high level of income disparity. In 2004, Namibia ranked 65 out of 175 countries on a global scale due to its gross national income (National Planning Commission, 2004), yet this dropped to a rank of 124 on the Human Development Index (a composite measure using life expectancy, adult literacy, educational enrolment, purchasing power parity and income). Namibia's rank has

HELP OR HINDRANCE? AN INVESTIGATION INTO LEARNING THROUGH WEB INTERFACES

by

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ABSTRACT

HELP OR HINDRANCE? AN INVESTIGATION INTO LEARNING THROUGH WEB INTERFACES

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Usability studies are often performed on software prior to release in order to improve user performance. Usability sessions can also inform website developers in order to help increase the business generating potential of websites. In an education setting, however, they can be used to inform educationalists about interfaces that can maximise learning potential.

Namibia is a multicultural, multilingual society in Sub-Saharan Africa, with enormous disparity over access to technology. The ICT policy for education aims to contend the growing digital divide and support an education system that is struggling to deliver. The education sector needs to ensure that interfaces are chosen with care for its learners to make the best use of the educational technology resources being deployed.

A usability study was designed with these issues in mind, to determine the influence of interface design on learning in an educational institution in Namibia. A pilot study identified obstacles and served to enhance the main study in which two web interfaces were used; one poorly designed and one well-designed. Learners from the institution were recorded during their interaction with the websites and then assessed for learning achievement. The results indicated that interface design can influence learning. However, research with a larger sample is necessary to fully understand the cultural and characteristic influences of Namibia's learners on reading and writing using the web.

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ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
COL	Collectivism (cultural dimension)
ESL	English as a Second Language
FEM	Feminine (cultural dimension)
HCI	Human-Computer Interaction
HIV	Human Immunodeficiency Virus
HPD	High Power Distance (cultural dimension)
HUA	High Uncertainty Avoidance (cultural dimension)
ICT	Information Communication Technology
IND	Individualism (cultural dimension)
IT	Information Technology
LPD	Low Power distance (cultural dimension)
LTO	Long-term Orientation (cultural dimension)
LUA	Low Uncertainty Avoidance (cultural dimension)
MAS	Masculine (cultural dimension)
STO	Short-term Orientation (cultural dimension)
VSM	Value Survey Model (Hofstede's cultural dimension tool)

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Chapter 1

INTRODUCTION

1.1 Introduction

Understanding how users interact with computer systems underpins research in the interdisciplinary field of Human-Computer Interaction. The growth of new technologies has increased the scope of investigations, so that usability testing has moved on from the traditional view of looking at systems in terms of how long it takes to learn to use them, their efficiency and speed. There are now many aspects of the user experience which are being considered and consequently there is a growing interest in the various applications of user-interface design. There is a need to understand users and their individual differences in situ and investigate human performance through usability studies relevant to their context. The scope for this has expanded exponentially with the growth of the World Wide Web, as there are vastly increased opportunities for interaction with web interfaces. The need to understand an increasing number of users and apply that knowledge in a meaningful manner fuels vital research and development in the field of interface design.

Investigations into universal usability have been driven by the dramatic rise of the World Wide Web as a global business arena. As with many software systems and interfaces, the physical, cultural and intellectual profile of the users is often very different to those who design them. Designers are faced with challenges to create universally usable interfaces (Schneiderman and Plaisant, 2005) but there also needs to be an increased understanding of how interfaces can affect the users. Different sectors of society have different responses to the technological developments which affect the field and each one must make an informed

response by thoroughly investigating its users interacting with appropriate interfaces.

The education sector in particular plays a vital role in ensuring citizens are equipped with knowledge and skills to be functioning members of a knowledge society. This involves accommodating information communication technology (ICT) literacy and its integration across all curriculum areas. In many developing countries, especially in Sub-Saharan Africa, the use of ICTs in education represents a potentially vital lifeline for teaching and learning in systems that are struggling to cope with the demands. It is common to find that much of the software and web interfaces in use for educational purposes, are designed by developers who do not share the same cultural or linguistic background as the users. Thus it is vital to investigate learners interacting with the interfaces to ensure optimal learning experiences.

1.2 Background

Namibia faces similar challenges to other developing countries in Sub-Saharan Africa; it is a developing country contending the digital divide with an education system that is battling to cope. However, it also has quite a unique set of circumstances which affect the country's ability to reach its education development goals. Namibia is ranked as a lower-middle-income country (World Bank, 2007) and therefore has access to a limited amount of overseas development assistance. Its vast geographical expanse (824 000 km^2) is home to a sparse population of 2 million (Central Bureau of Statistics, 2003), sixty percent of whom live in the six Northern regions of the country. Children under 15 account for 40 per cent (Central Bureau of Statistics, 2006a) which puts immense pressure on all Government systems, especially education. There is also a very

rank in the bottom three for reading and maths and the competence levels are extremely low, especially in the northern regions (Makuka, 2005). The literacy rate for adults might be 82 per cent, but in fact this translates into very low functional literacy in practise. Namibia wants to create a knowledge economy and Vision 2030 recognises the key role of the education and training system (Marope, 2005), but this will not happen without a knowledgeable and skilled labour force. The stark truth of the matter is that the Namibian education system is failing. It is producing citizens that are "untrainable and unemployable" (Insight Namibia, 2006). Literacy skills therefore are essential because they affect all subjects. It is, therefore, "unsurprising that Namibia is witnessing a decline in achievement in all areas" (Harlech-Jones, 2006).

