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).

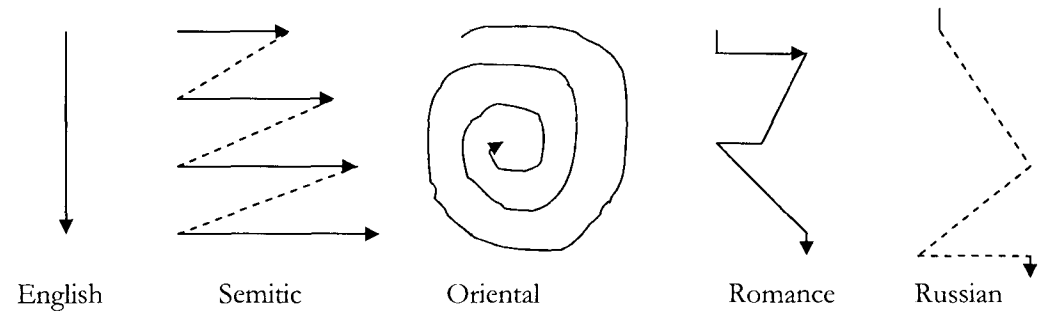


Figure 1: Cultural thought patterns from Kaplan (1966)

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

3.4.3 Learning assessment

After completing the tasks with each website, the learner participants were asked to minimise the screen and complete a 'learning assessment'. This was a paper-based task and for each website there were three types of questions asked, in line with the view of learning described in chapter 2: recall, understanding, application (Perkins, 1991). The first two questions tested recall, the second two assessed understanding, and the last question tested the learner's ability to apply the new knowledge. There were five questions in total, which were marked out of 10. The questions could not be answered from prior knowledge but were specific to the content of the websites.

3.4.4 Satisfaction questionnaire

The satisfaction questionnaire was a paper-based questionnaire consisting of 7 questions. Learner participants were asked to indicate which website was most frustrating and satisfying to work on, giving reasons for each. They were asked to list any difficulties and to comment on anything they felt necessary.

3.5 Usability session

The usability session was designed around aspects adapted from a number of usability studies conducted in South Africa and Namibia (Ford, 2005, De Villiers, 2004, Masemola & De Villiers 2006, Winschiers & Paterson, 2004, Paterson et al 2007). The methodology was based on general usability methodologies for formal usability testing in a controlled experiment. It had some distinguishing features with regard to the workshop type of structure (Winschiers & Paterson, 2004, Paterson et al 2007) and measurements (Masemola & De Villiers, 2006).

3.5.1 Usability laboratory

User testing requires the testing environment to be controlled and is commonly done in a usability laboratory. There are currently no permanent usability

laboratories in Namibia. One of the inherent weaknesses of usability testing according to Dicks (2002) is that testing is often done in an artificial situation. For these two reasons, it was felt that using a networked computer laboratory would be the ideal solution. The Polytechnic of Namibia has a number of computer laboratories available and one such networked lab was set up with web cams, headphones and Morae usability software. This meant that the participants were familiar with types of computers, networks and Internet connection speed.

3.5.2 Usability software

Morae Recorder software (see Techsmith) was loaded onto each computer in the laboratory. Prior to use, familiarisation took place.

Morae Recorder

The Recorder component (see Figure 2) of the software was used to capture all the details of the session, including the events and screen changes that were effected by the participant. Facial expressions were recorded by video and talk aloud monologues recorded by audio. The video and audio recording of the participants are used during the analysis stage, to give a fully representative recording of the interaction between participant and the interface.

