Telecentres. Retrieved: 28 September 2004, <http://www.acacia.org.za/telecentres.htm>
- [8] Fuchs, R 2000. If you have a Lemon make Lemonade. Retrieved: 04 August 2004, <http://web.ask.com / www.idrc.org.sg/en/ev-8785-201>
- [9] Ihde D 1977. Experimental Phenomenology: An Introduction. New York: State University of New York
- [10] Kaplan B & J Maxwell 1994. Qualitative Research in Information Systems. Retrieved: 14 October 2004, <http://www.qual.auckland.ac.nz/>
- [11] Ryan M 2004. Computer Centre Lets Impoverished Village Take First Step into Digital Era. Retrieved: 20 August 2004, <http://www.govtech.net/magazine/gt/2000/sept/poverty/computercenter.php>
- [12] Sayed, Y 2003. Missing the Connection? Using ICTs in Education. Retrieved: 15 June 2004, <http://www.id21.org/insights-ed01/insights-issued01-art001.html>

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# **Perceptions of Members in a South African Rural Community about the Prospects of Becoming a Digital Village**

**C. Rambowan,  
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Rembrandt Klopper**

## **Abstract**

This article addresses the need for a Telecentre in the community of Bayview, a rural community in KwaZulu-Natal on the eastern seaboard of South Africa. The researchers reviewed various refereed sources from which was concluded that in order to access information prospective beneficiaries first need to know what information is, what information is available digitally and how the information that they require can be accessed via a Telecentre. A questionnaire was distributed in the community, the data was collated and analysed. The major findings are that the community would benefit if a central information accessing facility were created, provided that people are being taught how to use such a facility and what they need to do to ensure that the facility remains viable and to ensure that inequalities in access are removed.

## **Introduction**

The provision of access to electronic information services is currently seen as a key to accelerating development in a community. The increasing use of electronic information has made possible new methods to deliver services and to supplement existing ones (Ellen, 2000). New technologies, if used innovatively, can help in bridging technological, knowledge and income

However, the use of electronic media involves constraints (Cornu, 1997).

- Humans need electronic tools to read the data.
- Electronic media generally have a shorter lifespan than paper or microfilm.
- It is easier to duplicate or alter an original (which raises problems of proof and authentication).
- The rapid pace of change in technology and on the information market makes it difficult to find stable and long-lasting formats to use (Cornu, 1997).

## **Benefits of Electronic Information**

According to Maxwell (2000), some of the potential benefits of universal access to electronic information can include: Significantly increasing the speed of achieving universal based on the achievement of universal access to information, communication technologies and appropriate content and applications; Decreasing poverty around the world, through the linkage of access to information and communication technologies; Opening up global markets through Internet commerce to any individual or entity that can gain access to the Internet and to online communications tools; and Increasing the spread of democratization through increasing civic discourse and citizen involvement in government.

Electronic communications provide new options for accessing people and resources through online discussion groups, mail services, library catalogues, encyclopaedias, dictionaries, newspapers, and other information resources. Computers, when appropriately adapted for access, allow people with disabilities to use computer software to communicate with family and friends, and to access electronic information without assistance (Burgstahler, 1998).

## **Main Challenges to Electronic Information**

It is important to understand that lowering the barriers to Internet access is helpful to everyone in the context of gaining easier access to information. An

argument can be made that every individual should have the right to access information regardless of disability, economic situation, or geographic location. Global access itself is not enough. Cost of access has to come down to where not just the elite in emerging nations can afford to get on the Internet (Maxwell, 2000).

Much has been written about "wiring the last mile" (that is, bringing the network to the home) and about making computers more available to those who can least afford them (John, 1996). Yet according to Keery (1997), electronic information is still only accessible to a privileged few. Access requires equipment, there are connection costs, and some training is required. Information on the Internet, which is often currently treated as if it were free, will cost more as the mechanisms of electronic charging become well-established. According to Ellen (2000), the cost of providing even basic telecommunication services limits the potential for widespread access to electronic information in a community that is poverty stricken. People in a poverty stricken community are unable to use the Internet because they do not have Internet access. They therefore look for the information elsewhere.

## **Role of Electronic Information in a Community**

The benefits of access to electronic information for a community can be viewed as having both private and public components. Private benefits of access are measured by the utility received by the individual as a result of connecting to the network (e.g. to facilitate business transactions, to minimize transport costs, to contact family and friends). Although difficult to quantify, the public benefits of rural telecom service can be substantial. Public benefits of access to electronic information to a community can improve living standards in communities by providing important commercial, social and educational benefits. The potential benefits of access to electronic information for a community can include (Whu, 2002):

- Economic efficiency due the reduction in the costs of market transactions (i.e., need for less travel)
- Links local businesses to the trade, transportation and commerce systems

- Improved community services, such as education and health
- Stronger cultural ties and improved national and social cohesion
- Contact with families and friends who migrate to urban areas for work and education
- Access to services (health, education, information, etc.) that enable urban people to improve their lives

## **Socio-economic Characteristics of Rural Communities**

Rural communities are economically undeveloped and focus on subsistence activities. Rural villages in specific geographic areas rely on mining or fishing (coastal regions). Other villages depend upon agriculture which is also an important activity for rural towns. Small grocery stores are the main private business in all rural villages. In larger rural towns, restaurants are also a dominant category of business. Rural villages sell their produce and purchase goods and services from larger, more developed, rural population centres. Many rural communities have no sewage, although smaller and medium-size towns and larger population centres have piped water. Some rural villages have a primary school, but secondary schools are less common. Capital towns, though possibly small in size, are particularly important to surrounding villages, since they are generally the nearest site for secondary education, health services and other basic infrastructure. Province or district capitals also often provide the focus for market and trading activity as virtually none of the satellite villages have market sites. Transportation, accessibility by road, and types of road surface of rural villages to their hub town varies widely. Dirty roads, narrow paths and trails connect most of the rural communities; however, foot paths are sometimes the only access to remote villages (Whu, 2002).

## **Digital Inclusiveness**

More than 80% of people around the world have never heard a dial tone let alone surfed the Web. The gap between the information haves and have-nots is widening. The digital divide refers to the gap between those people who

have access to digital technologies and information on the Internet, and those who do not. It is evident from that the bulk of Internet users come from first world, developed countries (Singh, 2004).

Kagan (1998) argues that in order to understand the information gap, one must first look to the context on the ground. The growing gap between the information rich and information poor both within countries and between countries is determined by the class structure and treatment of minority population groups within and between countries. While IT are spreading widely in rich countries, only the elite have access to such technologies in poor countries.

According to Butzen and Liston (2005) the Internet and other types of electronic communication have reinforced the disadvantages of rural areas. Advanced electronic communication has become integral to almost every kind of business activity and a prerequisite for competitive advantage in nearly every industry, as well as dominating many cultural and social activities. The economic impact of the Digital Divide is felt not only in the infrastructure, but also in the workforce. In many rural areas, the majority of the workforce is not computer literate, and the cost of upgrading the skills of an entire workforce is prohibitive to most employers (Butzen & Liston, 2005).

The existence of the digital divide attributes to high levels of poverty, lack of telecommunications infrastructure, and high costs of connectivity. Although the digital divide exists, steps are being taken at a macro level to develop technology centres or digital villages in townships and rural villages. However, it is these digital villages that will contribute to the healing process. The digital divide does not only exist at a macro level, it has also manifested itself at a micro level in organizations where people are educated, well paid, with access to hardware and telecommunications infrastructure (Singh, 2004).

### **Community Inclusiveness Based Access to Electronic Information via Telecentres**

According to Whu (2002), Telecentres are community owned and operated facilities which house modern information and communication technology

made available for the community's use. The facilities provide communities with access to electronic information and education services and can perform important developmental roles. Delgadillo and Gomez (2003) argue that community Telecentres also provide training for facilitators and promoters, covering not only the technical aspects of information and communication but also the strategic uses of digital technologies for social change. Community Telecentres are places for social encounter and interaction, for learning, for personal growth, and for mobilizing efforts to address community problems and needs. Telecentres differ from Internet cafes in that Telecentre operators provide users with personalized computer training as well as support in applying ICT for specific purposes.

According to Ernberg (2005), community Telecentres offer access to new and more diversified sources of information such as information to new, appropriate, environment friendly methods and technologies for agriculture, aquaculture, forestry, mining and other activities in rural areas. In addition, information on markets and prices for their products and services in other parts of the country and the world is offered. Delgadillo and Gomez (2002) argue that Telecentres gives communities their own voice, strengthening the exchange of experiences and collaboration with groups and networks at the national and international level, and facilitating communication with emigrants and displaced persons.

Telecentre is a concept of rural development which would help rural people gaining access to economic, social, educational and training opportunities through the use of modern ICT. Due to poor connectivity, inadequate infrastructure and other limitations, most of the centres provide very limited services. Low levels of communication infrastructure in the rural areas make it difficult for these to be linked electronically. As Richardson (1997) notes, rural communities represent the last connectivity.

## **Socio-economic Benefits of Telecentres in Rural Communities**

Short (1998) argues that Telecentres have moved from being "a service" in the community to being a focal point. Benefits derived effect the community as a whole as well as the individual. According to Oestmann & Dymond (2001), community Telecentres expand access to information and

communication technologies based services; extend the reach of public services such as education, health and social services. It provides information of general interest to the local community, including government information, and of special interest to specific groups such as farmers, local businesses and non-governmental organisations, and provides access to infrastructure, technology support and advice for the development of businesses.

Oestmann and Dymond (2001) argue that these services provided by community Telecentres can develop rural and remote infrastructure; provide rural regions with better public services and improved local administration, generate employment and foster socio-economic development, integrate relatively isolated communities into the national and international information network and thus accelerate exchange of private goods and services, transfer expertise in areas such as agriculture, to and from the community, and give producers access to market information, thus reducing the need for middlemen and increasing rural incomes.

## **Research Questions**

This study explores community access to electronic information and the extent to which electronic information is being used. This study examines and analyses the use of electronic information in a community, by addressing the following research questions:

1. What information do people need in a community?
2. How do they go about finding it?
3. What factors affect use of electronic information?

## **Concluding Remarks about Literature Surveyed**

This section has discussed relevant research relating to the lack of electronic information in a community. Information on the Internet and the WWW was introduced which provided a better understanding of what is electronic information. Previous information seeking studies were reviewed focusing on the challenges to electronic information, this was important for

examination of how people approach finding information needed in everyday life. The majority of work in this area was found to be community focused. A number of studies were identified which explored factors affecting use of Telecentres.

New technologies, if used innovatively, can help in bridging technological, knowledge and income divides (Mrayati, 2001). An important trend is the emergence of community access to both basic and value-added communications as a key means of achieving universal access. While individuals in many poor locations may not be able to afford the upfront and recurrent costs of owning a telephone line or an Internet-enabled computer, a community as a whole may be able to effectively share such facilities (Whu, 2002).

## **Research Methodology**

### ***The Respondents***

The participants selected for this research were members of the Bayview community. The community consists of approximately 1000 people all of different age groups. The reason for choosing this community is that members of this community come from disadvantaged backgrounds. Particular respondents were selected because they are computer literate, but lack access to electronic information. A convenience sample of 200 members of the Bayview community was selected. Because it is not known exactly how many of the approximately 1000 members of the community are computer literate, it cannot be stated with confidence that a representative sample of computer literate residents completed the survey.

### ***The Survey Instrument***

The questionnaire consisted of 23 questions. A total of 200 questionnaires were collected which comprised of respondents from the Bayview community.

#### ***Questions 1 – 5***

These questions focused on demographic particulars such as the respondents' age group, gender and ethnicity.

*Questions 6 – 9*

These questions were used to determine the types of information the respondent needed in everyday life and their understanding of the various ways in which that information could be accessed.

*Questions 10 – 15*

These questions were used to determine the levels of IT skills of respondents and how they acquired information communication skills.

*Questions 16 – 20*

These questions were used to determine the respondents' own perceptions about how useful it would be to access information electronically.

*Questions 21 – 23*

These questions were used to determine the respondents' knowledge of Telecentres and whether or not building a Telecentre in the community would improve access to electronic information.

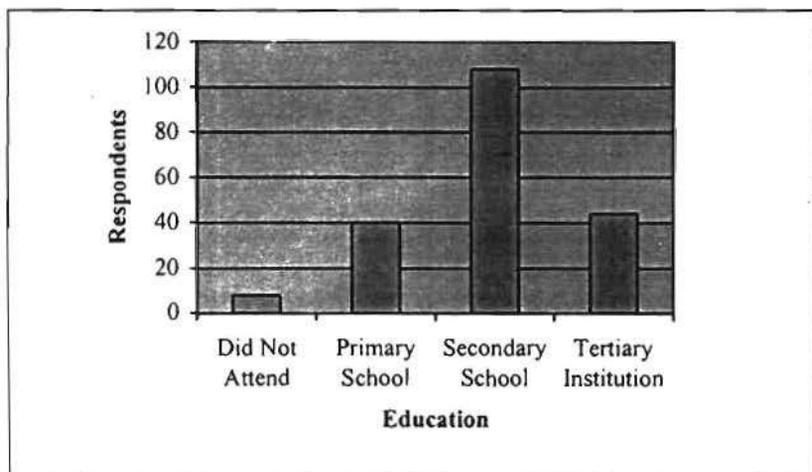
The questionnaire will provide information of most relevance to the research which will enable a picture to be built up identifying the interaction and levels of involvement between the community and electronic information. The researchers used XLSTAT to compare and analyse the data collected from the questionnaire depicted in tables and graphs next.

## **Presentation of Results**

This section deals with the analysis and presentation of the data collected. The data was collected using a questionnaire. The questionnaire was designed to investigate the extent to which electronic information is used the Bayview community to access electronic information.

## Data Analysis

### *Education and Employment Status of Respondents*



**Figure 1: Level of Education**

Figure 1 shows that the members of the Bayview community do not have a high level of education. About 4% (8) of the respondents have no educational qualification. 20% (40) of the respondents attended only primary school, 54% (108) of the respondents attended secondary school. Only 22% (44) of the respondents attended a tertiary institution. The members of the Bayview community lack further education and that could be a reason why the members lack access to electronic information.

Electronic information is being used in different ways for educational purposes. Many students have e-Mail addresses to communicate with their colleagues, their lecturers. The development of the WWW as tool has resulted in departments developing student project work and placing it on the Web (Wilson, 1995). Through the Internet students and educators can register with educational institutions anywhere in the world, access archival material or receive online instruction from central national services (Jensen & Esterhuysen, 2001).

Unemployed respondents made up 29% (58) of the total sample, slightly fewer than the percentage of part-time respondents. The remaining groups include 19% (38) full-time workers, 16% (32) students and 6% (12) pensioners. According to Falch (2005), provisions of access to electronic information are important for creation of local employment opportunities.

### ***Information Requirements in Everyday Life***

A piece of information is an indication or an event brought to the knowledge of a person or a group (Cornu, 1997). According to Kagan (1998), information has become global and has become king of the global economy. In earlier history, wealth was measured in land, in gold, in oil, in machines. Some respondents had multiple information needs. The most frequently mentioned need was employment (15.7%; 22). This contributes to the fact that 29% of the respondents of the Bayview community are unemployed and 33% of the respondents work part time while 15.7% (22) of the respondents also need crime and safety information. This is due to the high crime rate in South Africa. Following crime and safety is consumer information. 12.9% (18) of the respondents need consumer information for everyday life. Consumer information includes information about services available, service price, product information and quality of service etc. Nearly 10% (13) of the respondents need education and school information and another 13% of the respondents need health information.

<b>Response</b>	<b>Percentage</b>
Consumer	12.9
Employment	15.7
Education and schooling	9.3
Child care, family and personal	5.9
Financial matters	2.9

Miscellaneous	5.7
Recreation	5.9
Crime and safety	15.7
Housing	4.9
Health	9.3
Social security	8.6
Internet related concerns	1.4

**Table 1: Everyday Information Needs**

The researchers also investigated the approaches to finding information in the Bayview community. 100% (200) of the respondents use television and radio to find information. Nearly 95% (188) of the respondents use printed materials such as newspapers to find information. Only 10% (20) of the respondents use the Internet to find information. The reason for this could be the lack of access to electronic information.

### ***Knowledge and Access to Electronic Information***

Electronic information is a term that is widely used in this study, and denotes any information which is available via the Internet. This includes information obtained from the Web, e-Mail, discussion lists, Newsgroups, and community networks and Internet Relay Chat (IRC) (Ellen, 2000). The provision of access to electronic information services is currently seen as a key to accelerating development in a community. The increasing use of electronic information has made possible new methods to deliver services and to supplement existing ones (Ellen, 2000). Access to electronic information is essential for describing and understanding the deficiencies of the present, building visions of a better future, developing practical ways to achieve those visions, and educating and inspiring those who must make the

future. The problem with this vision is the lack of access to the electronic information in the developing world (Godlee & Horton, 2000).

Response	Percentage
Home	8
Library	8
School	2
Work	26
University or Colledge	14
Internet café	12

**Table 2: Places where Respondents Access Electronic Information**

Twelve percent (24) of the respondents at the Bayview community did not know what electronic information is. It is mostly elderly members of the Bayview community that lack the knowledge of what electronic information is. The other 86% (172) of the respondents of the Bayview community claimed to know what electronic information.

Thirty percent (60) of respondents don't have access to electronic information while 70% (140) of respondents do have access to electronic information. Nearly 30% (52) of the respondents access electronic information via work while 14% (28) of the respondents access electronic information at university or college and 12% (24) at an Internet café. Only 8% (16) have access to electronic information at home. The remaining 10% (20) of respondents access electronic information at the library and school. Of 70% (140) of respondents that have access to electronic information, 52% (104) of this access is not in the provision of the Bayview community. The solutions listed below cannot be separated out from the overall solutions proposed for achieving Universal Access (Maxwell, 2000).

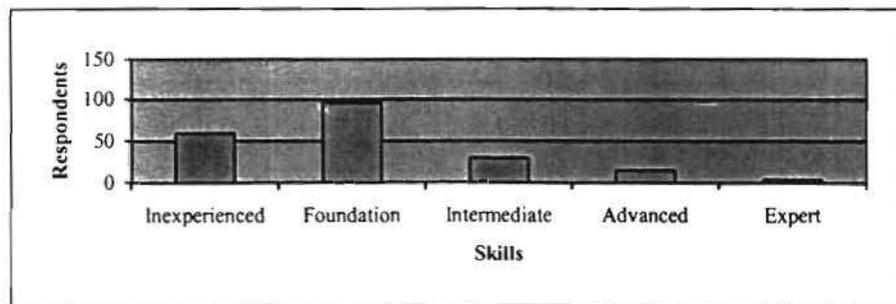
- Improve infrastructure on a global basis using an affordable, maintainable structure

- Explore building accessible electronic and information technology features for services offered by Internet Service Providers
- Recognition of the right to access information regardless of disability, economic situation or geographic location.
- Raise awareness of accessibility issues throughout the world.
- Encourage organizations working for the validation, management and distribution of speech, text, and terminology resources and tools, and to promote their use within the global telematics RTD (research and technological development) community.

Maxwell (2000) argues that to accomplish global access and access to all content, outreach and educational programs should be initiated and sustained to raise the awareness of accessibility issues. The system should be based on the principles of Universal Design since it must as much as possible be usable by everyone not just a privileged few (Maxwell, 2000).

### *IT Skills of Respondents*

Figure 2 shows that only a small percentage of the respondents have a good knowledge and experience on electronic information (8% or 14). These percentages could be due to the lack of access to electronic information or lack of knowledge to utilise the service. The highest percentage accounts for respondents who have foundation skills (48%), 15% (30) of the respondents have intermediate skills.



**Figure 2: IT Skills of Respondents**

Response	Percentage
Trial and error	23
Self taught	18
At Work	8
Advise from friends and family	15
Courses offered at educational institutions	6

**Table 3: How Respondents Learned to Use Electronic Information**

The most popular method of acquiring the necessary skills to use electronic information was via trial and error (23%). The second most popular method for learning to use electronic information was self taught. Nearly 20% (36) of respondents used this method to use the Internet, while 15% of the respondents received advice from friends and family. Eight percent (16) of the respondents acquired their skills to use electronic information at work. According to Ellen (2000), long experience of user education programmes has shown that teaching information retrieval skills to students should be embedded into the curriculum and done at a time when the user can understand its appropriateness. This training should also be adapted to the varying abilities of the users. If students are aware that the skills required for using electronic resources are not insular, and indeed provide them with valuable transferable lifelong skills, skills which employers will be looking for, they may be more likely to learn how to use them. Therefore, if academic staff were to promote electronic resources, with references for students to locate, this may increase the number of students acquiring the necessary information retrieval skills.

### ***Reasons for Using Electronic Information***

Web-based e-Mail proved to be the most popular facility used that does not require specific software and can be directly accessed from anywhere in the world. The next most popular use was searching for information on a

specific subject (18% or 36). The other 3% (6) of the respondents used electronic information for chatting and 4% (8) for downloading software.

Response	Percentage
Chat	3
Download software	4
e-Mail	35
Specific subject search	18
Other	10

**Table 4: Reasons for Using Electronic Information**

Ten percent (20) of the respondents used multiple services, or had several reasons for using electronic information. However, this means that the majority the respondents, 60%, had only used the Internet for one purpose. The reasons for limiting use to one purpose could be time and cost, but it may also indicate a lack of awareness of web sites which could be relevant to them or a lack of skills needed for searching. The use of e-Mail was popular (15% or 30) while keeping in touch with friends and family was also common, but other types of use included job hunting (10%), checking entertainment sites, using chat rooms and booking holidays. According to Ellen (2000), the Internet can provide people with a variety of information about health.

Response	Percentage
e-Mail	15

Keep in touch with friends and family	9
Job hunting	10
Booking holidays	6
Searching for materials related to courses or current projects	11
Checking fan sites	4
National newspapers	2
Music and films	8
Health information	5

Table 5: Types of Electronic Information Use

### *Access to Electronic Information Hindering and Improving Everyday Life*

Limited time and lack of effective information retrieval skills seem to be the main barrier to using electronic information. Day and Ray (1998) argues that with effective information retrieval skills and knowledge of the most useful databases to search for a specific query, a smaller amount of information is often retrieved, and the time spent searching databases reduced. However, with more effective search engines and user-friendly interfaces, in-depth information retrieval skills would not be as essential and therefore the time spent using electronic information would also be reduced.

Response	Percentage
Too much information retrieved	16
Time consuming	18

Limited access to a computer terminal	14
Lack of IT knowledge to effectively utilise the services	14
Using electronic resources often detracts from doing work	8

**Table 6: Access to Electronic Information Hindering Everyday Life**

More than 10% (28) of the respondents stated that limited access to a computer terminal hindered their everyday life. This shows that the members of the Bayview community appear to experience difficulties locating a terminal. A number of comments on the questionnaire distributed to respondents highlighted concern as regards having limited information retrieval skills. This has led to a number of respondents relying upon the printed material they are familiar with, instead of trying to use the new resources.

Response	Percentage
Access to current up-to-date information	9.9
Easier access to information	19.2
Faster access to information	22.1
Access to a wider range of information	25.1

**Table 7: Access to Electronic Information Improving Everyday Life**

Twenty percent (40) of the respondents who answered stated faster access to information as a benefit of using electronic resources, yet 18% stated it was time consuming to use. This suggests respondents are, on the whole, confused about the potential benefits of electronic information. More than 10% (28) of the respondents felt that the main benefit of electronic information was to be able to access current up-to-date information.

### **Factors Affecting Use of Electronic Information**

The most common factor respondents said would prevent them from using electronic information was that they had difficulty accessing electronic information (28%). This contributed to the fact that 52% of the respondents access electronic information outside the Bayview community. Another factor which contributed to the difficulty of accessing electronic information was financial factors. More than 10% (24) of the respondents noted that financial factors prevent them from accessing electronic information. This is supported at the fact that only 8% (16) of the respondents have access to electronic information at home.