In addition to general concerns about the quality of the education, the system also faces a specific and very real threat due to the HIV/AIDS epidemic. The education sector faces a crisis of immense proportions: between 2002 and 2010 the potential loss of educators due to AIDS could be as high as 3 360, around 19% of the workforce (Abt Associates South Africa Inc, 2002). Increasing teacher absenteeism and delays in getting substitute teachers will affect both the quality and consistency of the teaching and learning.

In short, if Namibia has one of the greatest divides between rich and poor in the world, it is never more pronounced than in the in the area of education with technology. Socio-economic circumstances and historically imbalanced education policies as well as language barriers are some the reasons behind the exclusion of masses of people from their futures. There is a need to "empower whole communities in bridging the digital divide" (Office of the President, 2004).

Vision 2030 aims to "take Namibia from the present into the future" (Office of the President, 2004) and improve the quality of life for its citizens. The place of information and communication technologies (ICTs) is part of that plan and led

to the development of the ICT Policy for Education (Ministry of Basic Education, Sport and Culture, 2004), and the ICTs in Education Implementation Plan (Ministry of Education, 2006). The policy and implementation plan indicate the increased focus on ICTs for education that will require the education system to respond to the changing needs of its learners. If Namibia is to rise to the challenge, curricula, learners and educationalists alike will need to develop an informed response.

One strategy of the education system to improve matters is to use ICTs to support the shortage of instructional material. If ICTs are to be used to support teachers many of whom, even among the qualified, lack essential competencies such as mastery of their teaching subjects and reading skills (Marope 2005), then more information is required about the effectiveness of interfaces chosen for use.

1.3 Motivation for the study

This study was designed with the both usability concerns and the unique nature of Namibia's developmental challenges in mind; if educationalists are to start effectively using technology, there needs to be a body of knowledge of how technology affects learning. If the Internet is to be used as a resource to support an educational system that is overstretched in terms of human capacity, curricula and materials, it needs to be with a view to maximizing the learning potential and not just use for its own sake. Given the investment that many institutions are making in computer equipment in order to augment traditional teaching and learning facilities, it is important to increase the depth of knowledge about how these new technologies affect learning. Namibia's geographical barriers to providing quality education for all present additional impetus for this study as it will also impact on the body of knowledge about distance learning. Usability

studies are designed to inform the development of systems for increased performance, but they can also be used to inform the development of interfaces for increased learning.

The scope of this study spans a number of areas of interest; usability, interface design and learning. Existing literature and models are examined and used as a foundation. Thus the domain of Human-Computer Interaction is integrated with the concerns of education.

The purpose of this research is to investigate one aspect of how we can maximize the potential of learning with technology to better help our learners. The main research questions for this study are: 'How do interfaces affect learning?'; 'Does a well-designed interface promote learning?'; 'Does a poorly designed interface prevent learning?' The hypotheses that derive from these questions are:

H_1 A poorly designed website will negatively affect learning

H_2 A well designed website will positively affect learning

The null hypotheses therefore were:

H_{01} A poorly designed website will not negatively affect learning

H_{02} A well designed website will not positively affect learning

The research design (described in detail in chapter 3) is based on a general methodology for formal usability studies, but has some features that are specific due to its application in an educational context. It will be necessary to define 'learning' and to develop criteria for judging an interface to be 'good' or 'poor'. It will then be necessary to profile the learners for attitudes, usage and culture that may affect their interaction with an interface. For this, Hofstede's much discussed

cultural model will be used. A group of learners will be selected who are judged to be representative of an average student at the Polytechnic of Namibia.

The subject content that will be used as a basis for study will be English language learning and skill of reading. This skill has been chosen for two reasons: the concern over the lack of competence in reading skills amongst Namibian teachers and learners, as outlined in section 1.2; and the ability to compare texts to ensure that one web interface does not deal with harder content than the other, thereby reducing the possibility of 'learning' being attributed to a different level of subject content. A usability session that takes into account the cultural and linguistic characteristics of the learners will then be conducted. Studying the interaction with websites used for learning in the learners' own environment should yield a rich amount of both qualitative and quantitative data to determine how the design of an interface can affect learning. Unlike normal usability sessions, a learning assessment will take place following the interaction with the interfaces, to determine the level of learning achieved. Finally an analysis of the correlations between variables will show how the design of an interface affects learning under what circumstances.

This study is expected to contribute to the body of usability knowledge for this region, and inform educationalists in particular about how best to use web interfaces to maximise the learning potential of learners. The learner profile is expected to inform curricula and course planning for language learning at the Polytechnic of Namibia.

Chapter 2

THEORETICAL BACKGROUND

This study investigated the influence of interface design on learning for English language students from diverse cultural backgrounds. It naturally draws its theoretical base from a number of disciplines: Human-Computer Interaction and interface design, usability testing, education, language learning and culture. This section will deal with the relevant literature and theoretical background relating to these areas.