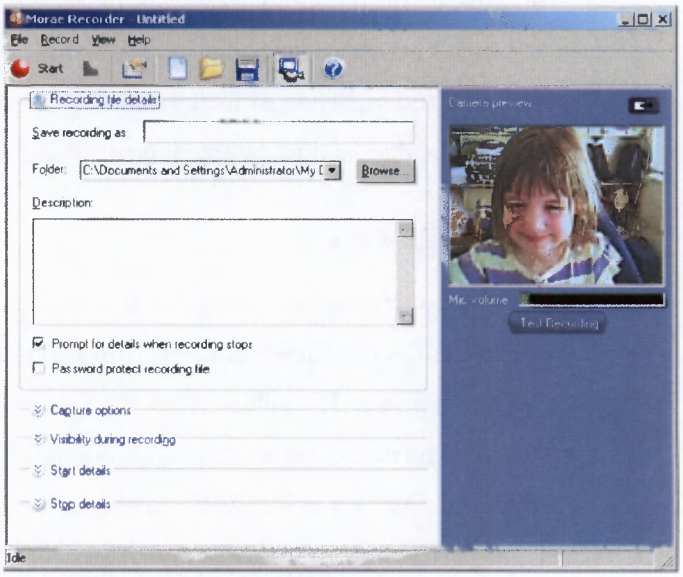


Figure 2: Screenshot from Morae Recorder

Morae Remote Viewer

For the main study, it was planned to use the Remote Viewer component for the evaluators to view the participants during the session. This would enable them to make notes and record events directly onto the session data. The remote viewer allows the evaluator to simultaneously see the video of the participant, and the screen that is currently in use by the participant. The audio recording plays simultaneously. In the event, there was insufficient time for the student evaluators to familiarise themselves and rapidly learn how to use new software. The remote viewer was therefore not used as originally planned.

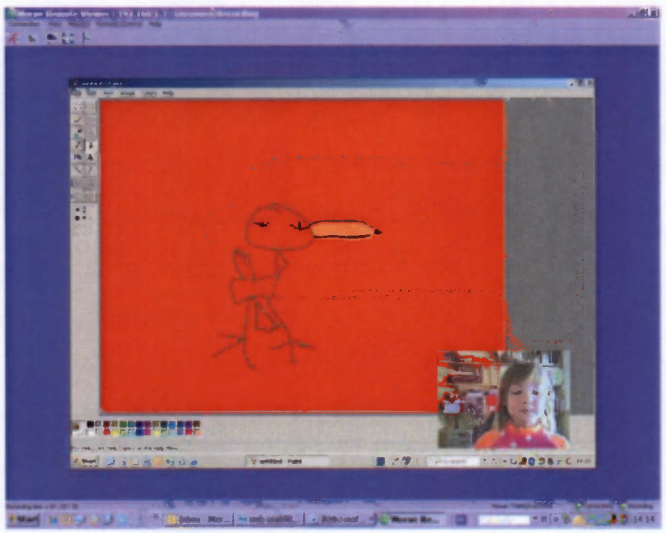


Figure 3: Screenshot of Morae Remote Viewer

3.5.3 Usability session design

Scripting: Scripting a usability session is advocated by researchers (Preece et al, 2007), especially if the testing is going to happen over a number of sessions. This is to ensure that each group being assessed has exactly the same input and instructions so that it the input cannot become a reason for skewed data. This was not necessary for the pilot study as there was only one group of learners, but for the main study, the sessions were scripted and followed exactly the same pattern.

Think-aloud: Think-aloud is a common method used in usability studies which involves the participants talking through everything that they do while completing

the tasks (see Preece et al, 2007, Masemola & De Villiers 2006). They are to verbalise their thoughts and experiences which will help explain the reasons behind a specific action. The video recording shows what action is being taken and possibly record any facial expression that might give a hint as to feelings. The learner-participants were asked to think-aloud throughout their usability session, as in Masemola & De Villiers (2006).

Participants: There has been great debate over the number of participants that are sufficient for usability studies (Nielsen, 2000, Spool & Schroeder, 2001, Barnum et al, 2003, Lidgaard & Chattratichart, 2007). Nielsen (in Barnum et al 2003: 698) states that he proposed that "the magic number for the actual test is 3-4" and 5 were just suggested to provide a contingency plan for 'no-shows'. However, the 'magic number five' was deemed insufficient by a number of researchers (Spool & Schroeder, 2001, Molich et al, 1999) who found that web testing required many more users, as each user would produce different findings. The danger is possibly that with too few participants, statistical analysis will not be possible (Preece et al, 2007). This study was limited by time, the number of evaluators and amount of equipment available. For the pilot study six students volunteered to present themselves for the session, and seven arrived on the day. A total of 11 students were asked to present themselves for the main study, and eight students turned up for testing. This number still falls within the range of 6-12 which were deemed sufficient by Dumas and Redish, 1999 (as cited in Masemola & De Villiers, 2006). Masemola & De Villiers (2006, p 126) found that five students were enough for usability study but "not enough to conduct serious analysis of learning and cognitive patterns".