<b>Response</b>	<b>Percentage</b>
Need support	19
Lack of experience	17
Perception	7
Interface problems	2
Financial factors	12
Distrust and E-Commerce difficulties	3
Lack of immediacy	28
Problems finding information	6
Lack of time	2
Other	4

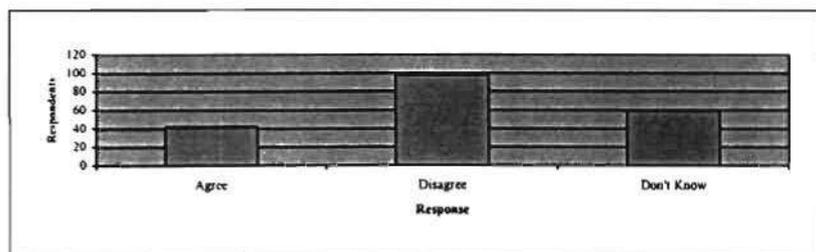
**Table 8: Factors Affecting Use of Electronic Information**

Nearly 20% (38) of the respondents said that they would need support to be able to use electronic information effectively. Closely linked to this was a lack of experience (17% or 35). This highlights the need for the Bayview community to include technologies for disabled people and those with different needs. The remaining respondents said that what prevented them from accessing electronic information were problems finding information, lack of time, distrust and e-commerce difficulties.

### ***Acquiring Significant Information from the Internet***

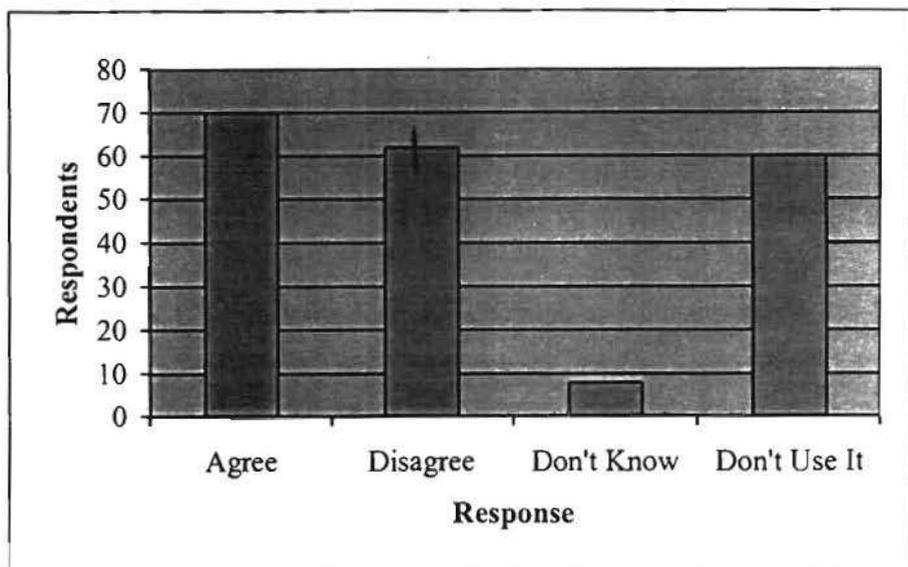
According to Burnett (2000), Internet-based tools of Computer Mediated Communication (CMC) such as e-Mail and other communication applications have become widespread.

Twenty one percent (42) of the respondents agreed with the statement. More research is required to determine whether this is due to a lack of information retrieval skills on the part of the respondent, or the problems associated with the lack of organisation of information on the Internet. Conversely, respondents may indeed lack the relevant information retrieval skills to use the Internet, hence resulting in find nothing of any significance from that source.



**Figure 3: Whether Respondents Acquire Significant Information from the Internet**

More positively, 49% (98) of the respondents felt they had acquired significant information from the Internet but with no indication of the nature of the information retrieved.



**Figure 4:** Whether Respondents feel that their Lifestyle would suffer without Electronic Information

Nearly 40% (70) of respondents declared that their everyday life would suffer without the use of electronic information, although a similar number have yet to be convinced. This shows that respondents, who place greater emphasis upon printed material, also utilise electronic information for everyday life. With the advent of the Internet, nations, regions, cities, villages, and individuals are able to work and to come together within global, networked communities based on shared interests at a speed and inclusiveness never before possible (Maxwell, 2000).

### ***Use of Telecentres to Access Electronic Information***

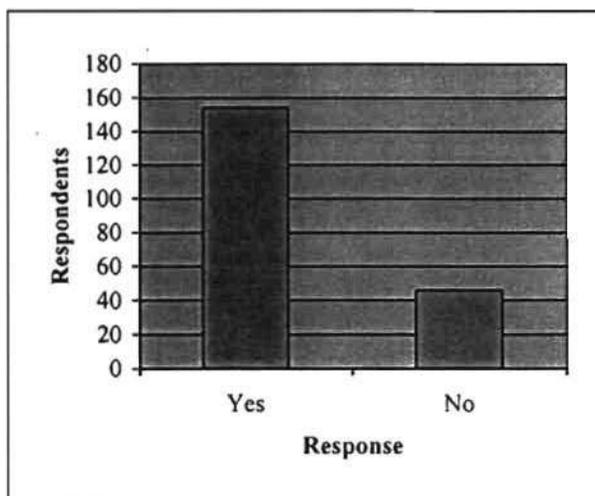
Community Telecentres represent an experiment in using digital technologies as tools for human development within a community. The stress here is on the social use and appropriation of the technological tools and the information that can be accessed through them, as part of a project for social change aimed at improving living conditions (Delgadillo and Gomez, 2002).

Eighty three percent (166) of the respondents have knowledge to what a Telecentre is. The remaining 17% (34) of the respondents have no knowledge to what a Telecentre is. Suzuki & Chamala and Suzuki (1998) argue that recent developments in information and communication technologies are remarkable and bringing about great changes in the quality of life. There is also an expectation that the benefits must reach rural and remote communities by application of these technologies. However, it has been recognised that diffusion of such new technologies is rather slow in rural communities compared with the urban counterparts. One reason for this is that they have disadvantages in terms of opportunities to access to technologies. In this context, the Telecentre concept has been implemented by communities as a new tool to introduce new information technologies to rural areas. According to Crellin (1992), 'Telecentre' is a new concept of rural development which would help rural people gaining access to economic, social, educational and training opportunities through the use of modern information and telecommunications technologies.

### ***Willingness to Use Telecentres to Access Information Electronically***

Eighty one percent (162) of the respondents in the Bayview community think that building a Telecentre in the community will help improve access to electronic information. Only 19% (38) of the respondents think that building a Telecentre will not improve access to electronic information.

According to Ernberg (2005), access to information and communication technology in a Telecentre also enables people to produce their own information resources, (e.g. products and services offered, skill profiles of people wanting a job, social and cultural events, and hotels, transport, tourists' sites, etc). All this contribute to improving living conditions in remote areas and to saving in transport cost and time but access to information and learning resources available through computer networks, such as the Internet, would have a much greater impact on social, economic and cultural development.



**Figure 5:** Use of Telecentre to Access Electronic Information

Figure 5 shows that 77% (154) of the respondents in the Bayview community will use the Telecentre to access electronic information. Only a low 23% (46) of the respondents will not use the Telecentre to access electronic information. The reason for this could be because the respondents lack the knowledge about what a Telecentre can offer. According to Komoski (2001), this describes an urgent nationwide need. It is the need to empower communities, families, and youth with digital tools and skills needed to bridge the learning and earning divides that disenfranchise.

Latchem (2001) argues that it is vital to ensure that learning and information are available to all, regardless of user circumstances, community-based Telecentres can provide people with the information and literacy skills to maximise their learning opportunities. However, Telecentres should not be seen as a quick solution to every social or economic problem. Telecentres must be carefully designed according to established needs, sound business planning and realistic expectations of what can be achieved within a certain timeframe. Telecentres are essentially about linking resources, knowledge and people without physical proximity. Telecentre support for distance learning will be most effective where they

are connected in a unified, coherent and innovative national or regional system for educational and social reform.

## **Summary**

New technologies if used innovatively can help in bridging technological, knowledge and income divides (Mrayati, 2001). An important trend is the emergence of community access to both basic and value-added communications as a key means of achieving universal access. While individuals in many poor locations may not be able to afford the upfront and recurrent costs of owning a telephone line or an Internet-enabled computer, a community as a whole may be able to effectively share such facilities (Whu, 2002).

Access to information has become crucial to a sustainable economic development and poverty reduction. Electronic information can help to reduce poverty and can bring many benefits to communities (Whu, 2002). A factor that affects the use of electronic is a lack of immediacy of electronic information. To some extent, this comes from a lack of familiarity with the Internet, whilst for others there seemed to be a lack of understanding about the range of information available in electronic form and a series of financial factors. This describes a community need. It is the need to empower families and youth with access to electronic information and skills in a community (Ellen, 2000).

Immediately following the conclusion of this chapter the researchers will provide recommendations based on the findings of the data collected. The researchers will thereafter provide recommendations for future study and outline the recommendations for improving access to electronic information.

## **Recommendations and Conclusions**

The preceding chapter analyzed and presented the data that was collected. Access to information has become crucial to a sustainable economic development and poverty reduction. Electronic information can help to reduce poverty and can bring many benefits to communities. This describes a community need. It is the need to empower families and youth with access to

electronic information and skills in a community. Immediately following this brief introduction the limitations of the study will be discussed. Thereafter the researchers will suggest some recommendations followed by future research. Finally the researchers will present concluding remarks based on the findings reported.

### ***Limitations***

The overall goal of the research project was to examine the access and use of electronic information from a community-centred perspective by exploring issues primarily from the viewpoint of users and non-users to identify factors affecting access and use of electronic information. The results should be extrapolated circumspectly from the Bayview community to similar ones in view of the fact that it is not known whether the 200 computer literate respondents constitute a representative sample of all the computer literate members of the community.

It should also be kept in mind that the data analysed here, was initially collected by the first author as part of a research methodology project, in partial fulfilment of an Honours degree in Information Systems and Technology at the University of KwaZulu-Natal, and that after the completion of the qualification it was subsequently analysed by all three authors as part of a mentoring project aimed at teaching students how to use meritorious research results to produce a peer reviewed scholarly article.

### ***Answers to Previously Posed Research Questions***

The following are the questions posed previously. The researchers will answer these questions based on the analysis and findings of chapter four and the reviewed literature from chapter two.

#### ***What Information Do Ordinary People Need in a Community?***

This study demonstrated the wide variety of information needs experienced in everyday life. The most frequently mentioned need was employment. 22% of the respondents needed employment information. This contributes to the

fact that 29% of the respondents of the Bayview community are unemployed and 33% of the respondents work part time. 22% of the respondents also need crime and safety information. This is due to the high crime rate in South Africa. Following crime and safety is consumer information. Consumer information includes information about services available, service price, product information and quality of service etc. About 13% of the respondents need education and school information and another 13% of the respondents need health information. The remaining respondents need information about financial matters, recreation, housing, social security, Internet related concerns, miscellaneous, child care, family and personal.

The study found a wide range of information needs amongst the respondents, which confirmed previous research in this area. Amongst respondents, only a small number involved use of electronic information (10%) which suggested that use of electronic information had not been integrated into everyday information seeking strategies. Nevertheless, the study showed that when electronic information was used it was an important strategy.

### ***How do They Go about Finding it?***

The researchers also investigated the approaches to finding information in the Bayview community. All the respondents use television and radio to find information. 94% of the respondents use printed materials such as newspapers to find information. The reason for the remaining 4% of the respondents not using printed material may be because of the lack of education in which the respondents are not able to read and write. A low 10% of the respondents use the Internet to find information. The reason for this could be the lack of access to the Internet.

### ***What Factors Affect Use of Electronic Information?***

In terms of use of electronic information in the context of everyday life the need for support, a perceived lack of experience in using electronic information, lack of immediacy and a series of financial factors were all factors hindering use of electronic information amongst respondents in the

Bayview community. The cost of using electronic information meant that alternative ways of addressing everyday information needs were sought, either by using more traditional methods or by using electronic information at locations where the cost of access was borne by others (college, friends, etc.). Respondents also mentioned a lack of assistive technologies (such as screen readers) as a factor preventing them accessing electronic information independently, as well as training in their use. Such technology should be available at Telecentres as it can be expensive for individuals to buy, thus creating a barrier to using electronic information in their own homes. These results are important for future Telecentres, because they clearly point to the need for staff resources to support people in using electronic information. They also suggest that unless access to electronic information is free people will continue to find other ways of addressing their everyday information needs. Consequently for Telecentres to be meeting the needs of communities and to be sustainable secure revenue funding will be essential.

## **Recommendations**

The main goal of the research project was to ensure that everyone has ready access to electronic information. In order to reach this goal, the researchers make the following recommendations. They suggest the launching of a special initiative to improve access to electronic information in the Bayview community. As first steps towards achieving universal access, the researchers recommend that some key areas need to be considered:

- Determining the everyday information needs of community members
- Researching barriers to using electronic information
- Providing speedy access to electronic information
- Providing affordable means to access electronic information
- Improving Internet connectivity
- Launching skills development training

## ***The Provision of Information***

It is important to note from this research that the key is information provision, in a form that may or may not involve the use of computer applications, Internet or email. Access to produce prices may be a matter of having access to a regular newspaper or a telephone, something that some of the worlds population takes entirely for granted. Many forms of information provision require improvement to facilitate the process of development to alleviate poverty, improve health and education and empower people. Nonetheless, public access to electronic information can play a role in this, and in lessening the digital divide.

The Bayview community face the dilemma of information and communications technologies further deepening the divisions between themselves and the developed communities whilst simultaneously recognizing that information and communication technologies provide the means for reducing that divide. Other than the simple acquisition of technology, specific mechanisms will be required to overcome the disadvantages suffered by the vast numbers of people who are unlikely ever to own their computer.

## ***People Affected by Issues to Access Information and Communication Technology***

People experience disability problems in many populations. Not all disabilities affect access to information technologies. As we age, the probability of developing a disability increases.

- Eye-sight may diminish
- Hearing may diminish
- Arthritis, injury or other causes may limit mobility

The number of people using the Web and other information technologies is steadily increasing. Access to these types of information mediums may be more critical for people with disabilities, who cannot easily access traditional information sources (e.g., print media by the visually

impaired; auditory media by the hearing impaired; the mobility impaired who cannot hold print materials, pens/pencils or interact with other communications media).

### ***Information Systems to Support Permanent Public Access***

The information systems to support permanent public accessibility need to be designed with a careful technological balance. On one hand, systems should incorporate technologies and features to best serve the users of electronic information. On the other hand, systems must be easily useable for the large majority of the population. This goal affects assumptions regarding typical hardware and software configurations that citizens will have available and suggests that electronic information needs to be made available in popular, easy-to-use formats. User interfaces to electronic information need to be designed to enable the large majority of citizens to use them in a straightforward way. A possible conflicting force may exist the use of formats that will make future maintenance simplest is also desirable, and these formats may conflict with the optimal formats that should be used to serve citizens today.

### **Conclusions**

The results of this study have indicated that there are inequalities to the access of electronic information. The results indicate that 30% of respondents have no access to electronic information and 52% of the respondents' access electronic information outside the Bayview community. However if given the opportunity to access electronic information at a Telecentre in the community 77% of the respondents agreed that they would take up this opportunity. The results have indicated that by building a Telecentre in the Bayview community, it will improve access to electronic information.

Telecentres provide local centres where individuals can utilise information and communication technologies for personal or business use in order to gain access to electronic information. These developments are aimed at providing access to information and communication technology to

those who do not have such facilities in their own home or workplace, to ensure that they are not excluded from accessing increasing amounts of electronic information. Telecentres can contribute to narrowing of the digital divide by offering a wide range of information and knowledge services for social and economic development for the Bayview community. Community Telecentres are also places for social encounter and interaction, for learning, for personal growth, and for mobilizing efforts to address community problems and needs. If Telecentres are implemented in this manner then the members of the Bayview community will be able to access and use electronic information.

Access to electronic information is essential for describing and understanding the deficiencies of the present, building visions of a better future, developing practical ways to achieve those visions, and educating and inspiring those who must make the future (Godlee & Horton, 2000). The problem with this vision is the lack of access to the electronic information to the Bayview community.

## **References**

- Burgstahler, S 1998. Disabilities, Opportunities, Internetworking and Technology (DO-IT) on the Electronic Highway. Available online at <http://staff.washington.edu/sherylb/CSUN94.html>. Accessed on 09 August, 2005.
- Burnett, G 2000. Information Exchange in Virtual Communities: A Typology. Available online at <http://informationr.net/ir/5-4/paper82.html>. Accessed 20 August, 2005.
- Butzen, S & CD Liston 2005. Rural Community Colleges and the Digital Divide." Available online at: <http://www.league.org/publication/abstracts/learning/llabs0305.htm>. Accessed on 09 August, 2005.
- Chamala, S & A Suzuki 1998. Role of Telecentres in Rural Development in Australia. Available online at <http://www.jsai.or.jp/afita/afitaconf/1998/P08.pdf>. Accessed on 20 August, 2005.
- Cornu, JM 1997. Guidelines on Best Practices for Using Electronic Information: How to Deal with Machine-readable Data and Electronic documents. Available online at <http://europa.eu.int/ISPO/dlm/documents/gdlines.pdf>. Accessed on 09 August, 2005.

- Day, J & K Ray 1998. Student Attitudes towards Electronic Information Resources. Available online at <http://informationr.net/ir/4-2/paper54.html>. Accessed on 09 August, 2005.
- Delgadoillo, K & R Gomez 2002. Community Telecentres for Development: Lessons from Community Telecentres in Latin America and the Caribbean. First edition. Available online at [http://www.web.idrc.ca/uploads/user.S/10400104800Community\\_Telecentres\\_for\\_Development.pdf](http://www.web.idrc.ca/uploads/user.S/10400104800Community_Telecentres_for_Development.pdf). Accessed on 19 April, 2005.
- Ellen, D 2000. Telecentres and the Provision of Community Based Access to Electronic Information in Everyday Life. Available online at <http://www.hlss.mmu.ac.uk/infocomms/research/ellen/dellenphdthesis2000.pdf>. Accessed 10 March, 2005.
- Emberg, J 2005. Universal Access by means of Multipurpose Community Multipurpose Community Telecentres. Available online at [http://www.find-articles.com/p/articles/mi\\_qa3991/is200404/ain9397110](http://www.find-articles.com/p/articles/mi_qa3991/is200404/ain9397110). Accessed on 22 March, 2005.
- Godlee, F & R Horton 2000. Global Information Flow. Available online at <http://bmj.bmjournals.com/cgi/content/full/321/7264/776/>. Accessed on 20 August, 2005.
- John, R 1996. Putting Content onto the Internet. Available online at <http://www.firstmonday.org/issues/issue2/content/>. Accessed on 9 August, 2005.
- Kagan, A 1998. Social Responsibilities Discussion Group Paper: The Electronic Information Gap. Available online at <http://www.ifla.org/VII/dg/srdg/srdg5.htm>. Accessed 09 August, 2005.
- Keery, N 1997. The Challenge of Openness as European Union Information goes Electronic. Available online at [http://www.firstmonday.org/issues/issue2\\_12/keery/](http://www.firstmonday.org/issues/issue2_12/keery/). Accessed on 09 August, 2005.
- Komoski, K 2001. The Digital Stepping Stones Conference. Available online at <http://www.linct.org/>. Accessed on 9 August, 2005.
- Maxwell, C 2000. Global Trends that will Impact Universal Access to Information Resources. Available Online at on <http://www.isoc.org/isoc/unesco-paper.shtml>. Accessed 09 August, 2005.
- Mrayati, M 2005. Possible models of initiatives to promote ICT for

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- Employment and Poverty Alleviation 1. Available online at <http://www.escwa.org.lb/mtecpr/docs/eradication.pdf>. Accessed on 20 August, 2005.
- Short, G 1998. The Socio-economic Impact of Telecentres in Rural and Remote Western Australia. Available online at [http://www.itu.int/ITUUD/univ\\_access/seminar/buda/papers/final/f\\_short.pdf](http://www.itu.int/ITUUD/univ_access/seminar/buda/papers/final/f_short.pdf). Accessed on 20 August, 2005.
- Singh, AM 2004. Bridging the Digital Divide: The Role of Universities in Getting South Africa Closer to the Global Information Society. Available online at <http://www.sajim.co.za/default.asp?to=peer4vol6nr2>. Accessed on 22 October, 2005.
- Whu, EU 2002. Rural Telecommunications and Stanford Initiative on Community Corporations: A New Approach to Universal Access. Available online at <http://www.stanford.edu/~eulffe/ec391/Paper.pdf>. Accessed on 22 March, 2005.
- Wilson, TD 1995. Education for Information and the Internet. Available online at <http://informationr.net/tdw/publ/papers/efori.html>. Accessed on 9 August, 2005.

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# Using Health Information Systems to Solve the Shortage of Medical Experts in Rural Communities

**Vikash Ramharuk**

## **Abstract**

Technology has advanced beyond expectations. For instance, people use unlimited computing power at unlimited speeds with unlimited storage. The Internet also provides universal connectivity. Information technology (IT) is increasingly applied in the health sector. Applications of information and communication technologies (ICT) to the health sector include Electronic Patient Records, Health Information Systems (HIS), the setup of Intranets and secure Extranets via the Internet, and for sharing information among institution and individual participants in the health sector, the use of public networks such as the Internet to distribute information, Health Decision Support Systems, the provision of remote diagnostics via Telemedicine, and Community Health Information System for local, regional and national health planning. The overall goal of the research was to investigate alternative applications of Telecentres and HIS to help assess healthcare information. In doing so, it enhances the knowledge of the development of healthcare information resources. It identified some key areas that planners of HIS should include in their strategic planning.

## **Keywords**

Healthcare, Health Informatics, Internet, Telecentres.

## **1. Introduction**

The rapid growth and the increasing scope of services and widening of network connections are making the application of technology such as the use of Palm Digital Assistants (PDAs), Electronic Patient Records (EPR) and Decision Support Systems (DSS) in the healthcare sector inevitable. One of the many applications that were inevitable was universal access to healthcare information and services made possible by the growth of the Internet (Godlee, 2004). However, what is not taken into consideration is access to primary health care, especially for those in rural communities (The African Development Forum, 2000). People from disadvantaged communities have no access to the Internet let alone own a telephone or a personal computer in his or her house (Godlee, 2004). The next section will review relevant literature to ensure a proper prior knowledge base.

## **2. Literature Review**

### ***2.1 Information and Communication Technologies for the Health Sector in Africa***

The gap between the developed and the developing world that exists in information and communication services is also present in the health sector (The African Development Forum, 1999). Researchers such as Haux (2002), Hammond (2003) and Kusakabe (2005) are under the impression that the health sector is fifteen years behind other sectors in application of ICT. At the same time, it appears as though the gap between Africa and the developed world in the health sector is widening. Investment in ICT in the health sector in Africa could complement health services provision. By replacing traditional paper-based operations with flexible electronic means, new technologies could bring cost reduction and effectiveness in terms of timely delivery of services in Africa.

### ***2.2 Improving Information Access for Healthcare Providers***

Most healthcare providers in developing countries continue to lack access to the information they need to deliver the best possible healthcare with

available resources (The African Development Forum, 2000). However, progress has been made in many areas: increasing availability of ICT; increasing number and range of health information support programmes; increased availability of free resources on the Internet; evolution of an international community committed to improving health information access; and increasing political interest in access to healthcare information as a key development issue (Lallement *et al.*, 2004). Healthcare providers are a diverse group with widely varying social, educational, cultural, economic, and behavioural attributes. They have a variety of information needs: the needs of a community health worker in rural Kenya are different from those for instance in Kathmandu (Godlee, 2004).

### **2.3 Medical Informatics**

Medical informatics helps gather and record facts, and to interpret them in order to participate to the process of care or to build new medical knowledge. But at the same time they are conceived and built, computerized medical applications that change the health-care system itself and its efficiency by modifying the relationships between the actors of the system and by creating new opportunities or problems (Degoulet & Fieschi, 1997).

According to Rothschild *et al.* (2004) a system is a set of interrelated elements, with each element connected to every other element directly or indirectly. A hospital is a type of system, yet healthcare IT has largely failed to view it as such (Rothschild *et al.*, 2004). HIS are primarily there to support hospital activities on operational, tactical and strategic levels. However, they form another level of important building blocks in the national health system to allow appropriate management information allowing appropriate levels of control (Economic Commission for Africa, 1999). In South Africa, for example, there is a system in place to request a standard monthly hospital report form from public and private sector hospitals, which is complementary to the information systems at individual hospitals (The African Development Forum, 1999). It appears as though computerized HIS are being implemented in an increasing number of hospitals in Africa.

## **2.4 Research Questions**

Much of the literature addressed the problems faced in the health sector, especially in Africa but the following still remains a problem:

- What measures should be undertaken to ensure an efficient, advanced, and yet affordable future Health Information System?
- What purpose should Electronic Patient Records serve?
- Define the issues involved in improving access to healthcare information?