2.1 Human-Computer Interaction

There are clearly two main elements to computing: people and computers. As interfaces make up the part of the computer system that a user can see, touch or hear, knowledge of how we see, touch and hear would seem necessary to develop more effective interfaces. This is in effect, how the area of Human-Computer Interaction (HCI) began: by gathering data from experimental psychology using tools from computer science. HCI necessarily draws upon a number of disciplines (computer science, cognitive psychology, ergonomics, engineering and graphic design). As Schneiderman and Plaisant (2005: 4) point out, "harnessing the computer's power is a task for designers who combine an understanding of technology with a sensitivity to human capacities and needs". Difficulties began to emerge because systems and software are designed by programmers who display personality traits that are unlikely to help them understand the majority of people (Landauer, 1995, p170-171). However, it is the 'majority' who use the systems and thus the area of research began as 'human factors', collecting data on perceptions and cognitive processes. Visual perception (see Dix et al, 1993)

relates to interface design and is concerned with how to make interfaces more usable. Usability testing involves monitoring user interaction with the software or interface and has now become a common design tool used prior to a software release.

2.2 Usability

2.2.1 Definition of usability

A number of definitions of 'usability' have been developed over the past two decades. ISO 9241 (1998), was developed by the foremost general standards body for computing and therefore has been widely used. They define usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context". The International Organization for Standardization kept adding to ISO 9241 as the field of Human-Computer Interaction developed. Attributes have been added which can be ascribed to the rise in popularity of the World Wide Web and the exponential growth of web interfaces in operation. Nielsen (2003) defines usability as a quality attribute that assesses how easy user interfaces are to use. There are other attributes (learnability, efficiency, memorability, errors, utility and satisfaction) but usability for websites is seen as a necessary condition for survival; people will leave a web site that they find difficult to use.

2.2.2 Usability in interface design

Designing effective and usable interfaces requires that designers think about factors such as functionality, ease of learning, task efficiency, ease of remembering, subjective satisfaction, understandability (Laueson, 2005, Preece et al, 2007). Designers indicate that it is impossible to design an interface that scores

highly on all factors, and that levels may be necessary, i.e. an educational web interface for grade 3 learners, will need a higher level of ease of learning and subjective satisfaction, whereas an interface for fighter pilots will need more emphasis on task efficiency and understandability.

Ensuring usability necessarily involves considering who the product is being designed for in the development stage. Some of the earliest design principles developed by Don Norman in 1988 are still in use today: visibility, feedback, constraints, consistency and affordances. There are many publications and websites devoted to the topic of design principles; Nielsen's useit.com site being one of the most well-known. All the advice about criteria and principles are applicable, but will only be effective if designers gain insight into the characteristics of their target users (often referred to as User Centred Design).

"Designs should be based on careful observation of current users" (Schneiderman & Plaisant, 2005: p110), as it is the human factors that will determine how successful a product is. Human memory capacity and its limitations, for example, have played a role in designing software and interfaces. Miller (1957, as cited in Sommerville 2004), first indicated that humans can remember approximately seven items of information. This has been used as a general guideline for menu development since. Nielsen (May 15 2006) applies the issue of memory to the importance in web site design by saying that short term memory capacity is important as it affects the potential for getting lost on a site. A person who can hold six items of information in their short term memory has great superiority over someone who can only hold four items. The better the memory, the less likely the user is to get lost and then frustrated and leave the site. Errors also need to be factored in as mistakes will be made. Any system will need to provide a way to recover from them. When too much information is being handled or the user is under stress then it is more likely that mistakes will

be made therefore a system should aim not to put more stress on the user by issuing alarming messages. Other human capabilities (cognitive and physical) need to be catered for too, for example colour blindness, physical manipulation and access. In order to involve the user effectively in usability processes, it is important to profile their characteristics and understand the factors that might play a part in their behaviour and reactions to the interactive product. Factors such as age, gender, physical ability, education, culture, motivation and goals can be important information that correlates with behaviours.

2.2.3 History of usability testing

Usability testing is a way of testing software systems by measuring the performance of users who would normally represent the typical users of the end product. This type of evaluation emerged in the early 1980s when it became clear that software development would benefit from input in 'human factors' (an early term for the discipline of Human-Computer Interaction). This interest stemmed from the growing realisation that many interfaces were poorly designed, leading to frustration on the part of the user which could possibly lead to failure on the part of the system. Any well-designed piece of software needs to match the skills, experience and expectations of the potential users (Sommerville, 2004, p363).

Since the 1990s much usability testing has been empirically conducted, in specialised 'usability laboratories' equipped with recording and monitoring facilities. User interaction is observed and recorded (audio and video). This formal usability testing is an expensive technique, requiring software for the analysis. It involves real end-users who are usually given a set of tasks to complete using the system. Their actions are recorded, often down to eye movement tracking and keystroke logging. Typical metrics involve recording the time it takes for users to complete the tasks, the degree of completion, the error rate, the time

it takes to recover from an error and the number of participants who successfully completed the tasks (see Dix et al, 1993, Preece et al, 2007).