In addition to the number, it is important to ensure that the participants are truly representative of the target population (Dicks, 2002). For this study, all participants were students with a similar background with regard educational

achievement and English language level (as they all were tested on entrance to the Polytechnic of Namibia into module 2). The content of the interfaces under test were English language learning topics and the learner-participants were therefore deemed to be representative of the intended users of the sites. The participants were also chosen from a variety of programmes but excluding Information Technology. In this way it was assumed that they were more likely to have a representative range of IT skills, experience and attitudes in relation to the entire student body. IT students while also having an English language requirement as part of their programmes were thought likely to have more developed IT skills and therefore would not be representative of the average student at the Polytechnic of Namibia.

Many usability studies are conducted in a one-to-one set-up (Masemola & De Villiers, 2006, De Villiers 2004), but unlike Masemola & De Villiers (2006) who had students arrive one at a time, in this study the students were asked to come in a group in sessions of 5-6 learners each. This was done because it was thought that for cultural reasons, more feedback would be forthcoming if a workshop type of participatory set up was arranged, similar to Paterson et al (2007) and Winschiers and Paterson (2004). Prior to the usability session, the students had all completed the learner profile questionnaire.

Evaluators: There were five usability evaluators: the researcher, a usability expert lecturer from the Polytechnic of Namibia, and three volunteer student-evaluators. "Usability evaluation methods can mask usability issues rather than uncovering them when cultural differences exist between the usability expert and the user. Users respond more freely and accurately to an interviewer from the same culture" (Paterson et al, 2007). For this reason, the student-evaluators were used to lead the focus group discussion and were trained by the expert lecturer as evaluators to help run the usability session. It was felt that learner-participants

would be more comfortable asking questions, be more forthcoming in the focus group discussion and that they would be more at ease. The evaluators volunteered from a second-year IT course at the Polytechnic of Namibia and shared similar backgrounds, were closer in age and shared some of the same home languages as the learner participants. There were two females and one male student evaluator and all three evaluated at the pilot session as well as the main session. For each session they were given a set of evaluation guidelines and reminder training by the expert lecturer as to what to look out for during the observation period.

Length of session: In line with practical session advice (Preece et al 2007), the session was designed to take no longer than an hour. This entailed changing the design of the tasks from the pilot study so they would take less time (see section 3.7.1).

Ethical issues: Informed consent was established with the questionnaires. Learners were informed that participation was voluntary and that there was no danger of their identities being revealed. At the beginning of the usability session participants were informed about tracking/logging equipment and given an opportunity to leave if they did not want to continue with the study should they not feel comfortable (in line with Schneiderman, 1998). All of the students remained for the study.

3.6 Performance measures and analysis

3.6.1 Performance measures

The most common measures of usability are efficiency, effectiveness, and satisfaction (see chapter 2). In this study efficiency was measured in terms of time on task, rather than task completion. The tasks were learning tasks in themselves

and were kept deliberately short to enable completion. Although time on task was maybe not as important to measure as other performances (Winschiers & Patterson, 2004, Masemola & De Villiers, 2006), it was measured in this study in order to compare the learners feedback about the sites. As with Masemola and de Villiers (2006), it was felt that "efficiency cannot be judged by low times taken on tasks". Speed of learning necessarily reflects more about the individual's learning style and personal ability than the design of an interface. Squires and Preece (1999) distinguish between peripheral cognitive errors which are in fact usability errors and true cognitive errors which are part of the learning process. In this study errors were not recorded, but requests for help were marked as events and counted as a measure of effectiveness. If a learning interface cannot be navigated and tasks completed without help, then it could be deemed as a less than effective learning site. In addition to requests for help, the two learning assessments (one self-reported and one double blind marked by two examiners) were taken as measures of effectiveness.

As mentioned in chapter 2, other common performance measures for usability testing involve the number of errors per task, the number of users making a specific error. For this study, these measures were not deemed to be useful. Making errors is seen as a vital part of the learning process, and as it was learning that was being measured, how the learning happened was not an issue, just whether learning took place.