## **2.5 Conclusion**

Technology has advanced far beyond expectations. IT can help improve the medical care in Africa. It is increasingly used to improve HIS. The problem is, however, that many communities cannot use this because there is no facility around to do it.

## **3. Research Methodology**

The participants of the study were patients from the local community clinic and learners from the Tongaat Secondary School. The sample size was 118, which constitutes a census of all the grade 11 and grade 12 learners at the school, together with patients from the local community clinic. The sample is representative of the number of patients a doctor at the local community clinical attends to on a daily basis. The questionnaire consisted of 28 questions of which 7 were open ended questions. A total of 118 questionnaires were collected from respondents from both rural and urban areas.

## **4. Presentation of Results**

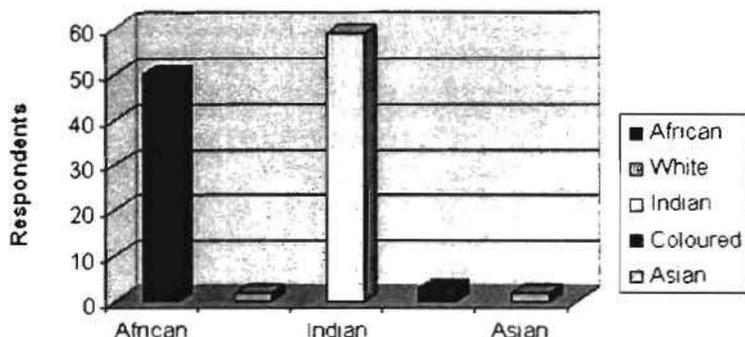
In this section the results of the survey are presented and interpreted.

### **4.1 Ethnic Composition of the Sample**

As compared to the samples taken by the Economic Commission of Africa (2000) and the African Development Forum (2000), which specifically targeted rural areas in Africa where clean water and electricity appears to be

a luxury, this sample is a combination of both respondents. In addition this sample highlights the inequalities all exist in access to healthcare information within a community as small as Tongaat.

Figure 1: Respondents by Race



#### 4.2 Level of Computer Literacy of the Sample

The computer literacy amongst rate the respondents show that not only is there a digital divide in Africa but it is also present in a small community such as Tongaat. The majority of the African respondents do not own a computer or have an alternate place to access computers. One of the factors that contribute to the level of computer illiteracy among the African race is that many of the respondents were at a school where they were exposed to computers. Had it not been for this, then of the African respondents above the ages of 20 only 10% (5) are computer literate.

The count implies that four different races were used. The ANOVA shows the results of the completely randomized analysis of variance. In this set of data, since the calculated  $F=0.85$  is less than the tabled  $F$ ,  $F_{crit}=4.26$ , the null hypothesis is accepted that the level of computer literacy, alternative access to computers and possession of a computer at one's home is all dependent on the race of the individual.

### 4.3 Willingness to Pay for Healthcare

Although great strides have been made over the last century in preventing diseases and extending life in the developed world, the situation in the African region remains bleak (Kusakabe, 2005). The reason for this is most likely due to insufficient funds. Many of the respondents are unable to pay for healthcare and visit the local community clinic as treatment is free. The researcher *cites* one of the respondents: "I will never be got dead at the local community clinic". When asked the reason for not wanting to visit the local community clinic, one of the respondents answered: "I just don't trust the treatment and service available even though it's free".

The majority of the respondents feel that they should be paying for primary healthcare. However, 29% (34) of the respondents feel that they should not be paying for healthcare. Among the respondents that feel that they should not be paying for healthcare, a majority of them argue that they were promised free healthcare by the government.

**Table 1: Willingness of Respondents to pay for Healthcare**

Age Group	Employed	Willing to Pay for Healthcare
0 – 19	0.075% (1)	80% (54)
20 – 29	62% (13)	77% (16)
30 – 39	100% (12)	58% (7)
40 – 49	88% (7)	43% (3)
50 and over	25% (2)	0% (0)

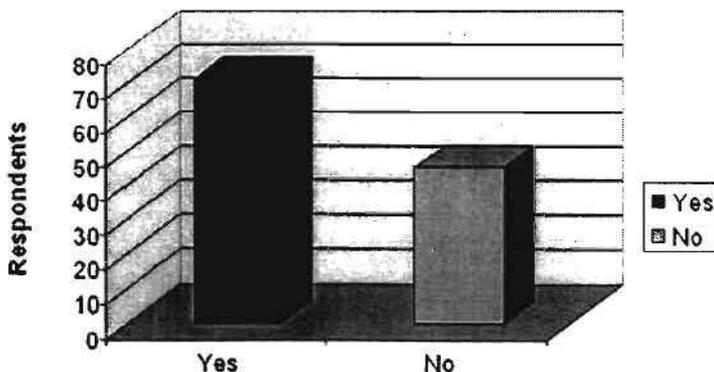
Table 1 illustrates that as the percentage of employed respondents increases so does the percentage of the respondents willing to pay for healthcare. However, as the percentage of unemployed respondents increases, the percentage of respondents willing to pay for healthcare decreases. Therefore, by developing Telecentres and improving HIS in these rural areas will not only improve access to proper healthcare but also create job opportunities for many of these community members. This will in turn put many of the community members in a better position to be willing to pay for healthcare.

The ANOVA shows that the total sum of squares within groups is 2.26, while the total sum of squares about the mean ignoring the groups is 2.29. The grouping accounts for a sum of squares of 0.02. The F statistic is 0.06 and this has a p-value of 0.98. In this set of data, since the calculated  $F=0.07$  is less than the tabled  $F$ ,  $F_{crit}=3.24$ , the hypothesis is accepted that the respondents that are employed are more willing to pay for healthcare as compared to those respondents that are unemployed.

#### 4.4 Using HIS for Medical Diagnosis

It's a fact that there is a shortage of medical professionals in Africa (The African Development Forum, 2000). People staying in rural areas have to travel several kilometres in order to receive medical treatment and in most cases wait on average between one to two hours in doing so. Figure 2 illustrates the number of respondents that are willing to undergo treatment using HIS.

Figure 2: Willingness to undergo treatment using Health Information Systems



The development, strived by many individuals, to replace the patient record by a life long health record has not yet been established (Haux, 1997). Data relevant to patient care are still primarily held separately by the various institutions involved in the care process. However, the importance of

internationally available data that is accessible via the Internet and chip cards will increase (Haux, 1998). The researcher share the view of Haux that exchange of patient data should to a large degree done electronically.

#### ***4.5 Knowledge of Health Information Systems***

Many of the respondents coming from rural areas and impoverished backgrounds had no idea what so ever what a Health Information System is or what is its function. As compared to the respondents from urban areas only a few did not know what a Health Information System is and what is its function. This could be attributed to the digital divide between the rich and poor not only between the small community of Tongaat but also throughout the world. According to the Economic Commission of Africa (2000) the health sector is about 15 years behind other sectors in application of information and communication technologies and at the same time the gap between Africa and the developed world in the health sector is widening.

**Table 2: Knowledge of Health Information Systems**

<b>Background</b>	<b>Know what Health Information Systems are</b>	<b>Do Not Know what Health Information Systems are</b>
Rural Area	28% (14)	72% (36)
Urban Area	57% (39)	43% (29)
Total	42.5% (53)	47.5.% (65)

Table 2 indicates that the majority of respondents coming from rural areas have no idea what a HIS is nor do they know what the function of HIS is. This is probably due to the fact that many of the respondents from the rural areas have not been to school and only 10% (5) of African respondents above the age of 20 are computer literate. The researcher is of the opinion that even though many of the respondents from the rural areas have no idea

what the function of a HIS is they should at least have an alternate place to access computers.

**Table 3: Using Health Information Systems for Medical diagnosis and Treatment**

	Will use Health Information Systems for medical diagnosis	Will not use Health Information Systems for medical diagnosis	Will undergo treatment using Health Information Systems	Will not undergo treatment using Health Information Systems
Knowledge of Health Information Systems	86% (46)	14% (7)	78% (41)	22% (12)
No Knowledge of Health Information Systems	52% (34)	48% (32)	48% (32)	52% (34)

In Table 3 it can be concluded that as the percentage of respondents having some knowledge of HIS increases, so too does the percentage of respondents willing to use HIS for medical diagnosis and undergo treatment using HIS. This could be attributed to the fact that of the respondents that are not willing to use HIS for medical diagnosis many of them are not exposed to the latest technology available and therefore are unaware of the potential benefits that lie with these technologies.

**Table 4: Covariance – Knowledge of Health Information Systems**

Covariance		
	Rural Area	Urban Area
Rural Area	0.0484	
Urban Area	-0.0154	0.0049

Both the entries of the covariance output table are less than 0.05 (Alpha) which means that the hypothesis is accepted that respondents living in urban areas have a greater knowledge of HIS as compared to respondents living in rural areas. This could be attributed to the fact that respondents living in urban areas are more exposed to technology as compared to respondents living in rural areas who have little or no exposure to technology.

#### 4.6 Internet Usage for Healthcare

It appears as though important progress has been made in many areas of the health sector. The growth in access to the Internet and e-Mail have increased the possibility for interaction at local, regional, and international level, in addition more content is available to a growing number of people, especially those in tertiary institutions, hospitals, research institutions and urban settings (Godlee, 2004).

Figure 3: Respondents that have phoned or used the Internet for medical advice

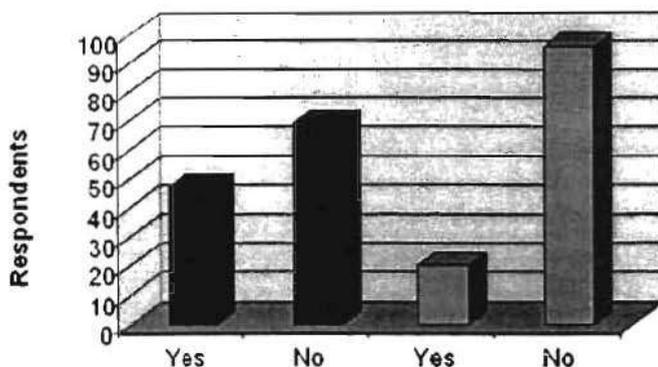


Figure 3 shows that 40% (47) of the respondents have previously phoned for medical advice, However, only 17% (20) of the respondents have ever used the Internet for medical advice.

**Table 5: Internet usage for medical advice**

	Will use the Internet for medical advice	Will use the Telephone for medical advice
Male	48% (30)	42% (26)
Female	76% (42)	41% (23)
Total	62% (72)	41,5% (49)

As mentioned previously only 17% (20) of the respondents reported having used the Internet for medical advice before. Of the present sample, , 62% (72) of the respondents agreed that they would use the Internet for medical advice if given the opportunity. Table 5 also reveals a greater willingness among females to use the Internet for medical advice than among males. Just over 75% (42) of the female respondents agreed that if given the opportunity, they will use the Internet for medical advice, while only 48% (32) of the male respondents agreed that if given the opportunity, they will use the Internet for medical advice.

**Table 6: t-Test - Internet Usage for Healthcare**

t-Test: Paired Two Sample for Means

	Will use the Internet for medical advice	Will use the Telephone for medical advice
Mean	0.62	0.415
Variance	0.0392	5E-05
Observations	2	2
Pearson Correlation	-1	
Hypothesized Mean Difference	0	
df	1	
t Stat	1.413793103	
P(T<=t) one-tail	0.196957897	
t Critical one-tail	6.313751514	
P(T<=t) two-tail	0.391915794	
t Critical two-tail	12.70620473	

The p-value of the observed statistic is 0.40. Since this value is greater than 0.05 it can be concluded that both the Internet and Telephone could be used extensively for medical advice.

## 4.7 Telecentres

It appears as though many of the rural communities suffer from lack of primary care physicians or specialized healthcare professionals. This inadvertently leads to rural community members travelling a great distance in order to receive proper healthcare services which in turn lead to over population of patients and local clinics, to such an extent that the ratio of patients to a single doctor exceeds three hundred to one. The respondents were asked to indicate the number of hours the wait in order to receive healthcare and the distance they travel in doing so.

**Table 7: Time spent and distance travelled to receive healthcare**

Background	Time spent waiting in order to receive healthcare	Distance travelled in order receive healthcare
Rural Area	48.88 minutes	10 kilometres
Urban Area	27.24 minutes	6 kilometres
Total	38.06 minutes	8 kilometres

## 4.8 t-Test to Analyze Distance Travelled and Time Spent to Receive Healthcare

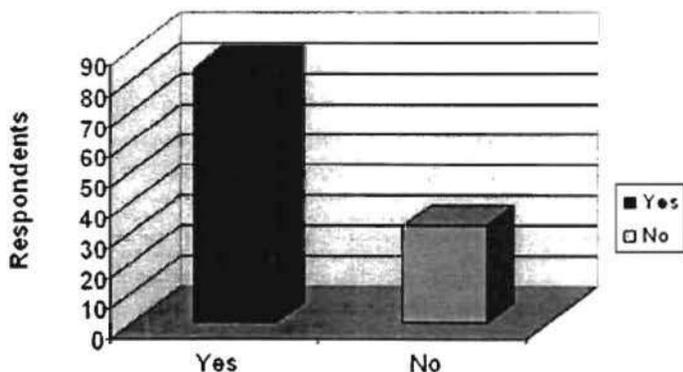
**Table 8: t-Test - distance travelled and time spent to receive healthcare**

t-Test: Paired Two Sample for Means

	Time spent waiting in order to receive healthcare	Distance travelled in order receive healthcare
Mean	38.06	8
Variance	234.1448	8
Observations	2	2
Pearson Correlation	1	
Hypothesized Mean	0	
df	1	
t Stat	3.408163265	
P(T<=t) one-tail	0.090846575	
t Critical one-tail	6.313751514	
P(T<=t) two-tail	0.18169315	
t Critical two-tail	12.70620473	

The t-statistic is 3.41. A two tailed test was used since the researcher is comparing both the distance travelled and time spent in order to receive healthcare from respondents living in both rural and urban areas for negative as well as positive skewing, where negative skewing relates to occurrences lower than the predicted average and positive skewing to occurrences higher than the predicted average. The p-value of the observed statistic is 0.18. Since this value is greater than 0.05, it indicates that on average, respondents from rural areas travel a greater distance and spend more time waiting for healthcare as compared to respondents living in urban areas. The t Critical value indicates how big the t-statistic would have to be in order to be significant. To be significant at the 5% level, the t statistics has to be 1.75 for a one-sided test and 2.13 for a two-sided test. If the sample sizes are larger then these values will be slightly smaller.

**Figure 4:** Respondents that intend using the Telecentre for Health Informatics



More than 60% (69) of all respondents do not know what a Telecentre is and more importantly 76% (38) of the respondents living in rural areas have no idea what the purpose or the function of a Telecentre is. This shows that Telecentres are required. However, on a more positive note 77% (92) of the respondents agreed that building a Telecentre will help improve the standard of medical information access.

#### 4.9 Using Correlation to Analyze whether Telecentres could Improve Access to Medical Information

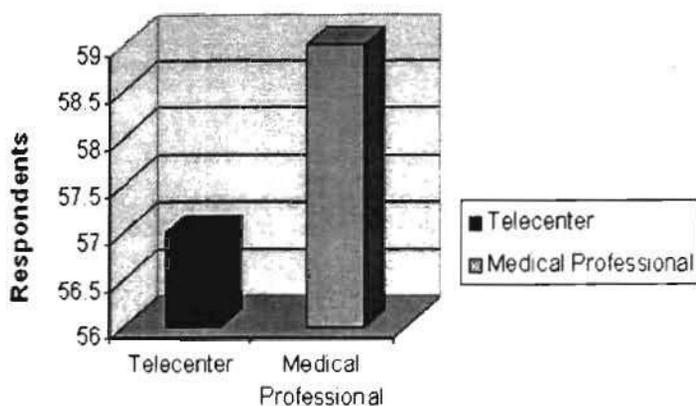
**Table 9: Correlation - Telecentres will improve access to medical information**

	Correlation			
	Knowledge of Telecenters	No Knowledge of Telecenters	Telecenters will improve medical information access	Telecenters will not improve medical information access
Knowledge of Telecenters	1			
No Knowledge of Telecenters	-1	1		
Telecenters will improve medical information access	1	-1	1	
Telecenters will not improve medical information access	-1	1	-1	1

The entries on the diagonal of the correlation output table are all greater than 0.05 (Alpha). The hypothesis is therefore rejected indicating that the respondents who have some knowledge of Telecentres agree that a Telecentre will improve medical information access. On the other hand many of the respondents from rural areas have no idea what a Telecentre is and are unaware of the potential benefits that lie in developing Telecentres in rural areas.

#### 4.10 Telecentre Access Versus Consulting a Medical Professional

Figure 5 indicates that 48% (57) of the respondents agreed that they will use the Telecentre for minor illnesses and 52% (61) of the respondents preferred visiting a medical professional then using a Telecentre for minor illnesses.

**Figure 5: Telecentre versus consulting a Medical Professional**

The researcher is of the opinion that the reason stated by many of the respondents not to use the Telecentre for minor illnesses is due to the fact that 76% (38) of the respondents from the rural communities have no idea what a Telecentre is or its function and this is depicted by Table 10.

**Table 10: Telecentre versus Medical Professional**

Age Group	Telecentre	Medical Professional
0-19	85% (57)	15% (10)
20-29	76% (16)	24% (5)
30-39	46% (6)	54% (6)
40-49	40% (3)	60% (5)
50 and over	12% (1)	88% (9)
Total	52 % (83)	48% (35)

The table illustrates that if it is faster and cheaper to receive healthcare using Telecentres 52% (83) of the respondents agreed on using the Telecentre while 48% (35) of the respondents would rather visit a medical professional. This is an increase of 4% as compared to Figure 2 (Section 4.3.). In a recent survey carried out by the researcher, after visiting

five of the local general practitioners in Tongaat it was calculated that a visit to the local general practitioner will set a patient back in the range of one hundred and twenty to one hundred and fifty Rand.

#### ***4.11 Using ANOVA to Analyze Medical Professionals Versus Telecentres***

The F ratio of 0.04 is much less than the  $F_{crit}$  ratio of 5.32. This indicates that if given the opportunity, respondents are more than willing to use a Telecentre for minor illnesses than compared to a medical professional. This could be attributed to the fact that the Telecentre will be considerably cheaper as compared to visiting a medical professional for minor illnesses and also the respondents will not have to travel many a mile in order to receive healthcare as the Telecentre should be developed in these rural areas and made easily accessible to the community members.

#### ***4.12 Conclusion***

The gap between the developed and developing countries continues to widen, and this is most evident in the African countries especially within the health sector (The African development Forum, 2000). However, they state that ICT applications present a considerable opportunity to narrow the expertise gap especially in rural areas. The benefits of offering rural and impoverished communities reliable and accurate access to the Internet and communication services are endless. The statistics calculated and given above all demonstrate this.

Lallement *et al.* (2004) note that there are inherent conflicts between the sustainability objective and the desire to assist those most in need - the poor, disadvantaged and un-electrified rural communities. In other words he states that the establishment and operation of Telecentres, Internet connectivity and communication services in marginal areas have to be treated as social investment projects with subsidies justified on equity grounds.

## **5 Answers to Posed Research Questions**

The following are the questions posed. The researcher will answer these questions based on the analysis and findings and the reviewed literature.

### ***5.1 What measures should be undertaken to ensure an efficient, advanced and yet affordable future Health Information System?***

On the brink of the 21<sup>st</sup> century, numerous institutions and people have concerned themselves with the future development of ICT and healthcare provision (Haux *et al.*, 2002). The three decisive factors to ensuring an efficient advanced and yet affordable Health Information System are the development of the population, advances in medicine and advances in health informatics.

### ***5.2 What purpose should Electronic Patient Records serve?***

The use of medical data such as the Electronic Patient Record is empirical in order to achieve patient-centred recordings for cooperative care. Haux *et al.*, (2002) state that patient-centred refers to healthcare across healthcare institutions and to the fact that information processing are not concentrated around just one hospital. It also means that all healthcare professionals, especially physicians and nurses, have access to relevant patients' data, according to their respective authorizations.

### ***5.3 What are some of the issues involved in improving access to healthcare information?***

Although only aggregated data may be made available via HIS the quality of input data should not be compromised. The training of Health Information System staff should be considered very important in terms of sustainability. Establishing HIS should be logically linked with the concepts of Telecentres in areas under serviced in terms of ICT infrastructure.

## **6 Recommendations**

The main goal of the research project was to ensure that everyone has access to relevant, reliable, and up to date healthcare information that they can understand and act upon. In order to reach this goal, the researcher makes the following recommendations for action on the part of the Government of South Africa and its partners.

The researcher suggests the launching of a special initiative to improve access to healthcare information in the developing world. As first steps towards achieving universal access, the researcher shares the view of Godlee (2004), in recommending that, establishing working groups to draft strategy, objectives, and programmes of work in seven key areas:

- Researching information needs and barriers to use of healthcare information.
- Providing access to existing materials for healthcare providers in developing countries
- Providing access to the results of research
- Improving relevance and usability of materials for healthcare providers in developing countries
- Improving reliability and currency of materials for healthcare providers in developing countries
- Improving Internet and e-Mail connectivity.
- Skills development and Training

## **7 Conclusion**

The results of this study have indicated that there are inequalities to the access of healthcare information. The results indicate that 10% of African respondents over the age of 19 are computer illiterate and have no alternate access to healthcare information. However, if given the opportunity to use the Internet or a Telecentre for medical information, 62% of the respondents agreed that they would take up this opportunity. The results have indicated

that by improving HIS and building Telecentres in these rural and impoverished areas, access to medical information will certainly also increase.

The development towards a more information and information technology-intensive, but also information technology-dependent, healthcare community is definitely a challenge with respect to security and privacy (Smith & Eloff, 1999). They also note that HIS are having a positive beneficial effect on healthcare organizations and delivery of healthcare. The development of the qualification for end-users of HIS should provide both a safety reassurance for patients whose medical records are involved and a confidence amongst healthcare professionals. This will promote the use of HIS by reducing two sources of opposition: anxious patients and reluctant medical professionals.

The real work of filling the Health Information System with medical knowledge has to be done by medical experts, who normally have other priorities. The challenge is convincing the experts that building such a system is their professional responsibility. Gell (1997) further states that constructing such systems which is of enormous help to the poor and less privileged is itself a scientific and professional achievement comparable or superior to writing a textbook and should carry the same recognition. Much appears to have been done in the development of technical standards, integration, and communication of HIS (Haux *et al.*, 2002). However, much more remains to be done.

## References

- Degoulet, P & M Fieschi 1997. Critical Dimensions in Medical Informatics. [online]. Accessed on 03/05/05 at: [www.bioinformed.isciii.es/BioinforSalud2002/Draft\\_WP.pdf](http://www.bioinformed.isciii.es/BioinforSalud2002/Draft_WP.pdf).
- Economic Commission for Africa 2000. ICT for Health Sector. [online]. Accessed on 12/05/05 at: <http://www.un.org/dept>.
- Godlee, F 2004. Improving Access to Health Information in the Developing World. [online]. Accessed on 15/05/05 at: <http://www.unitedations.org>.