Usability testing methods have now been developed and refined over the years and there are a number of different ways to conduct usability tests. Some of these involve experts, for example heuristic evaluation, guidelines review, consistency inspection, cognitive walkthrough, formal usability inspection (Schneiderman & Plaisant, 2005, p142). Other methods require users to be involved. Nielsen (1995) categorises four ways to test user interfaces; automatically, empirically, formally, informally. The automatic method would measure usability by computing a variety of metrics after running the interface through specialised software. This does not take into account the user in the same way that an empirical test would. An empirically tested interface is assessed by testing the interface using real users. A formal method of testing is described above, using exact measures and formulae to calculate findings. An informal method of usability testing however involves a rule of thumb system that draws on the experience of the evaluators.

2.2.4 Web usability

"Usability is often the most neglected aspect of web sites, yet in many respects it is the most important" (Nielsen, 2001, as quoted in Van Greunen and Wesson, 2004). With the vast growth of the Internet and number of websites available, traditional software usability criteria and testing methods can now be applied in the assessment of websites. It is important for website designers to realise the importance of doing both small and large-scale tests on their websites to maximise their impact and potential for drawing customers. However, procedures vary greatly depending on the goals of the study, and there is still debate over the optimal number of users and the level of investment necessary (Marcus, 2005, Nielsen, 2007). There is much information available on how to make a website

more usable (Keevil, 1998, Nielsen's useit.com alert box, Marcus et al, 1999, Bernard, 2003, Spool et al, 1998, Karvonen, 2000). However, there is a certain amount of misunderstanding surrounding usability and its application to web sites that leads Dicks (2002) to state that "usability testing may be on the verge of becoming a victim of its own success". The web appears to be filled with lists of design rules, flawed methods, non-representational users doing non-representational task and studies using poor test methodologies. Squires and Preece (1999) relate similar problems with looking at educational software.

One of the difficulties with web usability studies is that it is necessary to be aware that there are great individual differences among users and that while speed may be important (for a measure of efficiency), it should not necessarily be the focus. Nielsen (2006) points out that "when doing website tasks, the slowest 25% of users take 2-4 times as long as the fastest 25% of users. This difference is much higher than for other types of computer use". Yet, speed is not everything. Take education, for example, where a user who is fast to complete tasks does not necessarily learn better. The speed of learning can be attributed to individual differences and cognitive patterns. Usability testing for educational purposes is vital, as "formal usability testing can enhance the evaluation of e-learning" (Masemola & De Villiers, 2006, p188), and there is scope for more evaluation models to be developed specifically for educational purposes.

There have been a number of studies in the Sub-Saharan region and usability laboratories have been constructed, especially in institutions of higher learning (for example, UNISA, Nelson Mandela Metropolitan University). Many studies have looked at e-learning (Van Greunen & Wesson, 2002, Masemola & De Villiers 2006). While there are many aspects of usability tests that can be adapted and drawn on for a usability test involving learning as its goal, the more "conventional usability testing is not the optimal way to judge applications that

support learning, which by its nature, is focused more on a process than on generating a product" (Masemola & De Villiers 2006, p188). The efficiency of an interface for learning cannot solely be measured by the time it takes to complete tasks. The different learning styles that affect learners will be differ amongst the users, and "speed of learning is less a measure of system efficiency than it is a function of personal ability and learning style" (Masemola & De Villiers 2006, p188). Error minimisation is also not as appropriate to measure when assessing learning through an interface. It may not be possible to distinguish between cognitive errors and usability errors. Cognitive errors are an essential part of the learning process and therefore should not be treated as an error. It is only when a usability error causes so much frustration that learning is impeded, that an error may be a valid measure. "Usability errors should be avoided but cognitive errors should be permitted provided that support mechanisms exist to promote a recognition-diagnosis-recovery cycle" (Masemola & De Villiers 2006: 188). In addition to needing to understand the principles of usability testing, when looking at the specific group of users who are learners, it is also necessary to consider educational principles. How we learn and the cognitive processes that we go through to retain information are relevant to understanding our learners and being able to design better interfaces to promote learning.

2.3 Education

Ensuring that digital content has an appropriate interface for use with learners requires both an understanding of interface design as well as education and learning principles. There is still debate over what constitutes learning, and there is still no consensus about how we learn. However there have been theories put forward that advance our knowledge in both areas and much research has been done surrounding theories of learning and how they relate to learning with

technology. The three main movements of behaviourism, cognitivism and constructivism are relevant background theory for developing appropriate responses to teaching and learning with technology.

2.3.1 Behaviourism

Behavioural psychology developed as a prominent movement in the early part of the twentieth century and stemmed from experiments and theories proposed by Pavlov. Human behaviour was explained though stimulus-response interaction with more complex behaviour (such as reasoning) being thought to be made up of a composition of simple stimulus-response events. Watson and Thorndike were key researchers and later B.F. Skinner (1954) came to be known as the main protagonist (and developed radical behaviourism) as the belief that reinforcement or punishment led to changes in behaviour (see Atherton, 2005). In general, the effect on learning and teaching was to use tangible rewards to accomplish educational goals. Grading and achievement were seen as important. The role of the teacher was central as they were required to set up situations in which the students would learn to respond to a stimulus. Curricula were designed around sequenced learning content. When technology was used, it was mainly to enhance drill and practice sessions and to show simulations. Computer assisted instruction (CAI) was developed as one of the first instructional technologies that was popular in the 1980s. Behaviourism, however, was unable to explain certain social behaviours which led to further research into thought processes.