3.6.2 Analysis

Analysis of the usability session was done through the Manager component of the Morae software. This enables the researcher to analyse the data captured on video and on screen and audio by event logging and setting markers. The markers can be used to log events and the beginning and end of a task. This data can then be used in calculations of time on task, marker distribution etc. The video and

audio recordings can be replayed and cut into sections, analysed and presented in different formats, if necessary.

Figure 4: Screenshot of Morae Manager being used for analysis

3.7 Empirical study

One hundred and twenty learner profile questionnaires were distributed and returned during class times over a period of three days from 8th October to 10th October. According to Hofstede profiling works with 50 respondents, but becomes more accurate with more respondents. It was felt that approximately 100 would be feasible with the resources, and would give an accurate profile for Namibia.

3.7.1 Pilot study

The pilot study was conducted on Thursday 11th October, between 10.30 and 2pm. Six students were invited to attend, and seven students arrived and were evaluated using four websites and four learning assessments. A number of challenges were discovered during the pilot study which were then altered and adapted for the main study. The most significant alterations were:

1) Focus Group discussion: the discussion took up too much time and the student evaluator had difficulty in eliciting information. The list of focus group discussion questions was shortened and the evaluator was asked to use a whiteboard to write down responses after brainstorming. The learner-participants were asked to rank interface design criteria in order of preference. In this way the session became much shorter and more focused. The learners did not appear to be reticent to talk to the student evaluator, so the questions that were designed to help the students relax and feel at home were deemed to be unnecessary.

2) Learners were found trying to copy answers from the screen during the learning assessment, thus defeating the object of one aspect of learning: 'recall'. The task sheet was made more specific and tightened up the possibility of 'cheating'.

3) Due to the difficulty in getting experienced evaluators and due to time constraints and the connection speed, it was felt that it would be more appropriate to have the evaluators sitting next to the participants and making notes directly on paper, rather than having them at a different computer, using the remote viewer component.

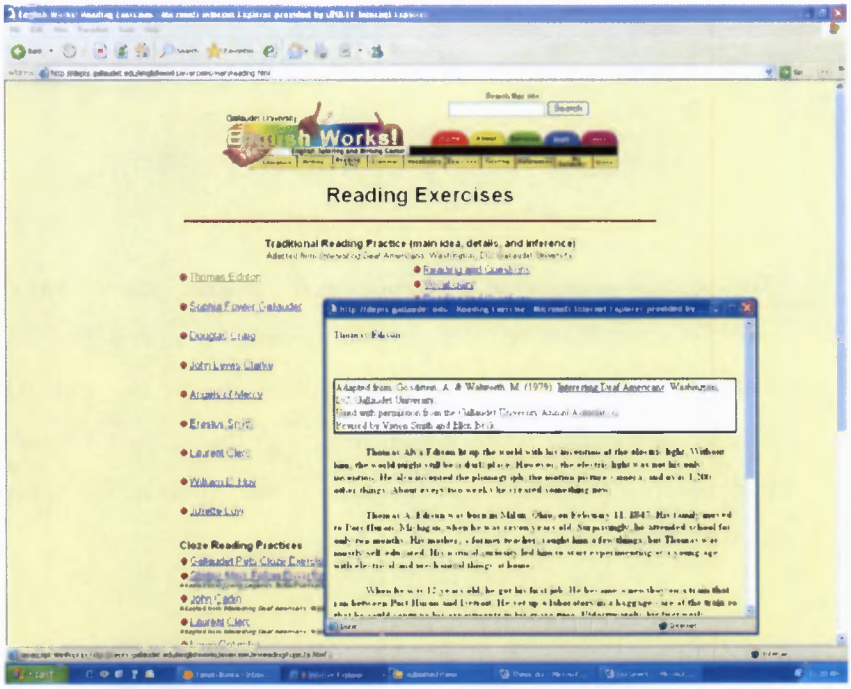
4) Four web sites were used in the pilot study: two that ranked lower on the heuristic scale (adapted from Keevil, 1998) and two that ranked higher. However, time constraints and the extremely slow speed of the internet at the Polytechnic of Namibia, meant that only one learner spent any time on the better website. Thus there was no comparative data and the results were inconclusive because five out of seven learners had not visited all four sites, but only the two poorer sites. Also given the level of the answers given in the learning assessment (between 5% and 65% correct) and in the student satisfaction questionnaire, it

was felt that easier reading passages were required for the main study, even if it meant that two passages had to be used that were of different lengths.