- Hammond, W 2003. Making the Boundaries Clearer: Revisiting Information Systems with Fading Boundaries. [online]. Accessed on 22/04/05 at: [www.snre.umich.edu/ecomgt/collaboration/Sustaining\\_Success.pdf](http://www.snre.umich.edu/ecomgt/collaboration/Sustaining_Success.pdf).
- Haux, R 1997. Aims and Tasks of Medical Informatics. [online]. Accessed on 02/05/05 at: [www.dwarf.umi.cs.tu-bs.de/cms/staff/haux/Publications.pdf](http://www.dwarf.umi.cs.tu-bs.de/cms/staff/haux/Publications.pdf).
- Kusakabe, M 2005. How to Scale Up Sustainable Telecentres? [online]. Accessed on 17/05/05 at: [www.Telecentre.rdec./27\\_R\\_7\\_Telecentre\\_Training\\_Camps\\_Kusakabe.pdf](http://www.Telecentre.rdec./27_R_7_Telecentre_Training_Camps_Kusakabe.pdf).
- Lallement, D, E Terrado & Y Zhang 2004. Empowering Information and Communication Technologies in Isolated Areas: Learning from the Solar-net Villages Program in Honduras. [online]. Accessed on 25/04/05 at: [www.esmap.org/.../30e871526524f10e85256fc3001149a3/\\$FILE/Renewable%20Energy\\_Article.pdf](http://www.esmap.org/.../30e871526524f10e85256fc3001149a3/$FILE/Renewable%20Energy_Article.pdf).
- Rothschild, A, L Dietrich, M Ball, H Wurtz, H Farish-Hunt & N Comerer 2005. Leveraging Systems Thinking to Design Patient-centered Clinical Documentation Systems. [online]. Accessed on 26/04/05 at: [www.bmjpp.com/Wed13/M1.pdf](http://www.bmjpp.com/Wed13/M1.pdf).
- Smith, E & J Eloff 1999. Security in Health-care Information Systems—Current Trends.” [online]. Accessed on 29/04/05 at: [www.show.scot.nhs.uk/elearning/availabletopublic/module1.pdf](http://www.show.scot.nhs.uk/elearning/availabletopublic/module1.pdf).
- The African Development Forum 2000. Improved Information and Communication Technologies for the Health Sector in Africa - Implications and Challenges. [online]. Accessed on 14/05/05 at: <http://www.uneca.org>.

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# **Finding Research Questions Using a Socratic Dialogue**

**Dan Remenyi and  
David Price**

## **Abstract**

It is not easy to formulate a suitable research question. Some research as too simple and other are too complex. The Socratic Dialogue may be used as a technique for facilitating conversation and reflection as a means of developing suitable research questions. The essence of this approach is that the discussants share experiences and in so doing they not only learn from each other but also identify interesting areas for research. The technique is affected through a structured conversation or discourse which is used to explore an agreed issue. The Socratic Dialogue 'conversation' consists of three steps or stages and is suitable for six to eight participants who may be colleagues or knowledge informants. It also requires a competent facilitator who can guide the group through its conversation and reflection. Socratic Dialogues will not always lead to a consensus but even when it doesn't it can be useful to researcher seeking useful research questions.

## **Keywords**

Socratic dialogue, discourse, learning, discovery, reflection, research questions, dialectic, conversation, experiences

## **Finding a Research Topic**

Traditionally academic researchers were required to find their research questions in the literature. In keeping with the fact that academic research is required to build on what has already been studied and what is already

known, it was said that the research question should arise as a result of previous research. This was certainly the case until the relevance of academic research began to be seriously questioned (Starkey and Madan2001), by both academe itself and by professionals who look to academics for new ideas and concepts. Grey (2001) pointed out that the academic practice of the late twentieth was not in keeping with the original values of academe which were to educate professionals. As a result of this questioning there is a new approach to finding research questions which includes finding appropriate questions in organisations.

This is, of course, especially useful to part-time students who are undertaking masters and doctorate degrees and therefore have access. But research questions do not often present themselves in a clearly articulated form. Sometimes they have to be teased out of complex situation.

In fact in business and management studies research questions often arise as a result of conversations. Issues are mentioned in conversations or discussions which have research potential but which are not yet explored or focused in order to fully understand what is involved in researching them. A technique which may be used to encourage in-depth conversation and which also promotes reflection on the ideas which are thrown up in these conversations is the Socratic Dialogue (Saran and Neisser 2004).

Developing a research question is a very personal matter and mechanistic approaches will not often facilitate useful questions and thus the Socratic Dialogue alone would not be an ideal approach to settling on a research question. However if it is used correctly it can point the way to topics and issues which may then lead to research questions.

Finding a suitable research question is a non-trivial part of any research project or research degree. The difficulty arises because the research question needs to have a number of characteristics which are sometimes hard to fulfil. It is important that a research question has most if not all of the following attributes. The research question needs to be<sup>1</sup>:-

1. of direct interest to the researcher and to his/her supervisor;

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<sup>1</sup> Some of these attributes of a research question are interdependent and the list should not be considered to be in order of importance.

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## *Finding Research Questions Using a Socratic Dialogue*

2. based on a real problem recognised by the academic community or practitioners in the field, and preferably both;
3. associated with one or two established fields of academic study, and preferably not more than two;
4. referred to directly or indirectly in the academic literature;
5. answerable by academic research practice;
6. if empirical then appropriate evidence is, or will become, available;
7. neither too wide ranging or so complex that it is unreasonable to expect it to be answered within the usual time allowed for a research degree;
8. reducible to sub-questions which may be answered directly by the collection of evidence;
9. Capable of being expressed in a clear and unambiguous manner.

Because of the difficulty in finding a suitable research question, research degrees are sometimes started without having established a clear question in the hope that one may arise as a result of exploratory research during the first few years of the degree. However it is not unusual for research degree candidates to be still struggling for a suitable research question some years after the research degree has been formally commenced<sup>2</sup>.

### **The Question of the Question**

As mentioned advice offered to those commencing a research degree has traditionally been that a research question needs to be found through a thorough investigation and understanding of the academic literature. This

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<sup>2</sup> Research degree practice in the United Kingdom today normally required a research degree candidate to have submitted a research proposal which should include a fully developed research question. However, even where this is strictly adhered to, research degree candidates can change their minds and find themselves without a research question well into their degree registration.

meant that a research question would be discovered with the aid of some previous researcher identifying a problem and pointing out its potential for future research either in a published paper or perhaps in the final chapter of a research dissertation for a masters or doctoral degree. A strict implementation of this approach meant that real problems experienced by practitioners, unless they were also referred to in the literature, were not eligible to be considered, in their own right, as a suitable research degree subject.

It is now thought that this approach is too restrictive. Insisting that the research question originated in the academic literature, assisted in establishing and maintaining rigorous research standards, but at the same time it also lead to research questions being less relevant than they could or indeed should have been. It has now been established in the business and management field of study that a research question may be found by reference to current business situations – problems, challenges or opportunities. This does not, of course, release the research degree candidate from knowing the literature, but it does give the individual a different starting point. The problem which is now faced is that current business problems, challenges or opportunities are often not understood or expressed in such a way that they can be easily reduced to useable academic research questions. Sometimes what management suggests as a problem is actually not the case<sup>3</sup>. Sometimes managers are not especially articulate about their problems and challenges. Sometimes the expression of the issues is too vague or high level to be used as a research question. In these circumstances the research question has to be teased out so that the issues are clear and the question complies with all or most of the question characteristics described above. Teasing out questions usually means discussing the issues with several people and trying to find some degree of consensus. The Socratic Dialogue is a technique for facilitating this as an appropriately structured conversation and subsequent reflection can assist in highlighting the real research issues.

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<sup>3</sup> It has sometimes been said that management is not really the art of solving problems but rather the art of finding out exactly what the problem is.

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## **What is this Socratic Dialogue?**

The Socratic Dialogue is so called because it is based on a question and answer process which is not entirely dissimilar to that described by Plato as the *dialectic* and who attributed the development of that technique to Socrates. The traditional dialectic was originally conceived as a conversation between two people. Socrates, when he visited the marketplace in Athens, is reputed to have engaged individuals in controversial conversation and argued with them one at a time. He is said to have been a past master at this and was always able to point out the weaknesses and the fallacies in other people's arguments<sup>4</sup>. Socrates normally achieved this by pointing to experiences which he and his victim could agree supported Socrates argument.

In the 21<sup>st</sup> century this one-to-one approach would take too long to have any real impact even among relatively small groups of academics and their informants. In any event, it is now felt that perhaps more depth as well as breadth can be achieved when a group of individuals are involved in these dialogues as this offers a wider range of different insights. The original Socratic model relied on one 'master' who dialogued with the learners. The new approach allows multiple individuals to benefit from multiple experiences. There is quite intentionally no '*master*'. Everyone's experience is equally valid and the facilitator plays a background role. The Socratic Dialogue is specifically not a debate – it an exchange and exploration of experiences. Although insights will come from participants hearing they speak as well as engaging in discussion, most of the benefit comes from active listening. What is said by the participants of the Socratic Dialogue is of course key to its success and here the facilitator needs to be careful that only experiences of the participants are discussed. Thus to be a member of a Socratic Dialogue and to get full benefit from it, an

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<sup>4</sup> As Socrates did not write an account of this himself we only have Plato's account of what actually took place.

individual needs to be enthusiastic about sharing experiences and hearing the thoughts of others<sup>5</sup>.

It is also the case that all the individuals who participate in the Socratic Dialogue may benefit from the conversation and reflection. It is not simply a tool which will benefit the researcher alone.

## **The Socratic Dialogue Applied to Research Questions**

The first step in the Socratic Dialogue involves bringing a group of appropriate people together, say, six to eight, to closely examine an opening question<sup>6</sup>. Ideally the question should be made known to the individuals in advance and they all need to be familiar with the issues involved and be prepared to share their experiences with each other. The questions which are amenable to this are wide ranging and many. A few examples of such questions are:-

1. What is the nature of effective knowledge management?
2. How could the real benefits of intellectual capital be harvested?
3. What is the nature of good leadership?
4. How are we to improve our understanding of our client base?
5. What would help us achieve a greater commitment from our colleagues to our corporate strategy?
6. In what way could we obtain a greater delivery of benefits from our information systems?
7. What are the most critical human resource challenges which we currently face?

These examples of an opening question are, in academic research parlance, possible research topics that can be explored with a view to helping in the establishment of a research question.

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<sup>5</sup> See <http://www.philodialogue.com/Authenticity.htm> viewed 25 March 2006

It is important to focus on the fact that the conversation generated during the Socratic Dialogue is required to be entirely experientially based. This means that participants are not allowed to discuss the question in terms of anything other than their own personal experiences with the issues involved. Mentioning theoretical views on the subject is generally not allowed.

## **Discovery as a Way to Knowledge**

At the heart of the Socratic Dialogue is the notion of learning through discovery. This discovery operates by creating an opportunity for debate and reflection in a non-threatening conversational setting. This objective enhances understanding by discussing the *actual experiences* of the group. The group needs to be open, non-adversarial and needs to treat all opinions as equally valid and important. Ideally the group should be relatively small. Members of the group may come from diverse backgrounds but care has to be taken with individuals from different status levels.

In addition to examining research topics and research questions the Socratic Dialogue is generally used to:-

1. encourage participants to think independently and critically, and to then reflect on that thinking;
2. build self-confidence in individuals own thinking;
3. answer a philosophically oriented question and to endeavour to reach consensus,- i.e. to reach an outcome;
4. engage in the co-operative activity of seeking answers to questions and to understand each other through the exploration of concrete experiences;
5. Deepen individual insights and understandings.

Ideally the Socratic Dialogue leads to a consensus among the individuals. But participants may not always reach a definitive outcome in the form of totally agreed research question or even a set of possible research questions. This should not necessarily be seen as a failure, as the Socratic Dialogue experience itself promotes reflective learning which is useful in the research process.

## **The Process of a Socratic Dialogue<sup>7</sup>**

The process of a Socratic Dialogue requires the use of a set of guidelines or rules which, although not inflexible, need to be kept consciously in the mind of the facilitator.

At the outset it needs to be said that no philosophical training<sup>8</sup> is needed to be part of a Socratic Dialogue. Openness and an interest in learning from others are perhaps the only qualifications required to derive benefit from a Socratic Dialogue. A firm but sensitive facilitator is required who can ensure that the group does not stray too far off the subject and that no one person dominates the discourse.

Before the group assembles an appropriate question needs to be established. This question needs to be well-formulated and general in nature. As it is effectively a research topic it should not be a long and complex question. Each member of the group needs to be made aware of the question in advance and be asked to reflect on their experience regarding the issue in the question. The only qualification for being a participant in a group is that the individual has some direct experience of the subject matter being discussed.

### **Discourse in Five Parts**

There are five parts to a Socratic Dialogue. These are:-

1. The telling of the original stories;

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<sup>7</sup> A Socratic Dialogue is not to be confused with the Socratic Dialogues (Greek Σωκρατικός λόγος or Σωκρατικός διάλογος), which are prose literary works developed in Greece at the turn of the fourth century BCE, preserved today in the dialogues of Plato and the Socratic works of Xenophon - either dramatic or narrative - in which characters discuss moral and philosophical problems, illustrating the Socratic method. Socrates is often the main character. [http://en.wikipedia.org/wiki/Socratic\\_Dialogue](http://en.wikipedia.org/wiki/Socratic_Dialogue) viewed 25 March 2006.

<sup>8</sup> See website [http://www.sfcp.org.uk/socratic\\_dialogue.htm](http://www.sfcp.org.uk/socratic_dialogue.htm) viewed 25 March 2006

2. The choosing of one story to explore in detail;
3. The retelling of the story and the detailed conversation and reflection;
4. The compiling of what has been understood and learnt from this detail;
5. The confirmation of how these understandings relate to all the original stories.

When the group assembles each participant is asked to recall a real life experience which is directly related to the question or topic. Each story should be told in no more than three minutes and the facilitator should keep the speakers to the time limit. A list of titles or key words for these different stories should be compiled by the facilitator as they are being told.

When all the stories have been told the group itself chooses one of these stories/experiences to examine in detail. Specifically the facilitator should not influence the choice of the story. It may take a while for consensus to be reached as to which experience is the most relevant or the most effective to closely examination. The member of the group who has provided this story, and who is referred to as the example giver, needs to be prepared to recount the story in as much detail as he or she can recall, and also be prepared to be questioned about this experience by the other members of the group.

The story is now retold by the example giver in five to ten minutes. This provides a broader and a more in-depth perspective of the experience being discussed.

Members of the group are encouraged to ask questions which come into their mind without too much analytical thought. These questions may seek background information or details of the actions, attitudes and values of the individuals involved in the example. This part of the Socratic Dialogue may take between one or two hours.

The retelling of the story of the real life experience needs to be transcribed, at least in summary, as do all significant comments made by the other members of the group. The discourse between the members of the group needs to unfold slowly and carefully with as much consensus in

understanding as possible being established on a step by step basis. Here any conflicts (differences of opinion or differences in usage of language) should be resolved if possible and a genuine attempt be made to formulate shared insights and knowledge. This will become the overview of the discourse or dialogue and is used to summarise the key issues raised during the dialogue. This activity will need about half an hour. Each member of the group is now asked if their individual story relates to the summary created. The extent to which the summary reflects the essence of each story is discussed and the summary changed if this discussion reveals new dimensions of the story. This process may require up to half an hour.

## **Drawing out Research Questions**

Once the overview has been established then the discussion needs to turn to the issue of research questions. The overview as a statement based on a summary of individual experiences will inevitably contain issues which could be further explored. Identifying these issues will produce a list of possible research questions. As mentioned above the Socratic Dialogue cannot be relied on to produce research questions in any mechanistic way. What it does is produce a collective understanding of a topic which will usually lend itself to further exploration and thus to research questions.

## **Making the Socratic Dialogue Work**

The Socratic Dialogue is actually an exercise in learning through exchanging experiential knowledge that leads to new insights or discoveries by reflection. The group members need to be honest in the recounting of their experiences and to be honest in describing their personal reactions to the experiences of other members. The Socratic Dialogue should be as judgement free as possible. Any suggestion that a member of the group is being judged by the other or by the facilitator will reduce the value of the event. Members' thoughts need to be expressed as clearly and simply as possible. If something is not clear then it should be discussed until everyone understands the point being made. This requires at all times careful attention to the discussion. If members of the dialogue become tired then they should advise the

facilitator who may call for a break for refreshments. There should in fact be a number of refreshment breaks as in general running a Socratic Dialogue for more than an hour and a half without a break is not advised.

It is important that no one individual or group of individuals dominate the Socratic Dialogue. If this occurs then any member of the dialogue may ask the facilitator for a break for the purposes of having a meta-discussion. A meta-discussion involves talking about how the Socratic Dialogue is proceeding. Normally there is little need to have these meta-discussions. When they do arise they should be concluded as quickly as possible so that the group may return to the main purpose of the event. If any member of the dialogue feels that the discussion is drifting way from its original purpose then he or she may also call for a strategy-discussion. Strategy discussions are used to refocus the dialogue if it has wandered away from the original point.

### **The Facilitator and the Socratic Dialogue**

A skilled facilitator greatly enhances the Socratic Dialogue. The function of the facilitator is to ensure the smooth running of the meeting and to bring all the members of the group into the discussion.

The facilitator will normally keep the record of the different experiences and will also act as scribe for the overview of the detailed study on the chosen experience. It is important that the facilitator does not attempt to influence the direction of the discourse. The discussion may stray off the subject and provided these lapses are not for long or too far from the question they may be tolerated. However in the end the facilitator should bring the discussion back to the issue for which the Socratic Dialogue was initiated.

### **Timing and the Socratic Dialogue**

A Socratic Dialogue may be structured in several different ways. Firstly a Socratic Dialogue may be run as one continuous event. Of course this does not imply that there are no refreshment breaks. In such a case using a large group, say ten people, then a whole day of eight hours would be

required to complete an event. Some events may require a little longer, perhaps twelve hours. Smaller groups may require less time say three or four hours. In some circumstances it may not be possible for individuals to make such a long period of time available. In these cases the Socratic Dialogue may be conducted in a number of parts or a number of sessions. The first session might run until the group has listed its experiences and perhaps chosen the one which they wish to study in detail. Then two or three sessions of one hour each could be put aside to elaborating on the one chosen example. In this way the Socratic Dialogue experience could be obtained over an extended period.

### Some Final Points

The Socratic Dialogue facilitates learning through discovery by reflecting on actual experiences. Therefore the conversation needs to be based on real experiences, which means avoiding what Shakespeare referred to in *Othello* as, “*Mere prattle without practice*”<sup>9</sup>. These experiences need to be discussed actively by all the members of the group who need to say what they really think and in an ideal situation the discussion needs to proceed until a high degree of understanding and consensus is reached. Thus in a Socratic Dialogue there is a need to start with the concrete experience and remain in contact with this experience throughout the entire event. Proper insight is gained only when the link between any statement made and personal experience is explicit<sup>10</sup>. This means that a Socratic Dialogue is a process which concerns the whole person. The members of the Socratic Dialogue should attempt a full understanding of each other. This involves much more than a simple verbal agreement. Participants should try to be clear about the meaning of what has just been said by testing it against their own experiences. In ideal circumstances the limitations of individual personal experience which stand in the way of a clear understanding should be made conscious and thereby it is hoped that this limitation will be transcended.

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<sup>9</sup> *Othello* Act 1, Scene 1 line 26.

<sup>10</sup> See [http://www.sfcp.org.uk/socratic\\_dialogue.htm](http://www.sfcp.org.uk/socratic_dialogue.htm) viewed 25 March 2006.

Beware of being distracted by less important questions. Following a subsidiary question until a satisfactory answer is found may be useful, but again it may not be. Groups often bring great commitment to their work and gain self-confidence in the power of their intellect or reason. This may mean not giving up when the work is difficult. Sometimes the discussion has to move on, but it may return to the problematic issue again. An honest examination of one's thoughts and the thoughts of others is essential. This honesty may help with the striving for consensus although consensus itself may not necessarily arise.

## **Summary and Conclusions**

Finding useful research questions can be a major problem especially for many masters and doctoral students. They often struggle to find issues which have an appropriate research potential. It is surprising how often a considerable amount of time is wasted by research students in pursuing questions which will not enable them to deliver the understanding which they need to demonstrate to obtain their degrees.

Research question development is not a subject which is frequently addressed in research methods classes. The characteristics of good and poor research questions, as mentioned earlier in this paper are often discussed. But how to arrive at a question is a problem. It is not easy to "teach" techniques which can facilitate the development of research questions. The Socratic Dialogue is an approach which helps to surface issues which may otherwise be difficult to discern or access. If the discussion is correctly facilitated then it can stimulate shared self learning as well as lead to insights and understandings which often in turn offer a list of useful questions.

But it is worth pointing out that this type of shared learning will not suit all research topics or indeed all researchers. A Socratic Dialogue can take time – a considerable number of hours. Some researchers find listening to members of a group such as this tedious. Some of the members of the group can have relatively naïve views. There are also situations in which the Socratic Dialogue will be cumbersome – perhaps if there are too many views for the Socratic Dialogue to converge on an

agreed opinion. Without achieving a final consensus the Socratic Dialogue can still be valuable but not all the members may see this as being effective. However, most of the time the Socratic Dialogue will help tease out research questions from a research topic and will thus be of use to a researcher.

## **References**

- Hatchuel, A 2001. The Two Pillars of New Management Research. *Journal of the British Academy of Management* 12:33 - 39.
- Grey, C 2001. Re-imagining Relevance: A Response to Starkey and Malan. *Journal of the British Academy of Management* 12:27 - 32.
- Saran, R & B Neisser 2004. *Enquiring Minds*. Stoke-on-Trent: Trentham Books.
- Starkey, K & P Madan 2001. Bridging the Relevance Gap: Aligning Stakeholders in the Future of Management Research. *Journal of the British Academy of Management* 12:3 - 26.

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# **The Challenge of Diversity: Participation Rates in a Flexible Learner Support Programme**

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## **Abstract**

The present study reports the results of an investigation into the rates of participation among English first and second-language students in the different components of learner support system in the first-year Psychology programme at the University of KwaZulu-Natal, which has been designed to provide a hybrid mixed-mode offering, in which tutors play a crucial mediational role interacting with students to combine the flexibility of open learning and the essential learner support structures more typical of face-to-face delivery systems. The research results show that the differentiation of learner support offerings in an open system has been substantially effective in response to the challenge of diversity, that students who would ordinarily perhaps have remained anonymous in a large class or even in workshop sessions, developed strong relationships with tutors, and that it is imperative that the focus remains on developing students' autonomous academic engagement as opposed to setting up relationships of dependency between tutors and students.

## **Introduction**

The challenge for post-apartheid South African higher education institutions is to deliver quality education for all students. However, the manifest

inequities under the apartheid system and continuing resource limitations in the provision of schooling, means that entrants to universities have had very diverse preparation for higher education study and, hence, have wide-ranging learning needs and expectations. The task, therefore, is to create learning opportunities that will both benefit and challenge this highly heterogeneous student body, facilitating optimal learning for all students. In this process, it is imperative to radically re-evaluate our existing conventional educational operations. 'South Africa's transition from apartheid and minority rule to democracy requires that all existing practices, institutions and values are viewed anew and rethought in terms of their fitness for the new era' (Higher Education White Paper 3 1997: 3).

Although the impetus for curriculum transformation is particularly urgent in response to the extreme inequalities of South Africa's educational history, similar demands are emerging throughout the higher education sector globally in the 21<sup>st</sup> century (e.g., Dill & Sporn 1995; Hanman, English & Silver 1999; Northedge 2003a; Radford 1997). Increasing access for nontraditional students (Biggs 1999; Matiru 1987; Northedge 2003a) and the changing terrain of intellectual and vocational work (Biggs 1999; Dill & Sporn 1995) mean that "business as usual" in higher education is simply no longer a tenable option. The traditional teaching approach with an emphasis on the transmission of information in the lecture format and reliance on independent reading by students seems starkly inappropriate for meeting these contextual demands. On the one hand, this conventional approach homogenizes the learning process by assuming adequate preparation for independent study. In reality, the paucity of previous learning opportunities for many students means that they lack the appropriate critical frameworks and skills for autonomous task engagement. On the other hand, the lecture mode negates the express aim of university study to develop critical, active learners by (ostensibly) positioning students in a passive role. Conventional face-to-face classroom-based education assumes the presence of a teacher as the necessary link between students and knowledge with teaching conceptualised as the transfer of knowledge 'from one vessel to another' (Fox 1983: 151). This view of students as passive recipients of imparted knowledge is at odds with both national development priorities and epistemological imperatives (Northedge 2003b; Williams 2005) in the context of the rapidly changing demands of the global economy.

The development of an “open learning” system utilizing mixed modes of delivery offers one possibility for addressing such wide-ranging demands in tertiary education. In conceptualizing a new framework for curriculum development, it is instructive to distinguish between the terms “open learning” and “distance education” that are often used interchangeably. “Distance education” refers to the process of studying by correspondence and reflects its origins as a non-contiguous method of educational communication in which proximal contact between teacher and learner is restricted (Hodgkinson 1994; Rumble 1992; Holmberg 1989). On the other hand, “open learning” primarily refers to issues of educational access. The focus is on unimpeded access to education that aims to surmount past conventional barriers such as pre-qualifications, age limits, geographic isolation, financial constraints and work timetables (Clark 1995; Jevons 1990; Rumble 1992; SAIDE 1995, 1999). Although the delivery systems of traditional correspondence courses may be said to address some of these open learning imperatives (notably the problems of geographic isolation or the time problems associated with studying while working), some aspects of a distance mode may, in fact, *limit* rather than facilitate open access. In particular, the isolation and lack of support afforded distance students may make the learning process extremely difficult.