2.3.2 Cognitivism

Cognitivism was developed in the late twentieth century in response to the gaps that behaviourist theory left in trying to explain cognition. Cognitive psychology does not refute behaviourism but builds on it and emphasises the unobservable mental constructs such as memory, attitude and motivation (Dalgarno, 1996). The importance of reinforcement and feedback still holds for cognitivism.

However, cognitive theorists viewed learning as involving acquiring and reorganising of cognitive structures. Schema became an important way to explain internal knowledge structures that learners would use to link to new information. It was in the 1950s that cognitive psychology began to influence learning theories. Its influence on curricula was in the organisation from simple to more complex, and to provide emphasis on meaningful chunks of learning. Chomsky was central in applying theories to language learning (Chomsky, 1986) as he insisted that language learning could not be explained through conditioning. Computer Based Instruction (CBI) was strongly influenced by cognitivism with the belief that humans process information by receiving, storing and retrieving it. However, cognitivism was unable to explain all the complexities that are involved with learning.

2.3.3 Constructivism

Constructivism began to gain momentum in the middle of the century, although it could be claimed that the insights of Socrates were really the beginning with the assertion that the cognition of the individual contains the basic conditions for learning (Kanuka & Anderson, 1999). The main influence in the development of constructivism was Piaget and his theory of intellectual growth. He first emphasized that the interaction between existing cognition and new experiences bring about conceptual change (Piaget, 1950). He proposed that individuals construct knowledge through processes of accommodation and assimilation (and not sequentially, in comparison to the behaviourists). New experiences are therefore fitted into an already existing framework. Constructivism does not put forward the idea of a specific pedagogy, but merely describes how learning happens. It is often associated with pedagogic approaches that promote learning by doing. Constructivist learning theories, therefore, centre on the learner who initiates and directs the learning experience, supported by the 'teacher' whose role is of a facilitator. There are different schools of constructivist thought: social

constructivism being particularly important, especially with regard to language teaching and learning and its application to educational technology. Social constructivism can be seen as the merging of Piaget's work with Vygotksy and views learners as unique individuals with unique needs, but who need to interact with others to arrive at a shared understanding of 'the truth' (Duffy and Jonassen, 1992). Vygotsky's 'zone of proximal development' purports that learners are challenged into development by being in close proximity to levels slightly above their own level of development (Vygotsky 1978). The application to technology could be obvious; with tools that allow learner to direct their own investigations, have access to different levels of information and allow interaction with the world, technology can be used to support a constructivist view of learning.

2.4 Education with technology

The influence of technology on our education systems has been profound over the last few decades and has required immense amounts of research to understand its different dimensions. There has been much research into educational technology and constructivism (Perkins, 1991, McKenna & Laycock, 2004, Gulati, S, 2004, Kanuka & Anderson, 1999, Squires & Preece, 1999). Some researchers have attempted to design constructivist learning environments (Jonassen, 1999) and others address changing roles of teachers and how and why the Web affects learning (Ehrmann, 1994, Theng, 1999, Wingard, 2004, Stary & Totter, 2006, Vat, 2001). While all of this makes a valuable contribution to the whole gamut of research available, it is still necessary to understand what is happening with learners when they are using technology to learn.

The goals of education are relatively simple in that we want learners to remember, understand and apply what they have learnt. "Surely we want what is taught retained, else why would we teach it? Unless knowledge is understood, to what

purposes can it be put? Finally, having and understanding knowledge and skills come to naught unless the learner actually makes active use of them later in life" (Perkins, 1991, p18). However, these three simple sounding goals are deceptively hard to achieve. There are other aspects to learning, but these are possibly core. Where, when and how technology helps or hinders learning is another question. As technology has increasingly become part of teaching and learning, research has often focused on comparative studies between face-to-face teaching and distance learning (see Daley et al, 2001, Thurmond & Wambach, 2004, King & Doefert, 2000), as technology was initially the domain of distance education. More recently there is much more technology available for face-to-face students, even in developing countries such as Namibia. There is a classic discussion around the variety of different media available and the fact that 'no significant difference' was found between the amount of learning that took place in a technology based classroom (typically distance learning) and face-to-face environment (Russell, 1997 cited in Twigg, 2001). For Namibia, with its educational challenges (see chapter 1), the importance of harnessing educational technology cannot be understated and never more so than for language development.

2.5 Language learning and culture

Learning language is a complex phenomena and as with educational theories, there have been many theories and suggested methods as to how we learn and how best to teach languages. What is of interest here is not how we learn language or even whether technology can help with language learning (see section 2.3.3), but how we can maximise the potential of technology to better help our language learners. It is not sufficient to use technology for technology's sake, to get students to go on the World Wide Web to search blindly for some sort of meaningful interaction that was previously unavailable to them (as seen so often

in Namibian classrooms), but to learn how to tailor the use of technological resources to our own learners. In Namibia there is a lack of local software and local content resources (Winschiers & Paterson, 2004, Paterson et al, 2007) and an official language which is the home language of just over 1% of the population (Central Bureau of Statistics, 2003). It therefore has a very large language learning 'issue', so it is necessary to have a focused approach to language learning backed by research relevant to the population. For Namibia, given its diverse population, this requires looking at culture. Kaplan (1966) was one of the first to suggest that rhetorical models stem from culture, which can be brought back to the influences of our home language. His suggestion was that the way writing is structured is very different for different cultures. He illustrated this by showing how meaning is structured in paragraph writing (Kaplan, 1966, p15), having studied close to 600 ESL (English as a Second Language) essays (see Figure 1 below).