5) It was not possible to ask for students to think-aloud into the microphone as with many usability studies, because the headphones were not functioning. This was changed for the main study.

3.7.2: Main study

The main study was conducted on Saturday 20th October, between 8.30 and 1pm. Eleven students were invited to attend, and eight students arrived and were evaluated in the customised computer lab using two websites and two learning assessments. There were three student evaluators, the researcher and the usability expert lecturer to observe and run the session. There were two sessions: the first between 9am and 10.30am with five learner-participants, and the second between 11am and 12.30 with three learner-participants. The learning assessments were completed after using each website (see the screen shots of each website in Figure 5 below) and the answers were blind double-marked by an independent moderator and the researcher. Similar to Masemola & De Villiers (2006) usability tasks were restructured from the pilot ones, made simpler and shorter and many think-aloud reminders were made. After each learner-participant had completed all tasks and filled in the satisfaction questionnaires they were thanked and offered a 1GB memory stick as a token for their time and willingness to participate. Student-evaluators were offered a 2GB memory stick as compensation for their time and help with both pilot and main usability study. Event logging was done after session, during analysis phase using the manager component of the software. Each video was scrutinised and the markers were set for when events occurred (the start and end of tasks and calls for help).



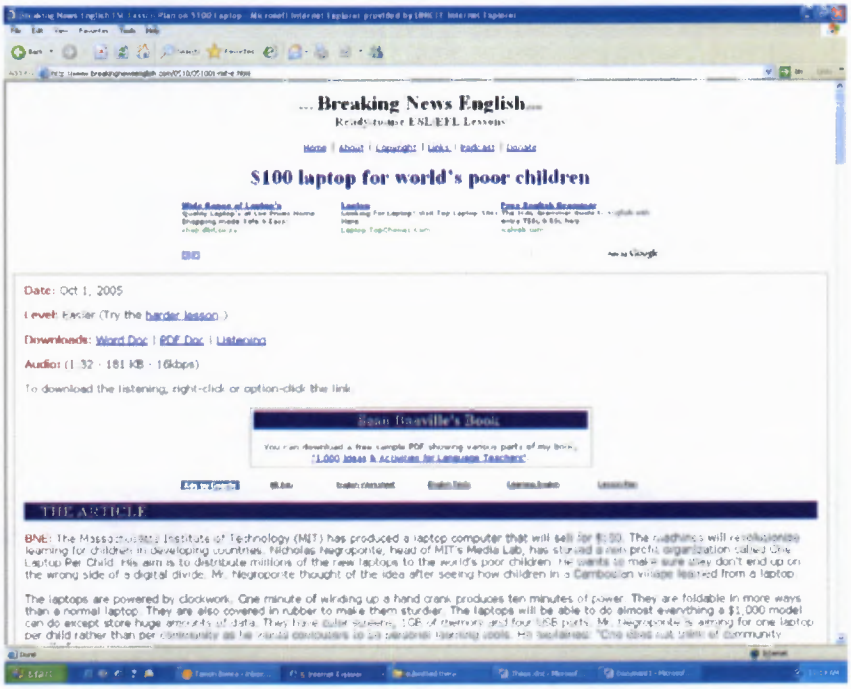


Figure 5: Screenshots of both websites used in the study

Chapter 4

FINDINGS AND DISCUSSION

This chapter outlines the findings from the usability experiment and supporting questionnaires. Data on performance measures were collected using a test task instrument comprised of test task, learning assessments and video and audio footage. Satisfaction was determined through the satisfaction questionnaire. The findings are divided into the two areas under investigation: the usability study findings and learner profiles.