Open learning programmes are first and foremost, student-centred, emphasizing individual flexibility with respect to the time, place and pace of learning (Holmberg 1989; Rumble 1992; Telford 1995) but also providing a range of learner support offerings. Because the approach incorporates various delivery systems (in particular, utilizing those modes most often associated with distance education, such as print and other media), it allows for the massification of learning opportunities that is imperative in a democratizing context. However, the simultaneous emphasis on creating a learner support infrastructure recognizes the value of interaction with other learners (perhaps even simply for very important motivational support, Cartney & Rouse 2006) and the particular mediational role of a teacher who may direct learners’ engagement in ways that may not easily be discoverable independently. As Biggs argues, ‘Good teaching is getting most students to use the higher cognitive level processes that the more academic students use spontaneously’ (1999: 4). The emphasis on learner initiative in utilizing

these support offerings ensures that students who require help have access to it, without hindering the progress of those that do not require the same amount of assistance.

The development of a curriculum for the first-year Psychology programme at the University of KwaZulu-Natal was designed to provide a hybrid mixed-mode (Garrison & Shale 1990; Smith 1987; Telford 1995) offering, combining the flexibility of open learning and the essential learner support structures that are perhaps more typical of face-to-face delivery systems. The development of text-based learning materials ensures that the course is open and accessible for a very large group of students (usually approximately 500 students in any given cohort). However, the central role afforded these materials means that the quality of textual design becomes paramount. Rather than providing the usual introduction to the discipline typical of first-year textbooks, these texts have been written by the module teachers with the learning needs of students (and especially underprepared students) in mind. The materials attempt not only to introduce students to the content of the discipline but, also, through tasks and written feedback to initiate them into appropriate forms of academic engagement (Bradbury & Griesel 1994). In this way, the texts function as second-order mediators of the learning process (Miller 2003), their structured design making the usually concealed characteristics of textuality overt and initiating readers into new ways of constructing understandings. However, despite the educational possibilities of such purposeful materials development, the provision of responsive learner support is viewed by many (including teachers and learners) as crucial to the success of an open learning system (Rumble 1992; SAIDE 1995, 1999; Telford 1995). In the initial phase (1995 – 1998) of implementation, the Psychology I programme was heavily reliant on delivery of the materials through a compulsory weekly workshop system and the results of this process have been extensively documented (see Miller et al. 1997, 1998, 1999a, 1999b, 2000, & 2001).

Perhaps the greatest challenge facing tutors in the implementation of this process lay in addressing highly heterogeneous learning needs in the group sessions. It became evident that the provision of a homogenous compulsory support system was unnecessary for those students who were confident in working independently with the materials and, conversely, was insufficient for those students struggling most with the task demands. In

response, the programme was adapted, increasing and differentiating the support offerings, and emphasizing student initiative in elective participation. In this restructured form, the programme provides a range of voluntary learner support offerings; structured group workshops on each module and less structured individualized daily help sessions addressing both academic and non-academic issues. It was considered particularly important to include opportunities for support and assistance with issues not strictly course-related, as there is a widely accepted view that broader psychological concerns, including various kinds of personal problems, may substantially impinge on the development of students' learning potential. The present study aims to investigate the rates of participation in the different components of learner support system, for English first and second-language students and across student academic performance levels.

## **Method**

### ***Participants***

The participants in the study were the entire enrolled class of 502 students in Psychology I at then University of Natal, Durban in 1999, of whom 385 were English first-language speakers (L1) and 117 were English second-language speakers (L2). The mother tongue of the second language speakers was one of the official African languages. Whether or not students were mother tongue speakers of English in South Africa in the nineties was a relatively accurate indicator of the level of schooling preparation they had been afforded under the apartheid system, in which Black African L2 speakers of English were severely discriminated against.

### ***Design***

The provision of learner support was considered pivotal to the success of the programme and, therefore, structured group workshops were conducted dealing with material for each of the four modules of the course (Introduction to Psychology, Evolution, Intelligence, and Personality). In addition, daily help sessions during the lunch hour ensured that students could obtain ongoing individual attention. These help sessions provided

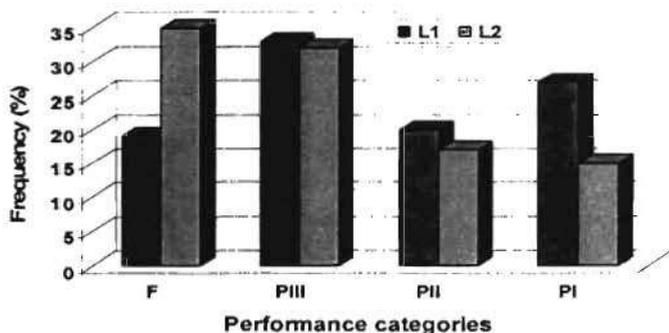
differentiated forms of assistance: tutoring dealing with issues directly related to the course, (for example, specific conceptual difficulties or the requirements of tasks, assignments and examinations) and consultation about more general academic issues of adjustment to university demands (for example, reading academic texts, time management, note-taking in lectures) and personal problems that might be impinging on students' academic performance. Attendance at both workshops and help sessions was recorded along with some descriptive information; students' identification details, problems presented, the tutor's response or strategy to overcome the problem and an assessment of the student's engagement and progress. Attendance at help sessions was categorized as low for 1-4 sessions; medium for 5-9 sessions; and high for 10 sessions or more.

Attendance rates were analysed in combination with performance data derived from official university records. Categories of academic performance were defined as follows: F = 0%-49%; PIII = 50%-59%; PII = 60%-67%; PI = 68%-100%. Comparisons were made between L1 and L2 students across categories of performance, workshop attendance, and help session attendance.

## **Results**

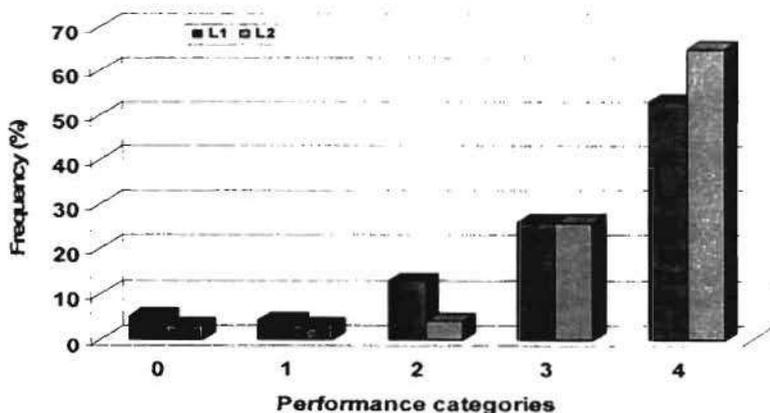
Rates of participation in the various components of the learner support for English first-language students (L1) and English second-language students (L2) were examined in relation to student performance. The performance profile of the whole class is presented in Figure 1. The figure reflects the proportion of L1 (N = 385) and L2 students (N = 117) who obtain final grades in each of the following categories: <50% (F), 50-59% (PIII), 60-67% (PII), >67% (PI). The patterns of performance for L1 and L2 students are similar but vary at the extreme ends of performance, with a failure rate of 35% for L2 and 19% for L1 students. Conversely, only 15% of L2 compared with 27% of L1 students obtain marks in the high (PI) category. In the two intermediate categories (PIII & PII) the performance of the L1 and L2 students is very similar as can be seen on Figure 1:

Figure 1: Performance of L1 & L2 students



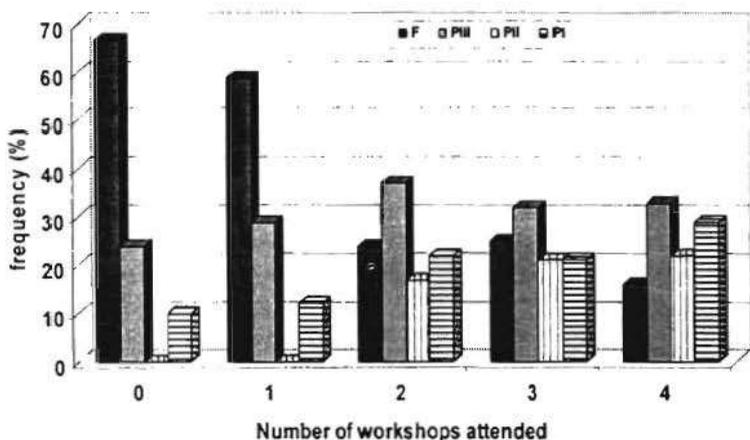
The uneven success rate of L1 and L2 students, reflected in Figure 1, is clearly indicative of heterogeneous learning needs among the students. It was in response to these needs that the various components of learner support, such as workshops and individual help sessions, were offered. Figure 2 presents the proportion of L1 (N = 385) and L2 (N = 117) students who participated in one, two, three, four, or none of the 4 workshops offered.

Figure 2: Profile of student participation in workshops



From Figure 2 it is evident that only a small proportion of the students in both groups failed to attend any of the workshops (L1 = 5%; L2 = 3%) and an equally small number attended only one workshop (L1 = 4%; L2 = 3%). The large majority of students did make good use of the workshops and attended either three (L1 = 26%; L2 = 26%) or four (L1 = 53%; L2 = 65%) sessions. Focusing on variation in final performance, rather than language group, in relation to workshop attendance produces a more differentiated picture. In Figure 3 the proportions of all the students (L1 and L2 combined), within each of the levels of workshop attendance (0, 1, 2, 3, 4), are presented across the performance categories (F, PIII, PII, PI).

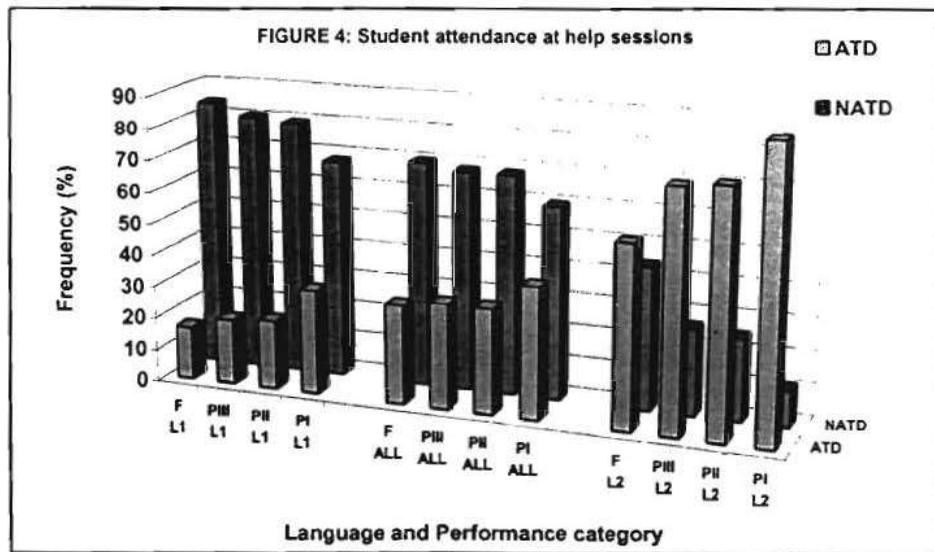
Figure 3: Student performance in relation to workshop attendance



The failure rates are substantially different between the students who attended all four workshops (16%) and those who did not attend any workshops (67%). Although not as high, the failure rate for students who attended only one workshop is also substantially higher (59%) than for students attending more than one workshop. Given the drop in the failure rate for attendance at more than one workshop (2 = 24%; 3 = 25%; 4 = 16%) the indication is that at least minimal engagement with the course, as expressed in workshop participation, has a notable impact on possibilities for

success. Furthermore, high performance appears to be related to levels of workshop attendance, with 29% of students who attend all 4 workshops achieving marks in the upper second or first class range (PI) with only 10% of students who never attended any workshops attaining this same level of performance. However, this small group of students who attended no workshops yet still obtained high grades overall, is indicative of a group of bright students who can move swiftly and independently through their work and who may in fact be hindered by other students who require assistance. It is in these instances that the beneficial mechanisms of an 'open-learning' system can be seen in operation. However, these results do seem to indicate that participation in this structured learner support programme is of benefit to the majority of students.

Figure 4 presents the participation rates for the less structured daily help sessions. For each performance category, the proportions of L1, and L2 students, and L1 and L2 combined (ALL), who attended at least one of the help sessions (ATD) as well those who did not attend any sessions (NATD), are presented in Figure 4.



Participation rates in this form of learner support were generally lower than in the more structured workshop sessions with only 34% of the students (N = 169) in the class (N = 502) attending help sessions at all. However, as is evident from Figure 4, the participation rates for the class as a whole (ALL) masks the striking difference between the participation rates of L1 and L2 students. Across all performance categories, Figure 4 clearly illustrates that the participation rates for L2 students is far higher than for L1 students. Whereas participation rates for L2 students range from 56% for failing (F) students to 89% for the high achieving (PI) L2 students, participation in the help sessions by L1 students ranges from 16% for failing students to 32% for the high performers.

Although the participation rates are very different between the two groups, there is a similar tendency for higher levels of participation to be associated with higher performance. In addition, it is worth noting that for L2 students the participation of failing students (56%) is considerably lower than the high level of participation for L2 students in all of the passing categories (PIII = 74%, PII = 75% and PI = 89%).

In Figure 5 this general pattern of participation in the help sessions is further differentiated in terms of low, medium, and high attendance. Low refers to attendance at 1-4 sessions, medium to attendance at 5-7 sessions, and high to attendance at 8 or more sessions. Figure 5 presents the frequency of help session attendance by L1 and L2 students within the different performance categories.

FIGURE 5: Frequency of help session attendance within language and performance categories

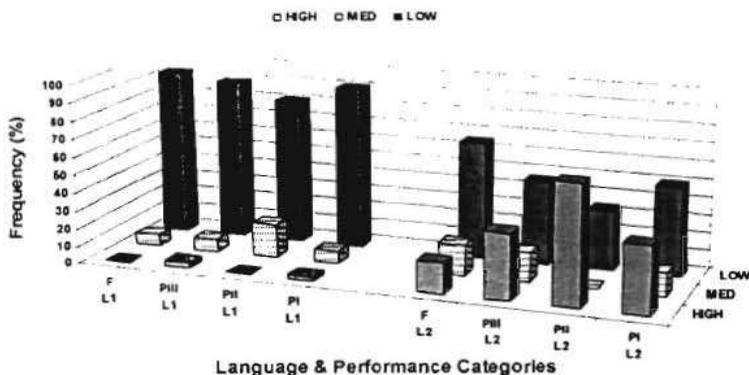


Figure 5 illustrates a major difference in the frequency of attendance between L1 and L2 students. Of the small number of L1 students who utilised the help sessions at all, attendance was low for the vast majority in all the performance categories, and very few made frequent use of the facility. Further, for L1 students, attendance at the help sessions does not appear to have any bearing on performance. For the L2 students the attendance pattern varies and frequency of attendance does appear to be related to performance. High frequency of attendance was recorded for 17% of L2F whereas across the other performance categories, there was a substantial increase in high levels of attendance (37% of L2 PIII; 67% of L2 PII; 38% of L2 PI). In particular, the high attendance (67%) recorded among L2PII students is noteworthy.

## Discussion

The analysis of these data suggests that an open learning support system offers innovative possibilities for differentiating the learning-teaching experience in response to heterogeneous students' needs. Discrepancies in the performance of L1 and L2 students in Psychology I indicate that the effects of apartheid schooling continue to be felt in the higher education sector. The various components of the learner support system were utilized more highly by L2 students and the higher the level of participation, the better the performance for this group of students.

The majority of all students attended the structured workshop sessions, although participation of L2 students was slightly higher than L1 students. Structured group interactions may be a familiar and accessible learning format for students making the transition between school and university. Participation in the workshop system is clearly associated with performance, with the majority of students who attended no workshops or only one workshop, failing the course. In contrast, the majority of those who participated more regularly in the workshops passed the course, with the highest pass rate among those who attended all four workshops. Although it is not possible to establish a direct causal connection between the learning-teaching that occurred in the workshops and students' performance, these results strongly suggest that participation is linked with successful

engagement. The workshops were highly structured and run by tutors who had been effectively trained to work with the course materials and, particularly, to mediate the task demands of university study. While this mediation is sure to have had direct benefits for learners, it is also likely that students who make the effort to attend workshops are more diligent in working with the materials independently and, therefore, attendance may be an indicator of general engagement with the course. Interestingly, there is a small group of students (10% of the class) who attend no workshops at all and yet achieve high marks. This indicates the value of a flexible system; these students are clearly able to work independently through the text-based tasks and have no need of further direct mediation.

Participation in the more flexible daily help sessions was far lower than in the more structured workshops with only a third of the students attending help sessions at all. However, while this may initially seem to indicate that this form of learner support is less appropriate than the workshop system, focusing on the participation of the class as a whole obscures the very different patterns of participation of L1 and L2 students. Across all performance categories, the majority of L2 students utilized the help sessions at some point during the course. Further, while the minimal use that L1 students did make of the help sessions bears little relation to final performance, this is not the case with L2 students. Higher performance for L2 students is associated with frequent use of the help sessions. In particular, the most frequent use of the help session system was recorded for L2PII students. This result is encouraging in that it suggests that the system seems to benefit those students who need it most. Further, more than simply passing, these students are obtaining solid second class passes indicating that a firm academic foundation has been laid.

To conclude, the differentiation of learner support offerings in an open system has been substantially effective in response to the challenge of diversity. However, some qualification of this assessment is necessary. There is a need for further qualitative work to assess the quality of learning-teaching interactions that occur in both workshops and individual help sessions. Informal feedback from students themselves indicates that they find the workshops very helpful, think they should be offered more often and, surprisingly, that they should be compulsory! It is possible that a more extensive structured workshop system would negate the necessity for the

more resource intensive help session system. However, where L2 students made frequent use of the help sessions, the benefits of this highly flexible and responsive format are evident in their performance. There were other less measurable but nonetheless, tangible, benefits. While the original intention in the design of support offerings was to address personal problems in specific sessions, this separation of personal and academic issues proved artificial. However, students who would ordinarily perhaps have remained anonymous in a large class or even in workshop sessions, developed strong relationships with tutors, gaining an almost personal introduction to the academy. Whatever the form of support offered, it is imperative that the focus is on developing students' autonomous academic engagement as opposed to setting up relationships of dependency.

## References

- Dill, DD & B Sporn 1995. The Implications of a Postindustrial Environment for the University: An Introduction. In Dill, DD & B Sporn (eds): *Emerging Patterns of Social Demand and University Reform: Through a Glass Darkly*. Oxford: Pergamon.
- Biggs, J 1999. *Teaching for Quality Learning at University*. Society for Research into Higher Education & Open University Press.
- Bradbury, J & H Griesel 1994. Text as Impetus for Learning. *State of the Art in Higher Education: Conference Proceedings of the SAAARDHE Congress 1*: 323-331.
- Clark, E 1995. Open Learning: Educational Opportunity or Convenient Solution to Practical Problems in Higher Education. In Thomas, D (ed): *Flexible Learning Strategies in Higher and Further Education*. London: Cassell.
- Fox, D 1983. Personal Theories of Teaching. *Studies in Higher Education* 8,2: 151-163.
- Garrison, DR & D Shale, D 1990. A New Framework & Perspective. In Garrison DR & D Shale. *Education at a Distance: from Issues to Practice*. Florida: Robert E. Krieger Publishing Co.
- Hannan A, S English & H Silver 1999. Why Innovate? Some Preliminary Findings from a Research Project on Innovations in Teaching and

- Learning in Higher Education. *Studies in Higher education* 24,3: 279-289.
- Higher Education White Paper* (3) 1997. South Africa: Ministry of Education.
- Hodgkinson, K 1994. Flexible Provision for Student Diversity. In Arfield J, A Hodgkinson, A Smith & W Wade (eds): *Flexible Learning in Higher Education*. London: Kogan Page.
- Holmberg, B 1989. The Concepts and Applications of Distance Education and Open Learning. *South African Journal of Higher Education*, 3,2: 18-23.
- Jevons, F 1990. Blurring the Boundaries: Parity and Convergence. In Garrison DR & D Shale (eds): *Education at a Distance: From Issues to Practice*. Florida: Robert E. Krieger Publishing Co.
- Matiru, B 1987. Distance Education in Kenya. In Smith, P. & M Kelly (eds): *Distance Education and the Mainstream*. London: Croom Helm.
- Miller, R 2003. Understanding: The Nurture of Nature – Part 2. *Psychology in Society* 29: 6-22.
- Miller, R, J Bradbury & SL Wessels 1997. Academic Performance of First and Second Language Students: Kinds of Assessments. *South African Journal of Higher Education* 11,2: 70-79.
- Miller, R, J Bradbury & K Pedley 1998. Academic Performance of First and Second Language Students: Disadvantage and Under-preparedness. *South African Journal of Science* 94: 103-107.
- Miller, R & J Bradbury 1999. Academic Performance of First and Second Language Students: Selection Criteria. *South African Journal of Science* 95: 30-34
- Miller, R, J Bradbury & P Dayaram 1999. The Half-life of Semester-long Learning. *South African Journal of Higher Education* 13,3: 149-154.
- Miller, R, J Bradbury & G Lemmon 2000. Justifying Means with Ends: Assessment and Academic Performance. *South African Journal of Higher Education* 14,1: 166-173.
- Miller, R, J Bradbury & K Acutt 2001. Academic Performance of First and Second Language Students: A Retrospective Appraisal. *South African Journal of Higher Education* 15,1: 147-153.
- Radford, J 1997. The Changing Purposes of Higher Education. In Radford J,

K Raaheim, P de Vries & R Willimas (eds): *Quantity and Quality in Higher Education*. London: Jessica Kingsley Publishers.

Rumble, G 1992. 'Open learning', 'Distance learning' and the Misuse of Language. In Tait A (ed): *Key Issues in Open Learning*. London: Longman.

SAIDE. 1995. *Open Learning and Distance Education in South Africa*. Swaziland: MacMillan Boleswa Publishers.

SAIDE, 1999. *Criteria for Quality Distance Education in South Africa*. (HYPERLINK <http://www.saide.org.co.za/Dcriteria/intro.htm>)

Smith, P 1987. Distance Education and Educational Change. In Smith, P & M Kelly (eds): *Distance Education and the Mainstream*. London: Croom Helm.

Telford, A 1995. Mixed Mode Delivery: The Best of Both Worlds? In Thomas, D (ed): *Flexible Learning Strategies in Higher and Further Education*. London: Cassell

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# The PhD: Pitfalls and Pathways

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## **Abstract**

A concern about the current performance of higher education research and research training institutions is raised by Qualifications Authorities in various countries. This is compounded by a lack of general acceptance of the need to improve student completion rates and times between first enrolment and graduation, while at the same time, recognising government's responsibility to provide information on completions, to encourage such a focus. This article provides information on postgraduate completions, and provides insights into what PhD examiners look for in dissertations as part of the duties of responsible supervisors and as part of departmental responsibilities towards their doctoral students.

## **Introduction**

James and Baldwin (1999) argue that to work with students to establish a strong conceptual structure and research plan has some implications for supervisors. Supervisors need to train students in the practices and ethics of research in the discipline and students need to develop a sophisticated research conceptualisation. One suggestion is to ensure that all students develop exceptional research concepts, not just exceptional students. This means that the supervisor has to ensure that students must be helped in such a way that they do not lose track of the ultimate goal, namely to contribute to solutions experienced in their particular discipline, and specifically to

refining some aspect of the theoretical framework of their discipline. Reis (2006) argues that lack of understanding of the reasons to complete a doctorate could also have implications for supervisors who need to ensure that they help to reflect growing capital investment in their postgraduate students. Supervisors should remember that the role of supervision remains profoundly ambiguous. Besides coping with the ambiguities of supervision is being complicated because some supervisors fail to keep track of the progress of individual students, and because some supervise because it is expected of them, not because they have a commitment to the creation and growth in a new body of knowledge in their discipline. This article addresses some of these issues around supervision and closes off with a number of case studies that highlight some of the problems that are addressed here.