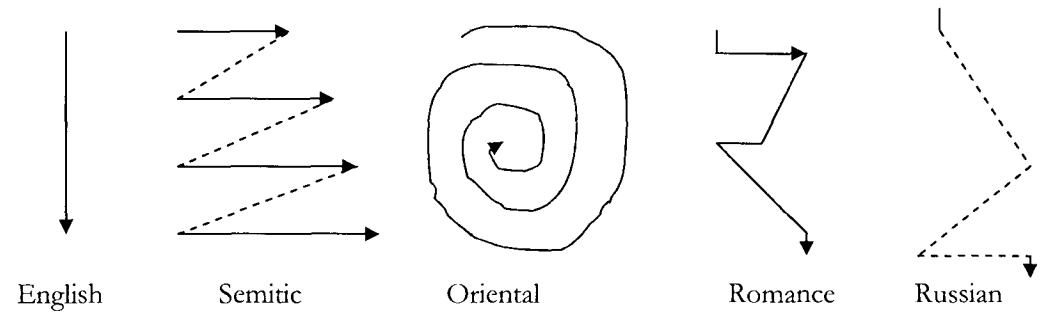

Figure 1: Cultural thought patterns from Kaplan (1966)

Although his work has been widely criticised for being too simplistic, inferring that the English rhetorical model is the norm and for lumping distinct cultures together, "Kaplan's theory is still extremely valuable because it points out the nature of those rhetorical differences which, although obvious to English native

speakers, are often 'felt' rather than understood" (Mao, 2003). It might be that cultural differences come from multiple sources and the concept of culture has become complicated and localised (Mao 2003), but to develop a body of knowledge about Namibia would be very valuable for language learning in education. If writing skills are distinct in different cultures, then reading skills will also vary and signposts of structures will not necessarily be transferable to another language (Kaplan, 1966). In this way, interfaces used for English language learning also need to take into account the user's culture, especially in a country where the software and interfaces that are being used are not developed by those sharing the same cultural background (Winschiers & Paterson, 2004, Paterson et al, 2007). This might mean that in order to find optimal sites for our learners, it might need to go beyond the traditional accommodations of globalising interfaces by "translating text and date, time and number formats" (Russo & Boor, 1993). Internationalisation and localisation of website are dealt with in a large amount of literature (Robbins, 2006, Marcus & Guttman, 1999, Bernard, 2003, Russo & Boor, 1993, Marcus, 2004, Evers, 2001, Nielsen, 1999, to name but a few) and many guidelines and much advice is available for the discerning designer, however, culture needs to considered in terms more complex than icons and colours if it is to be of value in an educational context.

Culture can be defined as "behaviour typical of a group or class of people" and a "system of meaning that underlies routine and behaviour in everyday work and life" (Yeo, 1996). There are many variables and debate surrounds what constitutes culture, but its place in interface design has some history and much research has been put forward since the development of the web as a global tool (Marcus, 2004 & 2006, Marcus & Gould, 2000, Bernard, 2003, Evers, 2001). For the purposes of this study it is important to retain a definition that has been used in other related research. Like Ford and Gelderblom (2003), culture will be taken to mean 'the cultural aspects that influence human performance achieved through

Human-Computer Interaction'. There are a number of existing models, but Hofstede (1991) has possibly analysed the greatest number of countries from a cultural perspective and many have used his dimensions as a base for web usability (Marcus & Gould, 200, Bernard, 2003, Ford and Gelderblom, 2003, Evers, 2001). Hofstede's model of cultural dimensions comprises of five aspects: power distance, individualism masculinity, uncertainty avoidance, time orientation (described in chapter 3, in relation to the current study).

Although Hofstede's cultural profiling has come in for some criticism with regard data collection and accuracy in profiling and the lack of insight into the depth and richness of cultures (Oshlyansky et al, 2006, Marcus 2006), it has been widely used. As Marcus (2006), Marcus and Gould (2000) indicate, in order to design an interface that is fully consistent to the user, the designer needs to accommodate cultural dimensions as well as the user profile variables into the design of the interface. Yeo (1996) goes so far as to propose a cultural user interface. Marcus (2006) questions recent debate over whether culture is dead or "only of interest to people in the USA (who seemingly have little or no understanding of other cultures around the world)". He indicates that while there are many insights into culture, they are less numerous than the number of cross-cultural blunders. It seems that there is much more scope for an informed response to issues surrounding culture and the user. Thus profiling Namibia will prove to be a valuable addition to the knowledge base for Human-Computer Interaction and cross cultural concerns with regard usability and interface design.

2.6 Summary

Education has a pivotal role to play in any society developing a knowledge economy. Behaviourist, cognitive and constructivist theories have made valuable

contributions to the body of knowledge about how we learn and how best to enable our students to access knowledge and skills required for today's world. However, they need to be put into practice and married with the challenges of learning with technology. Software and web-enabled learning offer enormous potential for the field of education. Only through the knowledge gained in continued research into the field of human-computer interaction and usability studies (in addition to thorough investigations of our learners) will this potential be able to be realised. In Namibia this is particularly important in order to bridge the digital divide and develop sustainable approaches to software and interface development.