4.1 Usability study findings

Eighr learner-participants took part in the usability study on Saturday 20th October 2007. The recorded video and audio data was analysed in Morae manager. Event logging was done after the study in order to be able to concentrate fully during the live sessions. As the number of participants were too few to be able to perform statistical analysis (Preece et al, 2003, Masemola & De Villiers, 2006), the findings reported here are largely quantitative analysis based on totals and simple calculations.

The profile of the learner-participants, as shown in tables 7 and 8, give an overall picture of the learners and the possible influences on their performance. As it can be seen, all learner-participants had a positive attitude towards using computers, which could be expected from people who volunteered their time for a computer-based study. There was a range in age and experience and a balance of genders. They all showed reasonably high frequency of computer use with six participants using computers once a day or more. Three participants had over five

years experience, but none rated their skills as excellent.. None had any disabilities that may affect their performance. They were all of a similar English language level (they were selected from the same level English language course, module 2).

participant	*gender*	*age*	*use*	*experience (years)*	*skills*	*enjoy*	*colour blind*	*physical disability*
1	female	20-21	once a day	5+	good	yes challenge	no	no
2	female	18-19	once a week	0-1	poor	yes challenge	no	no
3	female	18-19	once a day	0-1	good	yes challenge	no	no
4	male	18-19	more than once a day	5+	good	yes challenge	no	no
5	female	20-21	once a day	0-1	fair	yes challenge	no	no
6	male	24+	more than once a day	0-1	fair	yes challenge	no	no
7	female	18-19	once a week	5+	good	yes challenge	no	no
8	male	20-21	more than once a day	1-2	good	yes challenge	no	no

Table 7: Learner participants' user profiles

The cultural dimensions are shown in Table 8, but as there were only 8 participants the influence of individual preferences would be far stronger than any cultural dimension and therefore could not be matched to any usage behaviour. As a group, their usage patterns were most frequent for typing assignments and using email. This was slightly different to the overall pattern (see section 4.7).

participant	*home language*	*power distance*	*individual ism*	*time orientation*	*uncertainty avoidance*	*masculinity*
1	Nam/Damara	low	individualist	long	low	masculine
2	Oshiwambo	high	collective	short	high	feminine
3	ruKwangali	low	individualist	long	low	feminine
4	Oshiwambo	low	collective	long	high	feminine
5	Oshiwambo	low	collective	long	high	feminine
6	Oshiwambo	low	individualist	long	high	masculine
7	ruKwangali	low	collective	long	low	feminine
8	*Oshiwambo*	*low*	*individualist*	*long*	*low*	**feminine**

Table 8: Learner participants' language and cultural profiles

The focus group discussions found that relevant content ranked as the most important interface criteria for the learner-participants. When asked to rank the design issues that they found most frustrating, they listed 'unnecessary information' and 'too many links' (making navigation confusing) as the most frustrating.

The video data was used with the satisfaction questionnaire findings and the learning assessment scores to establish the usability of the web sites with regard effectiveness, efficiency and satisfaction. Efficiency was established by comparing the times that the participants took to complete the tasks for each website and matching them to the learning assessment scores. Effectiveness was measured by requests for help and learning assessment scores. Satisfaction was established by looking at the learner preferences and their learning assessment scores.

The video footage for each participant was replayed after the live sessions, analysed for events and the following markers were logged (Table 9):

Measurements logged		**Mean time (minutes)**
Task 1	Read passage, website 1	2.98
Task 2	Answer questions, website 1	8.04
Task 3	Check answers, website 1	4.48
Task 4	Read passage, website 2	3.31
Task 5	Answer questions, website 2	4.32
Marker A	Select website 1	
Marker B	Select website 2	
Marker C	Request for help	

Table 9: Event logging markers

The task start time, task end time and each request for help were logged for each participant. The time each participant took to complete each task and the distribution of requests for help was then calculated. The mean times for each task are shown in Table 9. The task sheet (see Appendix B) asked the participants to open a pre-loaded website, read a text, answer the website self-assessment test questions, check their answers and then minimise the screen. Learners completed