### **Motivation for this Contribution**

The first author is established at London Business School, and is a regular commentator on business issues for the BBC. The second author is a retired professor of Communication Science who has successfully supervised dozens of masters and doctoral students over the past decade while at the same time having served as external examiner for about a dozen masters and doctoral students. In 2006 he served as the Research Coordinator for MBA and DBA studies at the Graduate School of Business of the University of KwaZulu-Natal where he is also co-supervising masters and doctoral students in Informatics. The third author has been active as a postgraduate supervisor and examiner in Informatics and Business Management for at the University of KwaZulu-Natal the past four years. He has recently accepted appointment as a professor in Informatics in the School of Computing at the University of South Africa.

This article presents a consensus position derived from a reflection on some of the authors' individual experiences as supervisors and examiners of doctoral students over the past decade. As a contribution to problem-based research, the article distils some general solutions for the problems identified here and more specifically to provide guidance to those who are in the process of doing their own PhD research. It focuses on pitfalls that could entrap supervisors and doctoral students as well as on pathways around them.

Agreeing to be an examiner for a PhD thesis is not a responsibility that we take on lightly. Also, we find the task of examining someone face-to-face as panel members during the subsequent *viva voce* (the candidate's oral defence of the thesis) to be daunting and stressful, particularly when knowing that the candidate may have invested considerable time, resources and emotion in producing the thesis. The candidate, particularly if s/he is a member of staff or has been funded by an employer, will also be under considerable pressure to get the PhD qualification and will lose considerable face if s/he fails. Candidates may also consider litigation if things are not done 'by the book', or if they feel they have other grounds for complaint.

The candidate's supervisor will also be under pressure because all supervisors are aware that their supervision skills are being examined along with the candidate's thesis. From a supervisor's perspective having a PhD 'go wrong' will create all kinds of problems, particularly in the higher education sector that is now overtly managerial, festooned with targets and populated by "quality assurors" often in central departments who have to be seen to control quality so that they can demonstrate that they are doing their jobs properly as the custodians of the university's holy grail of quality upon which its ranking depends. A reading of the Times Higher in England reveals that a number of institutions (yes, even those in the Russell Group) have been sued for not providing adequate supervision after a PhD has been failed. In one case a candidate who failed a PhD sued a university for not having been thrown out at the end of the first year of postgraduate studies, and for allowing the submission of a thesis that was subsequently found not to be up to the mark.

In a nutshell, examining a good PhD could be a rewarding experience where even the examiner feels that s/he has learnt from a well-crafted, up-to-date piece of research. Examining a poor PhD could be a nightmare and both a worrying and stressful experience. The trick for candidates – and their supervisors – is to make sure that the thesis being submitted is 'a well-crafted up-to-date piece of work'. While we have had the pleasure of examining such theses, some our experiences have unfortunately also been with examining poor theses that either had to be failed outright, or that had to be returned to the examination sections of host institutions with a clear set of recommendations to the candidates, identifying how the work should be

recast, rewritten and resubmitted (usually in a period of not less than one year). The authors would like to emphasise that they only fail a PhD as a last resort if the work submitted is considered flawed beyond rectification.

### **Problems around Postgraduate Supervision that Prompted this Contribution**

In this section the authors briefly look at general problems that relate to postgraduate supervision and examination, followed by problems experienced with the supervision and examination of business-related doctorates. However, before considering particular problems, the authors would like to bring into focus three cumulative (rather than supplanting) fundamental shifts that universities have undergone over time, easily lost sight of, that form part of the complex background of supervising and examining PhD theses.

#### ***The Three Shifts***

Three fundamental shifts in our view characterise the rise and development of universities in the Western tradition, namely the *secularisation*, *commoditisation* and *democratisation* of knowledge. Secularisation entails that there are no fields of enquiry beyond the bounds of human intellectual pursuit. Commoditisation entails that research must contribute to society by solving 'real world' problems. Democratisation entails a critical reassessment of the assumptions that underpin what is considered to be valid knowledge in Western civilisation.

The first shift already started taking place at the Renaissance period when universities emerged from religious institutions as independent institutions of knowledge, not under the sway of religious institutions. The first shift can therefore be characterised as the emancipative *secularisation of knowledge*. Secularisation of knowledge entails in principle that the values and norms that regulate knowledge exist in the inherent logic of knowledge itself, and not in religious or philosophical traditions, to be derived through critical reasoning.

The second shift, which started in universities around the middle of the 20<sup>th</sup> century in free enterprise culturally enriched open societies, and which now has become the norm rather than the exception, can be characterised as the *commoditisation of knowledge* because funding providers and students alike insist that higher education qualifications should lead to employability and should contribute to finding solutions for social and economic problems by means of problem-based research. In this regard Reis (2006) argues that universities need to see themselves as academic *enterprises*. Similarly, Martin *et al.* (2001) argue that because funding plays a role in higher education it could help improve academic efficiency. Supervisors in all disciplines therefore need to be aware of the micro-economics of control in universities because universities themselves have become commodities that are ranked on league tables for students as potential customers. In the before-mentioned commoditisation context it should also be remembered that as customers, students are also potential litigants.

The third shift, namely the *democratisation of knowledge* (sometimes also referred to as the indigenisation of knowledge), is prevalent in recently emancipated societies like South Africa. From an epistemological and ontological perspective this approach requires that higher education institutions critically reassess Western assumptions about knowledge and recognise indigenous knowledge as a legitimate object of sustained research. It furthermore sees knowledge as a tool for social transformation to achieve social justice by making learning accessible to students from previously disenfranchised sectors of society in order to facilitate access to previously inaccessible societal infrastructures.

### ***General Problems around the Supervision and Examination of Postgraduate Theses***

Supervisors are sometimes caught in the crossfire between reformists who require the democratisation of education and commoditisation pragmatists in university administrations who require brisk throughput rates. In view of the general perception that students with good grades are more inclined to finish a course of studies in good time, good grades have become a key variable

among admission criteria in disciplines where there are more applications than available study positions. Edwards (2002) points out that funding at universities has been reduced to four years for a doctorate. The pressure is now on universities to ensure that students complete their studies within this time frame. The term “timely completion” has drawn the attention of academic administrators because it can be quantified and be used as an instrument of accountability (Edwards, 2002).

Dropout rates are higher in disciplines or in research topics where more autonomy is required of students, while discipline-specific conventions and traditions also play a role. Edwards (2002) identifies a number of problems around postgraduate supervision from the student’s perspective, namely incompatibility with one’s supervisor, finding few supporting structures, isolation and confusion over resources. According to Martin *et al.*, (2001) the gender of a student could also play a role in the completion of postgraduate studies.

### ***Problems with Supervising Postgraduate Business Degrees***

There are several problems that affect supervision of postgraduate business degrees, and which in our view contribute to the downfall of this degree. It is our perception that the commoditisation process is more pronounced in business studies than in other disciplines. The workloads of individual staff members are a problem, particularly in disciplines that offer ancillary courses for related disciplines, making it difficult for some academics to engage in research and publication, both of which usually combine to serve as a springboard for postgraduate supervision. Another problem that many supervisors experience is to define original research, or how to gain enough experience in a topic that falls outside one’s field of expertise. A further problem is aligning the specific thesis requirements with the generic learning outcomes required by qualifications authorities (e.g. SAQA in South Africa). A further problem is to assess the adequacy of research libraries and to ensure that students review the required number of relevant references.

There are several aspects of supervision that are difficult to quantify from a supervisor’s perspective, but that in our view nevertheless should be

explicitly attended to as part of formalising the supervision process. Some of them are:

- the formalisation of the supervisor-student relationship
- how to facilitate an individual student's transition into postgraduate research
- how to establish a meeting of minds with each student
- the number and duration of consultation sessions with students
- criteria for continuous student evaluation
- how to examine specific subsections of work produced by students and give timely feedback that clearly differentiates between advice that could be taken at the student's discretion and directives that require implementation
- how to record a student's progress after each consultation session
- how to use such student progress records to give an occasional account of one's supervisory activities
- the criteria for being rated by graduates for the quality of one's supervision
- the division of labour in the case of co-supervision
- how to remain a quality control gatekeeper rather than becoming a co-author of dissertations
- and finally, how to help graduate students to publish and disseminate research findings after they had obtained their formal qualifications

## **Ensuring Relevant Research**

The best way to ensure relevance is to use a problem based research approach that focuses on an actual unresolved problem (or problem set). A thorough literature review is the keystone to ensure that the researcher is not reinventing the wheel by attending to problems that have already been solved:

- to what extent prior research has found solutions, enabling one to eliminate solved problems, identify yet unresolved ones and

thereby strategically locating one's research in relation to ongoing research in the field

- what the most appropriate research methodology would be to employ in order to solve the problems that one sets out to do
- how to design a research instrument that will enable one to answer specific research questions and thereby give a precise account of the extent to which one has been able solve the specific problem/s that one set out to do
- what the most appropriate theoretical framework would be to constrain the interpretation of one's own empirical results and to ensure that one's research is actually contributing to a relevant theory of one's discipline

In order for a student to successfully conduct relevant research, beginning with a thorough literature review, there needs to be a meeting of minds, based on a relationship of trust between student and supervisor in order for the student to tap into the expertise of the supervisor. In this regard James and Baldwin (1999) say that it is crucial for supervisors to get to know individual postgraduate students better and to carefully assess their individual needs. James and Baldwin further emphasise that the supervisor needs to spend time with the student to define the principal requirements of a thesis and to draft a timetable that also provides for dealing with last minute problems. Each person is unique and some people are reticent to reveal their true selves for reasons best known to them. A good supervisor will also encourage students to get involved in departmental activities such as occasional seminars, motivate them and work with them to establish a strong conceptual research framework and to develop a specific research plan. All of these require different individual approaches. It is worth noting that at the beginning of the supervision process the supervisor holds the balance of power which s/he gradually transfers to the researcher as the latter gains expertise in the field of study. What good supervisors never relinquishes, however, is the responsibility of being a quality control guardians in service of their fields of expertise.

Supervisors and students need to look at new approaches to ensure that they are focusing on the cutting-edge problems and not just on run-of-

the-mill topics. Supervisors should from the outset and throughout ensure that the student's written output remains concise, coherent and lucid, and that the various subsections remain properly aligned from the title page to the index.

Edwards (2002) argues that mandatory training of postgraduate supervisors has grown and is an approach that should be kept going. This is because of possible litigation by students due to a poor supervision. He notes that the transmission of tacit knowledge and experience are dismissed because they are not deemed to be the best approach. This is also because there is a lack of professional judgment and increasing bureaucratic surveillance of supervision and an emphasis on quantifiable outcomes with verifiable results (Edwards, 2002).

Yet, in spite of efforts to cultivate supervisors in droves, supervision, if approached properly, requires a genuinely complex set of tacit conceptual skills rather than taught ones. Competence to supervise is taken for granted among senior academics rather than being considered an incrementally and experientially acquired ability that is gradually transferred to students as they gain expertise. Because novice researchers did not ingest these tacit skills with mothers' milk, besides regular mind-stretch individual consultation sessions entailing robust supervision, novice researchers should also be intentionally and explicitly exposed to events and activities that impart specific research competencies, and that will allow them to network with other researchers in their chosen field of eventual expertise, e.g. by contributing to seminars, workshops and conferences.

Good supervision includes exposing the candidate to the uncertainty of outcomes inherent in authentic research, fear of failure, self-doubt, self-assessment, the need to make difficult decisions, the need to develop a structured research environment and a coherent conceptual framework to make sense of results, and finally, a mind frame of perfectionism that will not consider first attempts and initial formulations to be good enough.

Feedback approaches should be the main gauge by which both parties measure whether the supervision is successful because it must be timely, thorough and critical and given within a supportive personal relationship between supervisor and student. Approaches by the supervisor should ensure

that explicit protocols of supervision is followed, ensuring that the student/supervisors relationship is a lengthy and worthwhile one. Peer support and mentoring is an approach that can be regarded as a persistence enhancer.

## **The Pedagogical Basis of Good Supervision**

Edwards (2002) argues that a pedagogical basis could be used during the project by engaging a critical reflexive view of supervision, focusing on the relationship between teaching and learning and looking in particular at the complexities of the pedagogical practice associated with advanced level postgraduate supervision.

Highlighted practices are guided by some principles like supervision implies the fundamentals of good teaching, concern for students, interest in their progress and the provision of thoughtful and timely feedback. James and Baldwin (1999) also note that supervision is an intensive form of teaching and requires much energy because of a professional commitment needed for every student. The problem of personal problems can place a burden on the supervision because the student may not to pay full attention to requirements. Implications can also be that the individual is affected because of preferences by the student (especially cultural differences and this could impact on the student finishing off the degree) (James & Baldwin, 1999). The implication of possible failure has an impact on students' moods and they will move through different phases (excitement, despair, boredom and confidence). Edwards (2002) notes that supervisors should value these mood shift phases that students go through. Finally, supervisors are knowledgeable agents that can learn from one another about the supervision process.

## **What Distinguishes a Good PhD Thesis from a Poor One?**

In this section and subsequent sections of this contribution the authors are articulating a consensus position. As a recent article stresses, when an examiner is looking at a PhD s/he should always remember that what is examined is a PhD and not a submission for a Nobel Prize (Mullins & Kiley, 2002). Despite having examined a number of PhDs and having read several

books and articles about the PhD it is a difficult task to set down on paper the criteria that one would use unambiguously to define 'PhD-ness'. As Mullins and Kiley (2002:369) point out there is little well researched evidence about the examination of PhDs and the field is characterised by 'anecdotes, generally of the traumatic kind'. Unfortunately, we have a number of traumatic anecdotes.

Our consensus view of the PhD is that it is the process by which one serves one's academic apprenticeship. It is where candidates acquire the skills needed to become independently minded academics who can conduct research in a rigorous way. It is also where they achieve 'mastery' in particular fields (i.e. they become an expert on 'something'). Just as apprentices who graduate into any other 'trade' will still have some way to travel before they become a fully skilled craft worker, so the recent PhD will still have more work to do before s/he becomes a fully skilled academic craft worker. Consequently, we see the PhD candidate as a person who has achieved a certain standard but who still has some way to go along self discovered pathways around shortcut pitfalls to perfect newly acquired research skills. The PhD thesis should demonstrate both the candidate's current level of achievement and the potential of the candidate to go further and become an accomplished researcher in their own right.

Perry (1994) argues that a PhD (both person and thesis) should satisfy three criteria:

1. A PhD should make a distinct contribution to a body of knowledge through an original investigation or testing of ideas to a standard which is worthy of publication - this is, in our view, the acid test;
2. The researcher has demonstrated a level of competence in the design and implementation of a research process, including knowing how to collect evidence, an understanding of, and competence in, appropriate research techniques and an ability to report and evaluate the significance of research findings in the context of an existing body of knowledge, and
3. The candidate has achieved mastery of a body of knowledge, including an ability to make critical use of published

work and source materials with an appreciation of the relationship of their field of research to the wider field of knowledge.

Even though these criteria sound reasonably explicit, the problem for an examiner is how to apply these standards by the critical application of their own 'academic judgement'. It is interesting to note that the regulations in many institutions allow students to appeal against decisions on a host of issues (largely procedural) but few will countenance an appeal against the academic judgement of the external examiner. Where there is a 'split decision', most universities will call in an additional examiner and ask them to adjudicate. Some of us have been involved in cases such as these.

If we consider Perry's three criteria, we can raise issues with all of them. If we are to use 'publishability' as a robust test of academic merit, does this mean that the work should be publishable in a top flight academic journal or be publishable in some low rated, low status pseudo-academic or practitioner journal? How do we define and assess competence in research design? How can the candidate demonstrate 'mastery' and, more important, what constitutes 'mastery'? Researchers into the PhD process have commented on the 'indeterminacy' of many of these criteria (Mullins & Kiley, 2002:371). The greyness and indeterminacy of these criteria mean that the examiner's academic judgement is absolutely critical.

While, as academics, we should all be familiar with the criteria that demarcate good research from bad, and we should be unbiased and fair in the way we make our academic judgements, we have found ourselves to be very tested in a number of *vivas* we have participated in. What we propose to do in the rest of this paper, is to discuss how we have made the decisions we have in some of the *vivas* we have participated in. We will also discuss the process we go through in examining the thesis both in our private reading of the work and in the *viva*.

## **How do we Examine a Thesis, and What Process do We Go Through?**

The process often starts with someone 'chatting you up' at a conference or a

phone call or an email in which you are asked to be an external examiner. You feel flattered - and sometimes this is the only reward you are going to get. At this point the student might be a few months away from completion – if they are, this is a good insight that the supervisor is well organised and is planning ahead. The thesis arrives and you are normally given six weeks to read it before the *viva*. You have a flick through it and, if it looks OK, you feel inclined to read it. If it looks dodgy, there is a real temptation to put off reading it.

So, what distinguishes OK from dodgy? The abstract, the list of contents and the first few pages are often very informative. Spelling mistakes and typos in the first few pages never bode well and indicate to us that if the candidate is prepared to be sloppy in the way they present research that they were probably sloppy in the way that they did their research. A contents page that does not provide a clear logical and sequential overview of the thesis also gives a strong hint of problems to come in that the candidate is demonstrating that they have not developed a logical and coherent research plan. Indifferent presentation and untidiness are also powerful indicators of problems to come. A good indication of the quality of the thesis can also be gauged by checking if the references cited in the text have been listed in the reference section and also by scanning the reference list to see which journals the candidate has used most intensively. A review of the material sent by the university to accompany the thesis is also insightful – particularly if one can determine the length of time that the candidate has been registered. Our observation is that long gestation PhDs are often problematic.

To read a thesis carefully and to make notes to support the conduct of the *viva* will generally take us 2 to 3 days – sometimes longer, also for good theses. In total (including the eventual *viva*) examining a PhD takes us at least 3 and often 4 or more days. Our usual approach is to try to read the entire thesis from beginning to end and to make copious notes on the thesis. Sometimes we feel that we have written more than the candidate (we haven't – it just feels like it). Our attitude to the thesis and the candidate improves considerably if the thesis is easy to read, well written, well signposted, lacks grammatical/ syntactical errors, is well structured, has a well developed narrative (it has to tell a story) and is carefully presented. We use Post-it

notes extensively to mark key pages and to make comments that we will follow up during the viva. As we start to read the thesis, we are looking for things that make us feel 'comfortable' with the thesis and by inference the candidate and their supervisor. Things that make you feel 'uncomfortable' tend to reinforce each other and make you look harder for problems and to become suspicious. One of the most worrying things is when you come across two sections of the thesis where one section written in perfect, grammatical English and the other isn't. You immediately start to ask yourself if one person has written the entire thesis or if some sections have been cut and paste from other locations.

A good thesis takes less time to read and examine than a poor thesis. With a poor thesis, the examiner has to develop a robust case for defending his/her position in any recommendation that he/she might make. Most universities ask examiners to write a pre-viva report and to submit it to the University's research office prior to the viva. Here, the examiner is asked to indicate if they think holding the viva would be worthwhile. If the examiner thinks the thesis is too weak to be examined, s/he might take this option though this would reflect very badly on the supervisor and the institution. The examiner is usually asked if s/he wishes to make a preliminary judgement on the thesis (pass, pass with minor modifications, major modifications down to outright fail) but many examiners tend not to commit themselves until the candidate has had time to defend him/herself at the viva. We rarely commit at this point unless we feel that there is a cast iron case for us taking the decision we will eventually make. Our view is that the candidate should have the opportunity to defend her/himself. However, it is our experience that the viva confirms our prior expectations: a poor thesis is usually accompanied by a poor defence.

So, when examining a thesis, what do we look for? We have listed below some of the questions and issues that we wish to see properly addressed in the thesis and defended at viva:

- Has the candidate formulated a proper problem statement, consisting of a general problem that is decomposed into interrelated sub-problems, or alternately a research question?
- Have the research aims and objectives been clearly articulated?

- Has the candidate adequately reviewed the literature to determine solutions proposed by other researchers for problems identified, the most appropriate research methodology to employ and the most appropriate theoretical framework to constrain the eventual interpretation of the researcher's own research results?
- Is the candidate aware of the current debates in their field?
- Have any key papers, authors or journals been omitted from the review?
- Has the literature been subject to an insightful critique and synthesis or just summarised, or even worse, just listed?
- Has the candidate defined the current 'knowledge boundary' and identified how s/he proposes to move that boundary forward?
- Have the theoretical underpinnings of the research project been clearly articulated?
- Have other theoretical frameworks been reviewed?
- Is there conceptual clarity?
- Do the conjectures to be tested flow logically from the theoretical base?
- Is the methodology appropriate for the testing of these conjectures given the underpinning theory?
- Have the concepts been adequately 'operationalised' and have these 'operationalisations' been adequately justified?
- Has the approach to evidence collection been properly designed and has it generated robust evidence?
- Is the sample size/base of evidence adequate for the research design?
- Have the analytical techniques that have been used been properly applied?
- Have we been given enough information to let us make up our own mind about the reliability and validity of the results?
- Have the conjectures/hypotheses been refuted or not?
- Have the findings been adequately assessed in the context of the literature review and existing theory?
- Has the candidate demonstrated a mastery of 'key' research skills?
- Are the findings of academic and/or practitioner significance?

- Has the candidate done what they claimed they would do in the introduction?
- Are there any logical inconsistencies?
- Are there any major flaws in the chain of argumentation?
- Is the candidate aware of any major (theoretical or methodological) criticisms that could be levied at their research?
- Do the conclusions properly 'close down' all aspects of the research?
- Is there a contribution to knowledge and, if so, what is it?
- Is the thesis well written and well presented? Is there 'clarity of exposition'?
- Does the thesis tell us a story? Is there a narrative? Is the thesis well signposted internally?
- Do we feel comfortable that this person is really an expert in their field?
- Has the candidate demonstrated originality?
- Do we think parts of the thesis are publishable in a 'reasonable' journal?

When we were undertaking our own doctoral research, our supervisors actively encouraged us to present papers at 'good' conferences and to get parts of our thesis published in reputable scholarly journals before we submitted our theses for examination. When we submitted our theses, we appended these publications to the thesis. We feel that these are good tactics as the candidate gets known on the 'conference circuit' and, if published work is appended that has gone through the review process of a reasonable journal, then the candidate is providing clear evidence of the 'publishability' of their thesis and the originality of their research to the examiner. If the candidate can refer to, or append, their own published work in the thesis, our view is that this will strengthen their case for being awarded the PhD.

### **Instructive Negative Experiences**

Having outlined our approach to examining a PhD prior to holding the viva, from which supervisors and PhD candidates can discern pathways around the various pitfalls of failure, we would like to describe some of the experiences

we have had in examining PhDs by discussing some of the more blatant problems that we have had to confront. We accept that in the cases below we have emphasised the problems that we have had to address as an external examiner and that the cases focus far more on the 'negatives' than the 'positives'. We present these examples as instructive 'beyond this point there be monsters' warnings along the path to successful research.

***Case 1: A member of staff at a university who was about to run out of time in his/her registration for a PhD***

This was a long gestation PhD with a chequered supervision history. A decision had been made to submit the thesis for viva as, under the regulations of the institution, submission would give the candidate an extra year to complete the thesis (this was not disclosed to the external examiner prior to the examination). The thesis had major flaws: there was no clear methodology; the literature had been badly reviewed with key elements of the literature being conspicuously absent; the thesis was badly written in a flippant style; there were serious flaws with both evidence collection and analysis; and, the theoretical basis of the work was weak. Clearly, the thesis was not at the required standard and the opinion was that the candidate had been very badly supervised; that the thesis required significantly more work; and that the institution should find the candidate a competent supervisor. The candidate was asked to resubmit the thesis in not less than one year.

***Case 2: A member of staff at a university who had been registered for (well) over ten years***

Again, this was a long gestation thesis in which the research question had long ceased to be relevant. The evidence collected was substantially out of date. The literature was not 'reviewed' but 'listed' in that each sentence in the literature review chapter began with an author's name followed by an almost verbatim rendition of the key points of the paper 'cut and paste' from the journal article. The literature had certainly not been synthesised to provide a distillation of the key issues. The candidate was unaware of recent debates in the field and recent literature was conspicuously absent. The thesis was badly written. During the viva, the candidate was aggressive and unwilling or unable to see the examiners' collective point of view. The

candidate was asked to resubmit the thesis in a substantially revised format for consideration for a PhD in not less than a year. On resubmission the candidate was awarded an MPhil. A threat to appeal against the academic competence of the examiners was made by the candidate but not pursued.