It might be that teachers in Namibia have a hard enough job with the tension over resources, class sizes, burgeoning effects of HIV and AIDS, but if we are to use classroom time in an optimal manner, research needs to be done on how best to use that time for our learners. It may be that we need to be aware of cultural thought patterns, reading issues, learning styles, and also of the cognitive load of using technology and the Internet on students. We must approach the new technologies with caution and make it an informed response, as Levi & Conrad (1997, p227) warn, "just because a technology is possible, however, does not mean it is desirable, nor that it is being incorporated in a productive manner".

Chapter 3

RESEARCH DESIGN AND METHODOLOGY

In the previous chapter, theoretical backgrounds were established for Human-Computer Interaction, education, culture and language learning. This chapter outlines the research methodology for this study, drawing from usability techniques and tools adapted from studies in South Africa and Namibia.

3.1 Objectives and hypotheses

The main aim of the study was to investigate how the potential of learning with technology can be maximised to better help learners. To do this there were three objectives, to:

1. profile the learners at the Polytechnic of Namibia
2. measure the usability of two web interfaces in an educational context with regard to efficiency, effectiveness and satisfaction
3. investigate levels of learner achievement attributed to interface design preferences, culture, experience, skills and demographic characteristics

The purpose was to examine the relationship between interface design and learning, as measured by the gain in content knowledge through interacting with two web interfaces; one of poor design, and one of good design. The hypotheses were:

H_1 A poorly designed website will negatively affect learning
H_2 A well designed website will positively affect learning

The null hypotheses were:

H_{01} A poorly designed website will not negatively affect learning
H_{02} A well designed website will not positively affect learning

3.2 Research design

There were three phases to the design of the research: profiling the learners, conducting the usability session and analysing the data. Each phase required different tools: the profiling used the learner profile questionnaire; the usability session used focus group discussion guidelines, a task sheet, Morae usability software recorder component, a learning assessment tool and satisfaction questionnaire; analysis was done using the Morae manager component, MS Excel and SPSS. The dependent variable was identified as student achievement. The independent variables were motivation, gender, computer experience, culture, age, website preference and attitude.

3.3 Learner profile questionnaire design

The questionnaire was designed to collect two different types of data: learners' cultural characteristics and biographic data (see Appendix A).

3.3.1 Cultural profile

The cultural profile was modelled on the Value Survey Model (VSM) (Hofstede, 1994) with 20 statements that gathered data on five cultural dimensions. Each question required the respondent to state the level of agreement on a 5 point likert type scale. As the original VSM was designed for people in a work place, the questions were adapted to suit learners in a Namibian tertiary institution of education. They were kept similar to the questions used by Ford (2005) to enable

a reference check against other learners in a tertiary institution in a country with similar political history.

Individualism/Collectivism refers to the ties between an individual and society. An individualist user is concerned with themselves and their own family. Values of personal time and freedom are very important. A collectivist user is part of strong cohesive groups who value group achievement over personal recognition:

- High individualism: individualism is the basis for creativity and achievement
- Low individualism: group work, decisions, and action are important

Questions:	IND	COL
2. Social acceptance is more important to me than self-respect	Agree	Disagree
7. When doing an assignment as a group, each group member should get the same mark for the assignment, rather than getting an individual mark	Agree	Disagree
12. I would rather work on an assignment on my own than as a group	Disagree	Agree

Table 1: Individualism/collectivism questions

Power distance refers to the extent to which less powerful members of a society expect and accept unequal power distribution within that group (Marcus, 2000, Ford, 2005, Hofstede, 1994):

- High power distance: there should be well defined order. Everyone knows their position in society, there is centralised decision-making and authoritarian leadership.
- Low power distance: everyone should have equal rights and opportunity. There are fewer levels of management and democratic leadership.

Questions:	HPD	LPD
1. If a lecturer says something that I disagree with, I will challenge the lecturer **during** the lecture/class	Disagree	Agree
6. If a lecturer says something that I disagree with, I will challenge the lecturer **after** the lecture/class	Disagree	Agree
11. If a lecturer disagrees with the work that I have submitted, I will challenge the lecturer and stand up for my point of view	Disagree	Agree
14. I prefer to discuss lecture material with fellow students rather than with lecturers	Agree	Disagree
16. I often discuss lecture material with my lecturers outside of lecture times	Disagree	Agree

Table 2: Power distance questions

Uncertainty Avoidance refers to the way in which people cope with uncertainty and risk:

- High uncertainty avoidance: people tend to be emotional and aggressive and avoid ambiguous situations. They prefer to work in a structured environment and in a team.
- Low uncertainty avoidance: people accept that superiors do not always have all the answers and they are prepared to take risks.

Questions:	HUA	LUA
3. I am more comfortable in a learning environment with structured timetable slots and precise learning objectives, than in an open-ended learning environment	Disagree	Agree
8. I have no problem working on an assignment even if the objectives are not clear at first	Disagree	Agree
13. Unfamiliar situations make me feel uncomfortable	Agree	Disagree
19. I think that the correct answer is more important than an original/creative answer	Agree	Disagree

Table 3: Uncertainty avoidance questions

Masculinity refers to the degree to which traditional male values are important: assertiveness, ambition, achievement and material possession.