***Case 3: An overseas student at a UK university who had been registered for over six years***

The candidate had had a number of supervisors. This 'churn' in supervision had been caused by significant staff turnover at the institution. The candidate was currently being supervised by a person who was (clearly) not an expert in the field and while the supervisor had made reasonable attempts to supervise the candidate the lack of detailed subject knowledge was very evident. The thesis contained major flaws in terms of the conceptualisation of the research; the inappropriate use of statistical techniques; a poor writing style; and, a poorly conducted literature review. The candidate, during the viva, was given clear guidance on what the examiners thought were the core problems of the thesis and was asked to resubmit in not less than one year.

***Case 4: A student at a business school with no research plan***

The student started off with a researchable idea but changed supervisor as regular as someone who changes clothes. The student carried out his research *but* never presented his research proposal. He used a present instrument from another study to collect data and paid all the money to the statistician without getting approval from either his supervisor or the university. He was similar to the 'I did it my way' case except that he eventually got stuck. He had to present his research proposal to a higher degrees committee which turned the presentation down. In the meantime he paid thousands of pounds to someone to do his statistics for him without approval from the university's ethics committee.

When he ended up with another supervisor he was advised to shorten his 80 page proposal to a manageable length as well as his 120 page literature review. His comments were that the supervisor must tell him what to cut out. Obviously this comment was ignored by the supervisor. He then advised the new supervisor that he already collected the data and that the supervisor must tell the statistician what must be done, openly admitting that he knew nothing of the statistical analysis required to validate the research.

Eventually the supervisor withdrew from supervising the student because it was clear that this student was trying his utmost to get a PhD degree with the minimal amount of personal exertion. The university allocated a new supervisor with the candidate who had to start all over again.

In three of the cases listed above, the external examiner subsequently experienced major problems while examining the eventual thesis. In each instance, the external examiner could easily have made out a case for failing the candidate outright without having given them any opportunity to remedy their work. In two of the three cases, the external examiners let it be known that the problem was not solely that of poor research but also of poor supervision and lack of quality control at the host institutions. In two cases, the candidates had, without doubt, been indifferently and ineffectively supervised and the theses had been prematurely submitted.

## **How Do We Conduct a *Viva*?**

Different institutions have different regulations and protocols for conducting *vivas*. In some institutions, a neutral chairperson is used to ensure adherence to the University's regulations. In other institutions the supervisor can be present (but may not speak unless invited to do so by the examiners) In yet other institutions the supervisor is excluded from the *viva*. *Vivas* are tense and potentially stressful events: tears of joy - and sadness - are not unknown. *Vivas* are events to be taken very seriously and, in the age of the litigious student, to be run in strict accordance with the regulations of the hosting institution. It is our view that the candidate should be given every opportunity to show her/himself in a positive light.

Our approach is to develop a set of detailed questions before the *viva* and to share these with the internal examiner prior to the *viva*. We then agree on a strategy for running the *viva* with the other examiner(s). Our yardstick normally is that the candidate should be speaking for certainly over 80% of the time and preferably over 90% of the time as the *viva* is their opportunity to impress us with how much they know. To be candid, our first objective is to make sure that the thesis is their own work and that they know it inside out. One can only determine this by getting a candidate to do most of the talking.

An approach to asking questions is to work our way through the thesis sequentially asking 'top level' questions such as:

- Could you discuss why you selected your research problem/ question and why did you articulate it in the way you did?
- What debates are current in the literature in your field?
- What theoretical perspectives did you consider?
- Could you discuss the core concepts you have used?
- Why did you choose the theory/analytical framework that you did?
- Discuss and justify your methodological stance?
- How did you collect your evidence?
- Why did you choose to analyse it in the way you did?
- What did you find out?
- What is the academic/practitioner significance of what you found out?
- How does what you found out fit within the context of your literature review?
- What is originality in what you have done?
- What new knowledge, insights, frameworks or models have you identified or developed?
- What, with hindsight, would you have done differently?
- What have you learnt from your experiences?

While the above list will usually form the 'top level' questions, we will use detailed notes from the thesis to explore issues specific to the thesis particularly if techniques have been misapplied or we want to get the candidate to justify the choices they have made in more detail. A good viva is one where the candidate engages in a robust discussion of their work, is encouraged to demonstrate the full extent of their subject knowledge and is

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able to demonstrate that they have acquired mastery of the skills needed to do good quality research. A poor *viva* is one where the student feels that they are on the defensive, feels that he/she is being 'interrogated' or one where the examiners are doing most of the talking. At one *viva*, one of us asked the student several questions to which his answer was "It's in the thesis". Not only will this antagonise an external examiner, the candidate is also missing out on an opportunity to put their subject knowledge on display and to demonstrate 'mastery'. A *viva* is not a forum where modesty and reticence are good tactics. Actions that raise the critical stickles of the examiners are not recommended.

### **What Lessons have we Learnt?**

Having examined a number of doctoral theses and having been a *viva* chair in several others, we are yet to experience a PhD being given an outright 'pass' on the day of the *viva*. In one case, we recommended an outright fail on resubmission and in another case we have recommended that a PhD on resubmission be resubmitted again for an MPhil. These are decisions we have not taken lightly but unfortunately, the *viva* is the place where problems in the history of the PhD tend to 'float to the surface'. In a number of instances, our view is that the candidates have not only been badly supervised but also badly advised. In these cases we have tried to be 'lenient' by recommending both a resubmission (usually in not less than a year) *and* a change of supervisor.

The lessons we have learnt from the experiences we have been through range from the trivial to the structural. At a trivial level, the small things do count. If a thesis is littered with typos and grammatical mistakes, references are missing, referencing is inconsistent, figures and tables are sloppily produced and different font sizes are used, the examiner is going to be antagonised. Many examiners we have spoken to feel insulted that the candidate has neither taken sufficient time nor effort to get the basics right. Unfortunately, those theses where the basics have not been got right are invariably those with more significant problems.

Some of the theses we have examined have had major and very evident problems that should have been spotted by the candidate's supervisor prior to submission. These have included problems related to the

structure of the thesis, inadequate literature reviews, flawed argumentation, wrongly applied analytical techniques, inappropriate choice of theory, the inappropriate mixing of different research styles, badly articulated research questions and research questions losing their relevance because of the length of registration of the candidate. Many of these problems are avoidable but all too often not avoided. In this case, we should also add the caveat that applies to many supervisors 'let he who is without sin amongst you cast the first stone'.

Conducting a *viva* can be a challenging experience when the examiner encounters, face-to-face, a candidate that one could justify failing. However, in failing the candidate you would also be failing their supervisor/s and their host institution. Politically, this can be very difficult.

Many years ago, one of us met a driving test instructor and he was asked how he *really* made the decision who to pass or fail. He told one of the authors that he imagined the candidate driving a car with the examiner's wife and children sitting on the back seat. He said if he felt they would be safe in the hands of the learner, he would pass them but if he felt they would not be safe he simply found an excuse for failing the candidate. We sometimes feel the same in examining a PhD student. If we feel that they could run a major research grant from a funding council 'safely' based on the way they have conducted and presented their own doctoral research, then we think we should pass them. After all it's not a Nobel Prize.

## **Conclusion**

This article covers the importance that supervisors, external examiners and the *viva voce* play in any postgraduate students' life. It pointed out a number of pitfalls along the journey to academic success, and pathways around them. Finally, it hopefully demystified the process of examining a thesis, and what happens during the *viva voce*. It also explains what the student should know and how s/he should go about in order to safely pass through the final potential pitfall to success, the *viva voce*.

## References

- Edwards B 2002. Postgraduate Supervision: Is having a PhD Enough? Australian Association for research in Education Conference, Brisbane, Australia
- James R & G Baldwin 1999. Eleven Practices of Effective Supervisors. Centre for the Study of Higher Education and the Faculty of Graduate Research, The University of Melbourne.
- Martin YM, M Maclachlan & T Karmel 2001. Postgraduate Completion Rates, Occasional Paper Series, DET and Youth Affairs, Australia.
- Mullins, G & M Kiley 2002. It's a PhD, not a Nobel Prize': How Experienced Examiners Assess Research Theses. *Studies in Higher Education* 27,4:369-386.
- Perry, C 1994. Approach to Presenting PhD Theses: Notes for Candidates and their Supervisors. *Paper presented to the ANZ Doctoral Colloquium* University of Sydney, February. Later additions 28<sup>th</sup> December 1997. Available of MRC web pages.

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# Ergonomic Design of IT Teaching Laboratories

Anesh Maniraj Singh

## Abstract

African Universities and especially Historically Disadvantaged South African institutions use the traditional "chalk-and-talk" method of delivering practical computer lessons which are instructor led sessions conducted in laboratories. The design of laboratories has to be conducive to learning. Laboratories that are designed using ergonomic principles tend to be more user-friendly and facilitate the learning process. This raises the question: are University computer teaching laboratories ergonomically designed for the comfort of the student? In order to answer this question, this study was conducted at the University of Kwazulu Natal-Westville campus in the Department of Information Systems and Technology. A convenience sample of one hundred first year students was used. A simple questionnaire covering the main constructs of the study was administered to the students. It was found that there were a number of significant relationships between the design of the laboratories and student discomfort, some students who were exposed to previous computer training found the University facilities better, although not significantly. Students found lighting, positioning of the screens, ventilation and the direction that they had to face as some of the poor design features of the laboratories. A number of recommendations were made in order to ensure that the design of new laboratories took a learner centric and ergonomic approach which included: students facing the instructor and a projection screen, use of Smartdesks<sup>®</sup>, tiered floors and instructors should have control of lighting and room temperatures. Implementing the recommendations requires large investments. However,

providing a quality learning environment is bound to produce quality graduates.

## Keywords

Information systems, teaching laboratories, ergonomic design, student perceptions, computer-based training

## Introduction

In order to keep pace with globalisation and belonging to the Global Information Society (GIS), Computer Education is growing in importance in South African schools and tertiary institutions. Information Systems and Information Technology are important subjects forming the basis of new curricula. Computer classrooms and laboratories are springing up in these institutions to cater for the demand. Often, it is not possible to build new facilities; hence existing premises are being revamped to cater for computer equipment. However, many of the existing premises were originally designed for something else and don't easily lend themselves to effective computer teaching facilities. In essence it is like "fitting a square peg into a round hole". The learning environment has a major impact on learner's productivity and could be a promoter or inhibitor of success. This study asks the question "are university computer facilities properly designed to promote learning?" In order to answer this question, this study is comprised of a literature review that examines issues in computer room design which is supported by an empirical study that describes the situation in the Department of Information Systems & Technology at the University of Kwa-Zulu Natal (UKZN) in South Africa.

## Human Computer Interaction and Ergonomics

The lengthy periods of time that individuals spend using computers at school, at home and at work have necessitated the study of their interactions with the technology as it has serious implications for their productivity and health. Human Computer Interaction (HCI) can be defined as the study of the interactions between humans and their computers (Dix *et al.* 2003 ). The

purpose of studying HCI is to understand the impact of computers on individuals, groups and organisations in order to create effective, usable and enjoyable experiences with technology. HCI traditionally examines the computer interface such as the screen, keyboards, mouse and peripheral technologies used in computing. However, in order to create effective, usable and enjoyable experiences with computers, the subject goes beyond just the technology, but also extends to the physical environment in which computers are used.

According to Stair and Reynolds (2005), computer usage may affect employee effectiveness, employee stress and physical well being. They further state that medical and legal claims relating to repetitive motion disorder caused from using computers and other equipment are on the increase. Some of these problems stem from the design of the environment in which computers are being used. Ergonomics which is the study of how people use tools to do their work (Lengel 2003), examines the physical environment in which the human computer interaction takes place. According to Dix *et al.* (2003), Ergonomics is an established field closely related to but distinct from HCI. Stedman (in Jermolajew and Newhouse 2003) defines Ergonomics as a branch of ecology dealing with human factors in the design and operation of machines and the physical environment.

The study of Ergonomics especially Environmental Ergonomics is important as it deals primarily with performance (Dix *et al.* 2003). This is supported by Stair and Reynolds (2005), who are of the view that work stressors caused by a poorly designed environment can severely limit productivity and performance. According to Pheasant (in Jermolajew and Newhouse 2003), studying the computer users environment is intended to change things for the better by improving performance, productivity, health, safety and the users overall work experience.

### **Key Issues in Ergonomics**

It is evident from the foregoing that the key issues addressed by Ergonomics are performance, health and computer user satisfaction. It is important to understand these issues in greater detail.

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## **Productivity**

Productivity and employee performance are essential components in achieving a competitive advantage. The automation of processes in itself increases organisational productivity and performance. Processes that are still performed by people have been enhanced by computers leading to productivity and efficiency (Stair & Reynolds 2005). However, computers themselves are not enough to enhance productivity and performance, the work environment and proximity to all the necessary tools such as printers, fax machines, and consumables are equally important. Networked printers and fax machines make no sense in organisations where people have to walk to collect printing or send faxes from communal facilities. Besides the delay in having to walk to collect work, bottlenecks often occur when others are sending work to the same machine. A person who has left his/her workspace may have to wait for his/her job to be processed. Furthermore, communal facilities encourage social gatherings which add to the time spent away from one's workplace. Therefore, an individual's workspace needs to be designed in such a way that all tools required for the job are easily available.

## **Health**

Computer use may affect physical health as well (Stair & Reynolds 2005). Repetitive stress injury (RSI) is a condition that occurs due to repeated stress being placed on a joint and the muscles and tendons surrounding it Starr (2001). The physical impacts of computer usage can be classified into two groups namely musculoskeletal and vision problems.

### ***Musculoskeletal***

According to Starr (2001), common musculoskeletal injuries include:

- Tendonitis which is an inflammation of tendons that causes sharp pains in the fingers making it difficult to hold objects
- Carpal tunnel syndrome which is a condition caused by compression of the median nerve in the hand and wrist which causes wrist pain and a tingling numbness also making it difficult to hold objects

- **Thoracic outlet syndrome**, a condition caused by compression of nerves and blood vessels in the neck and shoulders resulting in neck and back aches.

According to Stair & Reynolds (2005), RSI's can be caused by excessive use of computer keyboards, the mouse and other equipment. However, according to Szabo & King (2000), undue reliance on Ergonomics to treat musculoskeletal disorders to the exclusion of proper diagnosis and treatment to other medical and health risk factors may adversely affect patients. In essence, poor ergonomics may not be the root cause of RSI's.

### ***Vision***

According to Verma (2001), some of the symptoms associated with excessive use of computers include: frequent headaches, blurred or double vision, burning eyes, excessive tearing, dry eyes and frequent blinking and squinting. According to Dhawan (2005), computer related eye problems are mostly as a result of users bad habits. He states further that computer screens do not emit harmful rays; it is merely the fixed focus on the monitor and low blink rates that causes the problems. The effects of the digital age are taking their toll on workers (Blessingame 2001). According to Catz (in Blessingame 2001), the eyes lead to the body and if vision is impaired, soon other functions will also be impaired. According to Blessingame (2001) and Dhawan (2005) there is no wonder cure available to solve the problem. However, simple adjustments such as monitor distance, lighting and a comfortable work environment will help in eye care (Blessingame 2001).

### **Computer User Satisfaction**

According to the Communications Workers of America (2004), job demand stressors which included poor ventilation and heating, poor lighting, poor workstation design and poor training were contributors to workers stress resulting in poor physical and emotional well being. Simple creature comforts can make a job a satisfying experience. Clean and comfortable surroundings add to the ambience and add value to a workers day. A workstation that is well laid out with all the necessary tools in close proximity reduces unnecessary repetitive movement thereby saving a worker

time and effort. Goldstein (2003) found that playing simple computer games may help personal productivity and make people feel better about their jobs.

It is evident that Ergonomics is not merely about creating the perfect physical environment; it is also about creating a healthy and safe environment as much as it is about creating a psychologically ideal environment. The issues discussed thus far are pertinent to organisations and worker productivity, but what link does it have with the computer classroom?

### ***Teaching with Technology***

Due to the information age in which we live, computers are being used more and more for instructional purposes and also to teach computing skills. Learners are exposed to learning environments that should also follow Ergonomic principles in its design to ensure productivity (which is represented by the learners grades), health (learners should also be protected from stressors in the computer classroom), and user satisfaction (learners should enjoy working in the computerised environment). In modern Universities of the Western World, teaching of computer courses such as computer literacy, applications software, and introductory programming, are fast becoming computer based themselves. Students are provided with step-by-step manuals that are accompanied by CD's that contain exercises, and audio visual presentations that guide the learner to perform certain tasks. Some of the CBT (computer based training) packages include self test exercises to reinforce learning and provide the learner with instant feedback on their competence to use a particular product. In developed countries this is possible as University students are exposed to computers and computer education at school, furthermore, their understanding of English, which is the medium of most computer based instruction, makes for easy comprehension and thus application of the instructions being provided. In African Universities, the CBT approach is hampered due to the digital divide that exists in Africa, one of the causes of which is language (Singh 2004). For most African University students, their first encounter with electricity, let alone computers, only takes place at the age of about eighteen when they enter the halls of academia. It is a daunting experience for the student to have to teach himself/herself to use a computer and to follow instructions in

English, which in many cases is not the student's home language. Furthermore, this becomes more challenging when the audio instructions are provided in a foreign accent. It is against this background that African Universities and especially Historically Disadvantaged South African institutions use the traditional "chalk-and-talk" method of delivering practical computer lessons which are instructor led sessions conducted in laboratories. Therefore, the design of laboratories has to be conducive to learning immaterial of what teaching methodology is used.

### ***Designing the Digital Classroom***

Design is the construction of the user experience and it covers many quarters, sometimes multiple and even invisible quarters (Dykstra-Erickson *et al.* 2001). This is supported by Dix *et al.* (2003) who state that the Ergonomic design of computer environments should be conducted by multi-disciplinary teams. These teams could be comprised of Ergonomists, Lecturers, Tutors, Network Specialists, Furniture Designers, Building Contractors and last but not least, the Learner.

### **Drivers of Classroom Design**

According to the British Educational Communications and Technology Agency (Becta 2001), there are two forces that drive the effective design of the digital classroom namely pedagogy and financial resources.

### ***Pedagogy***

Pedagogy refers to the strategies, techniques, and approaches that teachers can use to facilitate learning. Teachers could take a learner centric or teacher centric approach to teaching. There is no single pedagogy that is best, that is, the debate between learner centred or teacher centred, what is being taught will determine the pedagogy (Lengel 2003). Teaching practical computing skills lends itself to the teacher centric model where the teacher stands in front and projects his activities on a large screen and the learners follow on their computers. According to the Coastal Carolina University (CCU) (2003), the ergonomic design of the classroom reflects the preferred

pedagogy and impacts significantly on learner attitudes and achievement. Therefore, pedagogy must drive design.

### ***Financial Resources***

According to Becta (2003), effective Ergonomics is expensive and incurs both capital and running expenses. Therefore, learning institutions must have sufficient resources to maintain and support an ergonomically designed computer classroom.

## **Factors to Consider When Designing the Computer Classroom**

According to the Whole Building Design Guide of 2004, training facilities for adult learners must be flexible, technologically advanced, safe, healthy, comfortable, aesthetically pleasing and accessible. When reading popular literature around this topic, one will find extremely long lists of guidelines where different “experts” (mainly marketing people) make claims for their products. In order to provide an objective list the guide provided will address the following issues: accessibility, lighting, visibility, ventilation, desktops, floor layout and seating.

### ***Accessibility***

According to Jermolajew and Newhouse (2003), the needs of disabled and semi-disabled students need to be catered for. The room must be designed for wheelchairs and a row of seats needs to be dedicated for wheelchair bound students and students with walking devices. Desktops should have adjustable heights to park different sized wheelchairs under them and the desktop should be able to slide back and forth for easy access to the keyboard and mouse.

### ***Lighting***

As mentioned earlier, poor lighting affects vision (Blessingame 2001). There should be no windows behind users as the light from the windows will reflect on the screen making reading difficult (Lengel 2003). Similarly,

writing boards should not be used for projection as it reflects a bright blinding light into the eyes of the audience.

### **Visibility**

High visibility is high priority (Coastal Carolina University 2003), the less learners need to adjust their seats the more likely they are to remain focused. Therefore, corridor style layouts are very effective. Furthermore, the key to effective work is a natural neck and easy eyes (Lengel 2003). Learners who follow the teacher's instructions that are projected at a comfortable height where the neck and the eyes are not straining will be more relaxed and can concentrate on the lesson rather than on aches and pains.

### **Ventilation**

Most computer classroom windows are sealed shut to prevent theft. However, this prevents the flow of fresh air into the classroom. Combined with the heat generated from the computers and the heat from the users, computer classrooms are an ideal breeding ground for germs. According to Becta (2001), the ideal temperature in a computer classroom should be 18-24 degrees Celsius. Therefore air conditioners should be standard equipment. WBDG (2004) recommend that air conditioners should be adjustable to accommodate varying occupancy rates.

### **Desktops**

Becta (2001) recommends that desktops should be high enough for users to put their legs under comfortably. However they should not be so high as to lift monitors to a point where they obscure the users line of sight of the lecturer and projected images. SMARTdesks™ offers two desktops that allow for clear vision. The SR series uses a standard monitor that is sunken into the desktop allowing for greater visibility and a relaxed posture as illustrated in Figure 1.



Figure 1: SMARTdesk™ SR Series

The SMARTdesk™ SS series is illustrated in Figure 2.



Figure 2: SMARTdesk™ SS Series

The SS series has a sub-surface mounted monitor that provides clear forward visibility, but could affect posture dependent on the size of the user. Furthermore, the monitor takes up leg room which could be very uncomfortable for bigger people.

### ***Floor Layout***

Floor layouts are always a contentious issue especially when old classrooms are being converted into computer classrooms. Most organisations in order to get the most mileage for their money cram in as many workstations as they can. This compromises comfort, health, user satisfaction and productivity. The most space efficient floor layout is the Piers layout illustrated in Figure 3.

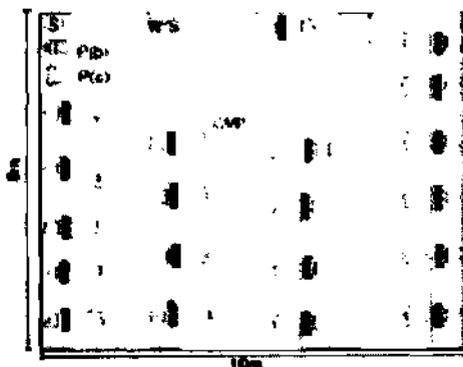


Figure 3: Piers floor layout. Adapted from: British Educational Communications and Technology Agency. 2001.

In the Piers layout, learners have to turn away from their computers to focus on the teacher/lecturer and projected images. The turning of the neck and back could result in repetitive stress injuries.

The Rows or Corridor layout as illustrated in Figure 4, is less space efficient. However, it allows for a more natural posture and line of vision.

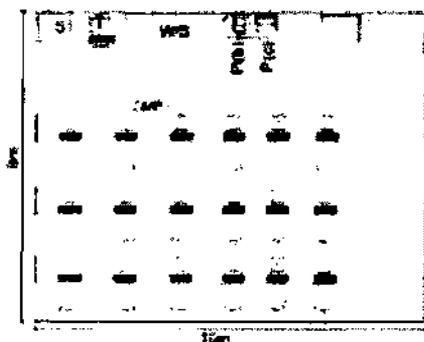


Figure 4: Rows/Corridor floor layout.

Adapted from: British Educational Communications and Technology Agency. 2001.

The Corridor layout usually has excellent viewability (Coastal Carolina University 2003). According to Becta (2001), long thin rooms are more difficult to teach in, therefore, when new rooms are being constructed, they should be more square which reduces the distance between the lecturer and the learner.

### Seating

The correct chairs are the key to healthy comfortable computing (Lengel 2003). According to Becta (2001) chairs should complement the desk height and they should be stable, maneuverable, and adjustable. Learning institutions must recognise that comfort is an important factor of student satisfaction and should obtain quality chairs (Coppola & Thomas 2000).

The list of factors that should be considered in the effective design of computer classrooms is much longer. However, the factors discussed warranted a detailed discussion as they impact on productivity (uncomfortable students are less likely to concentrate on lessons), health (learners facing the wrong directions could strain their necks and backs making adjustments to see the lecturer and projection screen), and learner satisfaction (learners are more likely to complain if their work environment is aesthetically displeasing).

## **Methodology**

### ***Motivation for the Study***

The computer practical teaching classrooms also known as laboratories at the Ex-University of Natal and the Ex University of Durban Westville were poorly designed. There was no evidence of consultation with learners to develop ergonomically sound teaching venues. Due to the merger of the two institutions into the University of Kwazulu Natal, this study was carried out as a means to motivate for ergonomically designed computer teaching rooms.

### ***Sampling and Sample Size***

A convenience sample of 100 first level Information Systems and Technology students was used for the study. The sample size constituted 8.5% of the first year population. However, due to the timing of the study, which was during the examination period, it was not possible to get a larger number of respondents.

### ***Data Collection Tool***

A simple questionnaire was designed by the author. The questionnaire was comprised of demographic questions followed by Likert Scale type questions where respondents had to make a choice of options ranging from strongly disagree to strongly agree. Only two open ended questions were asked to get input from respondents about what they would like to see in the design of their classrooms. The questionnaires were handed out to students who attended revision lectures.

### ***Results***

The data was analysed using SPSS (Statistical Program for the Social Sciences). A number of frequencies, correlations and cross tabulations were generated and are presented as follows.

## Sample Demographics

### *Race and Age Distribution of Respondents*

The sample consisted of 73% African, 25% Indian and 2% Coloured respondents. This is illustrated in Figure 5.

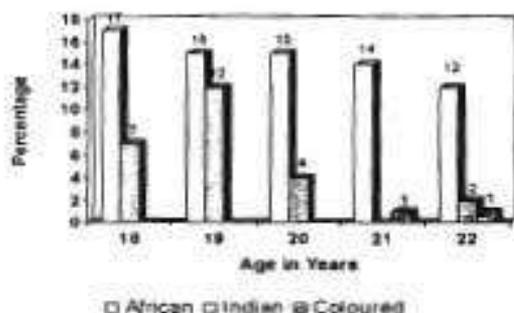


Figure 5: Race and age distribution of respondents.

The majority of the respondents (27%) were 19 years old.

### *Previous Exposure to Computer Training*

The majority of the respondents (57%) had been previously exposed to computer training as illustrated in Figure 6.

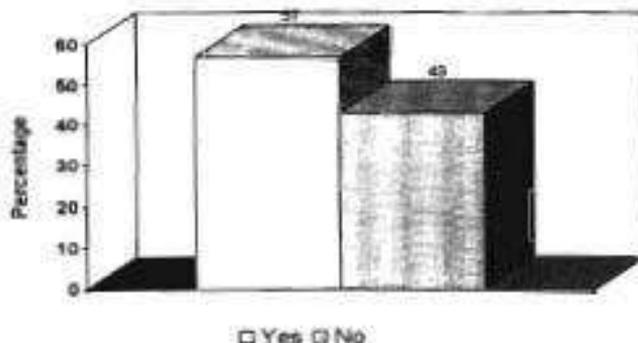


Figure 6: Previous Exposure to Computer Training

Respondents with previous training could provide valuable feedback comparing previous facilities with those of UKZN.

### **UKZN Computer Facilities Compared to Other Facilities**

Of the respondents who studied computers previously, the majority (27%) received computer training at school as illustrated in Figure 7.

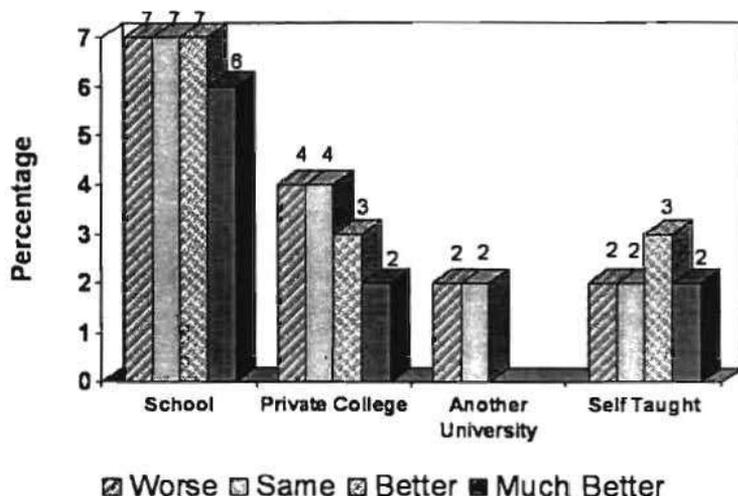


Figure 7: Comparison of UKZN computer facilities in relation to other facilities

There is no significant indication of how the UKZN computer facilities compared with previous facilities. However, 13% felt that the University had better facilities than their Schools. Only 7% felt that their Schools had better facilities.

### **Laboratory Design**

#### ***Student Perceptions of Laboratory Design***

Only 55% of the respondents said they disliked the design of the UKZN

computer laboratories. Figure 8 illustrates the issues that respondents did not like about the laboratory design.

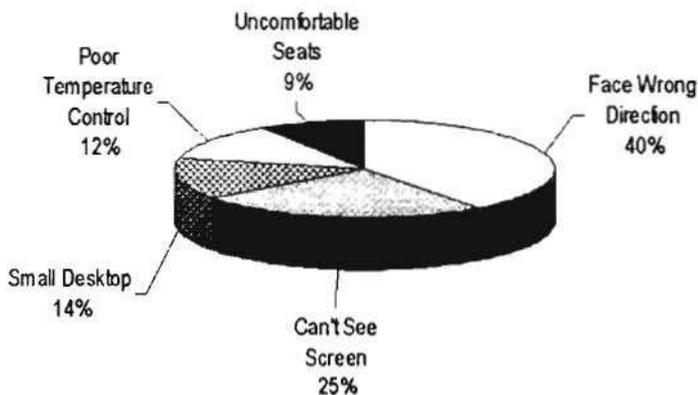


Figure 8: Problems associated with UKZN laboratory design

It is evident that the most pertinent issue related to the laboratory design was the direction which students faced. Forty three percent (43%) felt that the seats faced the wrong way. Many of the respondents (27%) could not see the projection screen. The desktop space (15%), temperature control (13%) and uncomfortable seats were the other issues raised. These findings tie in very closely with the issues raised in the literature review namely desktop design, ventilation, visibility, seating and floor layouts.

## ***Floor Layouts***

### ***Placement of Seats***

The majority of the respondents (49%) strongly agree that the seats should face the screen and tutor, whilst 33% agreed, as illustrated in Figure 9. This would support the Rows/Corridor layout recommended by Becta (2001).

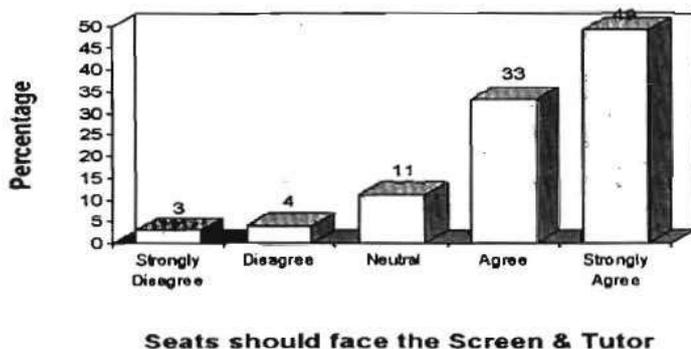


Figure 9: Seating Position

Only 7% of the respondents did not agree that seats should face the screen and tutor.

### Tiered Floors

A large number of respondents (52%) felt that the laboratories should be tiered as illustrated in Figure 10.

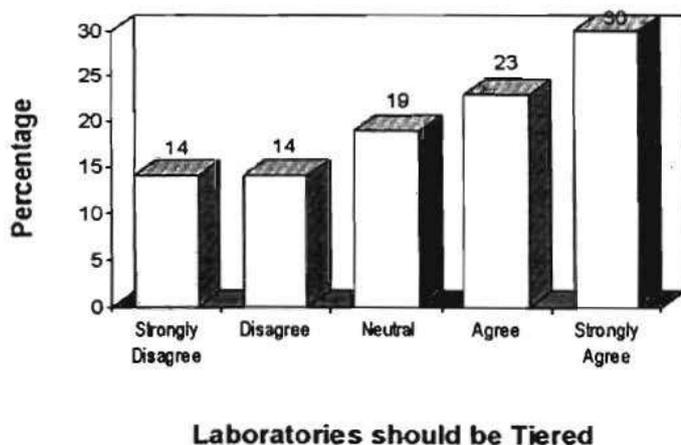


Figure 10: Tiered Floors

It is significant that 28% did not support tiered floors. This could be attributed to the fact that the question may have led them to believe that the rooms would be large, with large numbers of students. The reason for this is that to explain what tiered floors were the questionnaire described one of the large, one thousand seat venues at the university with which the respondents were familiar.

***Repetitive Stress Injuries***

The majority of respondents (93%) felt that they should not have to turn their necks to see the board or screen. Table 1 illustrates the relationship between students with stiff necks and those who felt they should not have to turn their necks to see the board or screen.

		Regular Stiff Neck					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Should not have to turn necks	Strongly Disagree	2	1	0	0	1	4
	Disagree	0	1	0	0	0	1
	Neutral	1	0	1	0	0	2
	Agree	1	5	5	8	4	24
Strongly Agree	0	7	8	21	33	69	

**Table 1: Relationship between neck problems and neck movement**

Of the respondents who felt that they should not have to turn their necks to see the board or screen, 66% also complained of regular stiff necks. Although it is difficult to develop a causal relationship without proper diagnosis, there is prima facie evidence that respondents suffer from thoracic outlet syndrome as a result of repetitive turning to see the board or projection screen. However, on conducting a two tailed Pearson correlation it was found that a strong relationship existed between respondents suffering with stiff necks and regular neck movement. Since the floor layout in the computer laboratories follows the Piers arrangement (Becta 2001), it can be concluded that the floor layout has an impact on user health.

## Miscellaneous Issues

### *Ventilation*

As mentioned earlier, air conditioning plays a part in a computer user's comfort. Very often air conditioning works from a central plant and either runs too warm or too cold, therefore, Becta (2001) recommended that air conditioning should be adjustable. The respondents in the study strongly support this notion as evidenced in Figure 11.

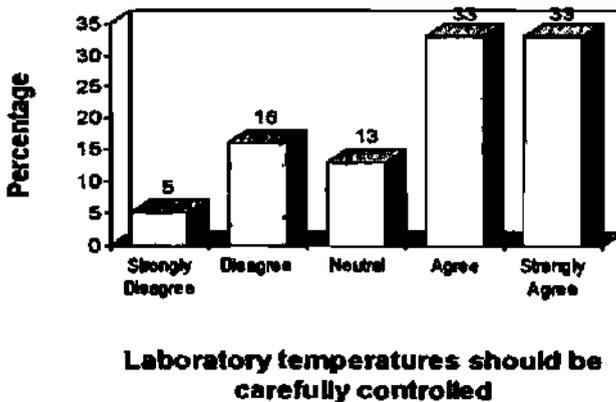
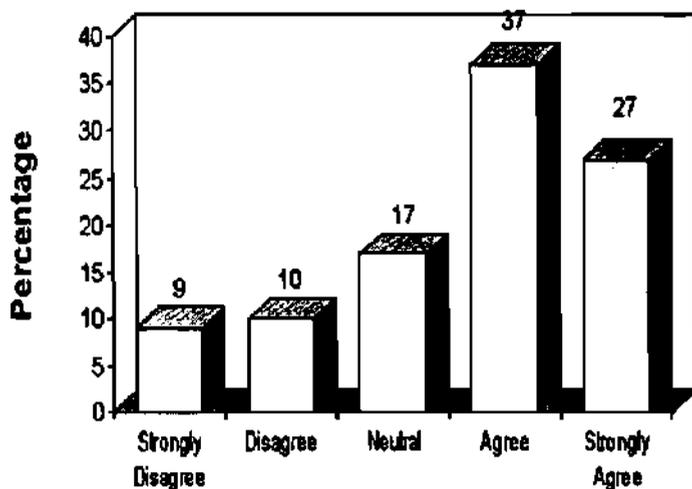


Figure 11: Laboratory temperatures should be carefully controlled

The majority of the respondents (66%) were of the opinion that laboratory temperatures should be adjustable.

### Seats

Although comfortable seating is important for healthy comfortable computing (Lengel 2003), the respondents were not overwhelmingly in favor of tilt and height adjustable chairs as evidenced in Figure 12.



### Seats should be tilt and height adjustable

Figure 12: Seats should be height and tilt adjustable

One could assume that the 19% of respondents who did not agree to have height and tilt adjustable seats either did not know what they were, or they were satisfied with what was available.

### Desktops

Sunken desktops provide greater visibility and allow users to sit at a comfortable angle. Besides being ergonomically friendly, they look extremely modern. However, respondents did not jump at the prospect of having something 'cool' in their laboratories (Figure 13)

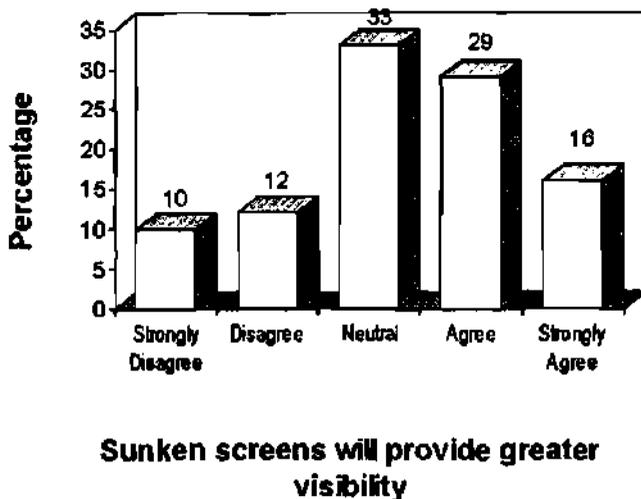


Figure 13: Desktop design - sunken screens

Only 45% of the respondents were in favor of sunken screens, of which, only 16% were strongly in favor. What is important is that 33% were neutral suggesting that they were not sure of what benefit it could offer, alternately, they could not visualise the desktop.

### Differently-abled Students

There were only four respondents who were differently-abled. These respondents were all in agreement that the facilities adequately met their needs.

The presentation of data shows that there are design deficiencies in the computer teaching laboratories at the University of Kwazulu Natal which need attention.

### ***Recommendations***

Making recommendations based on the data would suggest a major overhaul. However, there are major cost implications which requires both capital expenditure and running expenses, both of which the University in its transition phase can't afford. Therefore, the recommendations will be made as short term and medium/long term recommendations. The main assumption being made is that the pedagogy of teaching computer practicals will not change.

## **Short Term**

### ***Ventilation***

The issue of ventilation requires a minor set of modifications to the current air conditioner system. Being ducted air conditioning running from a central plant, a "one size fits all" approach is used where learners freeze in some rooms whilst others sit in stifling heat. Ducts that open into the rooms should have air flow regulators that can be operated with remote controls by the lecturer. By regulating the airflow into the rooms, temperatures can be maintained at a comfortable level based on the conditions within individual rooms.

### ***Visibility***

Projection screens are poorly placed and need to be moved and mounted permanently. Placement should be done with a full class of learners in attendance in order to find a position that offers optimal visibility for all. Unfortunately, due to the poor design of existing computer rooms, there will be blind spots as some students will be seated behind pillars.

## **Medium/ Long Term**

The School of Information Systems & Technology at UKZN needs to develop strategic building plans where they can translate ergonomics into

their planning. One of the options is to take a clean slate approach and build computer teaching classrooms from the ground up in an area dedicated to the School and its growth plans. Existing laboratories could be used as walk-in labs. However, this may not materialise for the next ten to fifteen years. Therefore, alterations to existing facilities are required.

### ***Visibility***

Existing laboratories as mentioned have pillars in them that obscure the view of the board and projection screen. The rooms could be reduced in size in order to incorporate the pillars into the walls. However, this will leave large areas of unused open space and rooms that accommodate smaller groups. Small groups are better to teach. However, this would require additional staff, which is a grey area in light of the merger.

### ***Floor Layout***

Some of the better and newer labs could be realigned in a Corridor style configuration ensuring that learners face in one direction towards the lecturer and projection screen. SMARTdesks™ or any generic could be built where screens are embedded into the desktop. This will ensure that shorter learners don't have to crane their necks or look around their monitors to see the projection screen. Proper floor layouts will ensure that repetitive stress injuries are reduced or eliminated entirely, especially if learners are facing the correct direction without having to keep turning or altering their posture.

### ***Seats***

The existing seats are padded. However, they are stationary and non-adjustable. Furthermore, the chairs are the stacking type and break easily. Rather than repairing or writing off the broken chairs, the School could gradually replace them with proper height adjustable seats.

### ***Teaching Technology***

The School could change its pedagogy and move towards a learner centric model. Learners could be given detailed manuals which they could follow

and teach themselves, alternately, they could be provided with Computer Based Training software that teaches them step-by-step. Should the School continue to use a teacher centric approach, then software such as NetOPs School could be used where the learners screen is split in two, the learner can view the teachers screen and his/her own screen. The teacher teaches from just about anywhere and the learner follows step-by-step on his/her screen. Using the latter approach will require major upgrades to the network.

### ***Breaking Bad Habits***

Learners need to be made aware of the health and safety issues associated with computer usage and they must be encouraged to take responsibility for their own welfare. Health issues which are normally taught in the second semester of the first year could be moved to the introductory lessons in the first semester. These issues could be reinforced in the practicals with proper demonstration from tutors. Shorter students need to be encouraged to sit at the front of the class or in seats from which they can best see the lecturer and the projection screen. Senior students who spend long hours at the computer should be encouraged to perform eye exercises and take regular breaks from their work

### ***Good Housekeeping***

Lab staff needs to conduct regular inspections to ensure that chairs are not broken. Broken chairs should be removed immediately into a safe area. Furthermore, broken desks, faulty air conditioners and broken window blinds need to be reported to the maintenance department for immediate repairs. Fire fighting equipment needs to be serviced regularly and fire doors inspected to determine their functionality. All papers and dirt must be removed immediately, and labs need to be cleaned regularly. During term breaks, a major spring cleaning operation must be conducted. Staff should perform visible, good ergonomics. If staff set the example, learners will follow.

The ideal computer classroom for universities should be built in tiers with curved desks surrounding the presentation area. The lecturer/tutor must have full control of ambience, comfort and must have a control desk from

which to operate the data projector, sound system, lights and air conditioning. All that is required to make this ideal a reality is funding.

## **Conclusion**

This study has clearly shown that at the University of Kwazulu Natal Westville Campus, computer facilities are not designed properly to promote learning. However, although the facilities are not ideal they have not hampered learning. The learning environment needs to be redesigned around the learner and learners should be integral to any future plans. In any study, it is important to outline the limitations of the study. The small sample size does not lend itself to generalise the results to all students and to all campuses of the University. Another study could be conducted using a larger sample and sampling all campuses. Furthermore, a similar exercise needs to be conducted in the School of Computer Science to determine unique needs of the School instead of using a one size fits all approach in designing labs. Some of the questions may have been ambiguous or may have needed explanation; hence, the questionnaire needs to be revisited. Other studies could focus specifically on each of the key issues of ergonomics namely productivity, health and user satisfaction. For Ergonomics to succeed, it will require support from the top and involvement from the bottom.

## **Bibliography**

- Blessingame, KM 2001. Eye Care in the Digital Age. Retrieved May 2005 from [www.benefitsnews.com/subscriber/go/index.cfm?i01/010415/inside4.htm&...](http://www.benefitsnews.com/subscriber/go/index.cfm?i01/010415/inside4.htm&...)
- Coppola, JF & BA Thomas 2000. A Model for E-Classroom Design: Beyond 'chalk and talk'. *T.H.E Journal Online*. Retrieved January 2005 from [www.thejournal.com/magazine/vault/articleprintversion.cf?aid=2594](http://www.thejournal.com/magazine/vault/articleprintversion.cf?aid=2594)
- Designing Computer Suites and Workstations in School 2001. British Educational Communications and Technology Agency. Retrieved January 2005 from: [www.becta.org.uk/technology/infosheets/html/hands.html](http://www.becta.org.uk/technology/infosheets/html/hands.html)

- Dix, AJ, J Finlay, DA Gregory & A Beale 2003. *Human Computer Interaction*. Prentice Hall: New Jersey.
- Dykstra-Erickson, E, W Mackay & J Arnowitz 2001. Trialogue on Design. *Interactions* 8,2. Retrieved January 2005 from: <http://portal.acm.org/ftgateway.cfm?id=361933&type=pdf&coll=GUIDE&dl=GUIDE&CFID=46361015&CFTOKEN=87667146>
- Goldstein, J 2003. Games at Work may be Good for You. BBC News. Retrieved May 2005 from: <http://newsvote.bbc.co.uk/mpappa/page/tools/print/news.bbc.co.uk/2/hi/technology/32>
- Jermolajew, AM & E Cowan 2003. Ergonomic and Anthropometric Considerations of the Use of Computers in Schools by Adolescents. *Australian Educational Computing Journal* 18,2. December.
- Learning Environment Design 2003. Coastal Carolina University, College of Education. Retrieved January 2005 from: [www.coastal.edu/education/ti/environment.html](http://www.coastal.edu/education/ti/environment.html)
- Lengel, J 2003. Computer Ergonomics. Retrieved May 2005 from: [www.powertolearn.com/cgi-bin/ptl/pfp/pfp.cgi?doc=/articles/teaching\\_with techno](http://www.powertolearn.com/cgi-bin/ptl/pfp/pfp.cgi?doc=/articles/teaching_with techno)
- Singh, A.M. 2004. The Role of South African Universities in Bridging the Digital Divide. *South African Journal of Information Management*. 6,2, June. [Online]. Available at: <http://www.sajim.co.za/default.asp?to=peer4vol6nr2>
- Smartdesks Workstations 2001. Classroom Desks. Retrieved January 2005 from [www.smartdesks.com/desk.html](http://www.smartdesks.com/desk.html)
- Stair, R, & G Reynolds 2005. *Principles of Information Systems*. Boston: Thompson Couse Technology.
- Starr, L 2001. Create Ergonomically Correct Computer Workstations. Education World. Retrieved January 2005 from [www.educationworld.com/atech/tech/tech076.shtml](http://www.educationworld.com/atech/tech/tech076.shtml)
- Szabo, RM & KJ King 2000. Repetitive Stress Injury: Diagnosis or Self Fulfilling Prophecy? *J Bone Joint Surg Am*. 82,9, September: 1314-1322.
- The Physiology of Job Stress. 2004. Communications Workers of America. Retrieved May 2005 from [www.cwa-union.org/osh/factsheets.asp?id=362](http://www.cwa-union.org/osh/factsheets.asp?id=362)

Verma, SB 2001. Computers and Vision. *Journal of Postgraduate Medicine*. 47,2. Retrieved May 2005 from [www.jpgmonline.com/article.asp?issn00223859;year=2001;volume=47;issue=2;spage119;epage=20;aulast=verma](http://www.jpgmonline.com/article.asp?issn00223859;year=2001;volume=47;issue=2;spage119;epage=20;aulast=verma)

WBDG Whole Business Design Guide. 2004. Retrieved January 2005 from [www.wbdg.org/design/do-print.php?cn=1.12.5](http://www.wbdg.org/design/do-print.php?cn=1.12.5)

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## *Alternation*

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Manuscripts should range between 5000-8000 and book reviews between 500-1000 words. However, longer articles may be considered for publication.

Attach a cover page to one manuscript containing the following information: Author's full name, address, e-mail address, position, department, university/ institution, telephone/ fax numbers as well as a list of previous publications.

*Maps, diagrams and posters* must be presented in print-ready form. Clear black and white photos (postcard size) may also be submitted.

Use footnotes sparingly. In order to enhance the value of the interaction between notes and text, we use footnotes and not endnotes.

Authors may use their own numbering systems in the manuscript.

Except for bibliographical references, abbreviations must include fullstops. The abbreviations (e.a.) = 'emphasis added'; (e.i.o.) = 'emphasis in original'; (i.a.) or [.....] = 'insertion added' may be used.

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- Mngadi, Sikhumbuzo 1994. 'Popular Memory' and Social Change in South African Historical Drama of the Seventies in English: The Case of Credo Mutwa's *Unosimela*. *Alternation* 1,1:37-41.
- Fanon, Frantz 1986. *Black Skin, White Masks*. Markmann, Charles Lam (trans). London: Pluto Press.

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