- Masculine users tend to be competitive and tough with material possession being important and well as recognition and challenge
- Feminine users focus more on time and working conditions and caring and social aspects of work and society.

Questions:	MAS	FEM
4. Competing with my fellow students is NOT important to me	Disagree	Agree
9. A lecturer who is friendly is better than a lecturer than one that has a good academic reputation	Disagree	Agree
17. Money and opportunities for advancement are more important to me than social issues	Agree	Disagree
18. It is more important to me to get the recognition that I deserve for the work that I do rather than to work with people who cooperate well with each other	Agree	Disagree
20. It is more important to me to have a challenging job at the end of my studies than a job that provides me with good working conditions	Agree	Disagree

Table 4: Masculine/feminine questions

Time orientation (not part of Hofstede's original dimensions but added later) refers to people's concern with past present and future. Long-term orientation values unequal relationships between the older generation and younger, with authority lying with older people. Short-term orientation values equality of relationships and reciprocity of favours:

- Short-term oriented people are concerned with the past and the present

- Long-term oriented: people are more concerned with the future

Questions:	LTO	STO
5. If I do a favour for someone I expect that person to do a favour for me in return	Disagree	Agree
10. I believe in living my life for the moment rather than planning for the future	Disagree	Agree
15. When I am learning something new and difficult, I persevere until I understand it	Agree	Disagree

Table 5: Time orientation questions

3.3.2 Biographic and usage profile

Characteristics such as age, gender, internet experience, usage, enthusiasm have been shown in previous research to affect performance (Lindgaard & Chattratichart, 2007, Nielsen 1989, Egan et al, 1983, Gomez et al, 1983, Olivier, 1999). Nielsen (1989) states that "individual differences are the most important effect for hypertext usability". For example, the importance of age shows different usage patterns because it is related to how accepting a person is to new technology. Although the participants' age range in this study was thought to be very narrow, extra questions relating to how computers have affected their lives and whether they enjoyed using computers were included in order to reveal information about acceptance. The years of computer experience, usage and self rated skill were collected. Home language was requested as a way of collecting objective culture, despite the complex situation with code mixing and switching in Namibia; it was the closest way to ascertain racial background.

3.4 Usability session tools

The usability session had four main parts: a focus group discussion, a usability session which included two sets of tasks to complete and two learning

assessments, a satisfaction questionnaire to be completed by the learner participants. The learner participants were selected from the body of learners who completed the cultural profile questionnaire, taking into account gender, experience and age as far as was possible with a relatively small sample.

3.4.1 Focus group discussion

The focus group discussion was designed to put learners at ease and to establish any high level quality criteria for web site interfaces. The discussion was led by a student evaluator as it was felt that the learner participants would be more forthcoming, able to make criticisms and suggestions, in a similar manner to Paterson et al (2007) and Winschiers & Paterson (2004). The learner-participants were asked to brainstorm both preferences and dislikes with regard web interface design and rank them in order of importance.

3.4.2 Usability tasks

It is important to ensure participants not only receive the same input through scripting sessions (see section 3.5.3), but also receive the same tasks for the usability session. Dicks (2002) warns that users having different tasks will mean that an interface will be used in different ways so that information gleaned by observing interaction could be less meaningful. In this study all students were given the same tasks (see Appendix B).

The usability tasks were deliberately kept simple to ensure that the session would not take too long. Two websites were used that had been evaluated according to heuristic evaluation, and screened for readability and appropriate content. There were five simple tasks for each web site and then the learner participants were required to complete a learning assessment. Each learner-participant was paired with a student-evaluator or an evaluator who took notes based on their observations and helped the students when required.

Web pages: Many websites were tested for their suitability before finally selecting two; using a heuristic evaluation adapted from Keevil (1998) (see Appendix C). The potential usability was assessed by grading many aspects of the sites according to the adapted evaluation criteria. Although there have been many criteria developed over the years, Keevil's offered the most systematic approach that could be adapted. Two websites were chosen:

'*Laptops for $100*': http://www.breakingnewsenglish.com/0510/051001-mit-e.html;

'*Thomas Edison*': http://depts.gallaudet.edu/englishworks/exercises/main/reading.html

They were compared for readability and context and the one that ranked lower ('*Laptops for $100*') was judged to be a poor site and one that ranked higher (a better site).

Readability: The texts on the websites were evaluated for readability to ensure that one site did not have a more difficult text than the other; otherwise it would skew the learning assessment. Readability was established by an amalgamation of four readability scores; SMOG (McClaughlin, 2007), FOG (Gunning Fog online instrument), Flesch-Kincaid and Flesch Reading Ease (in the spelling and grammar tools of MS Word). The length and suitability of content for the learners' context and cultural background were also considered. See Figure 2 below for a comparison of the four readability scores:

	Web page 1	Web page 2
Number of words in text	195	380
SMOG	10.12	10.46
FOG	9.39	10.8
FRE	53.8	51.8
Flesch-Kincaid	9.2	9.5

Table 6: Readability statistics for the two web pages