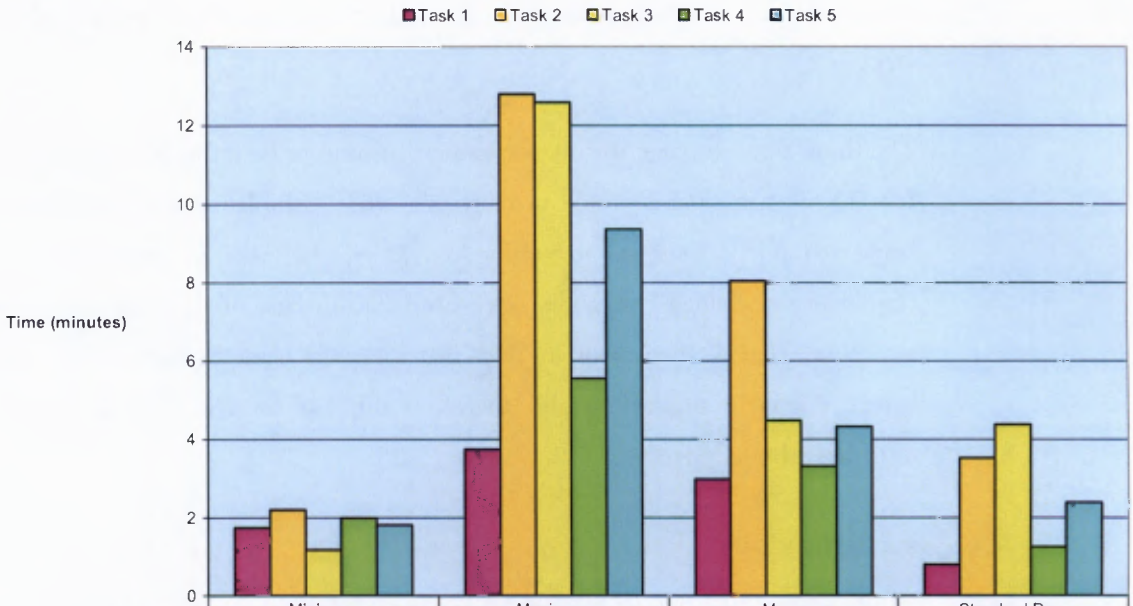
the paper-based learning assessment. Equivalent tasks were then completed for website 2.

The think-aloud footage for the sessions was found to be difficult to use as very few learner-participants would actually talk while completing the task, despite being reminded. Thus the recordings could not be used to gain insight on cognitive processing. This could have been due to lack of familiarity with the technique, general shyness or the fact that the tasks being undertaken required largely cognitive processing and therefore difficult to talk through without disturbing thought patterns.

4.2 Efficiency

Efficiency was measured by looking at the time it took the participants to complete the tasks for each website. However, as discussed in chapter 3, efficiency does not necessarily mean looking for the fastest time. As it was the measure of learning that was the key to the experiment, time taken to complete tasks was used in addition to learning performance measures and compared for each website.

Tasks 1, 2 and 3 relate to the use of website 1 (see Appendix B) and the data in Figure 6 shows that these tasks from website 1 took an average of 15.50 minutes for the learner-participants to complete. Tasks 4 and 5, which were the website 2 equivalent tasks, took 7.63 minutes. The learner-participants appeared to take much longer to read a text, answer and check their responses to questions on website 1, than they did for website 2. As there were a low number of participants in the study, however, average times cannot be used as a benchmark for performance on the website. Looking at individual participant's times for each task provides more revealing information.



	Minimum	Maximum	Mean	Standard Dev.
Task 1	1.75	3.74	2.98	0.8
Task 2	2.2	12.8	8.04	3.52
Task 3	1.18	12.58	4.48	4.38
Task 4	1.99	5.55	3.31	1.25
Task 5	1.81	9.36	4.32	2.39

Figure 6: Average & minimum and maximum time on task

Figure 7 shows the time spent on each task by participant. All the times were plotted on a scatter graph to enable identification of any outliers (Preece et al, p364). For larger data sets, outliers are usually removed before establishing patterns, as they tend to skew data. However with a small data set, as with this study, they can often reveal interesting information. As it can be seen in Figure 6, there are no 'outliers' for task 1; all participants took an average of 2.98 minutes to read the text (between 1.75 – 3.75 minutes). There was a great deal more variation for Task 2 which involved answering the self-assessment questions. Here participants took between 2.2 and 12.8 minutes to complete the task.

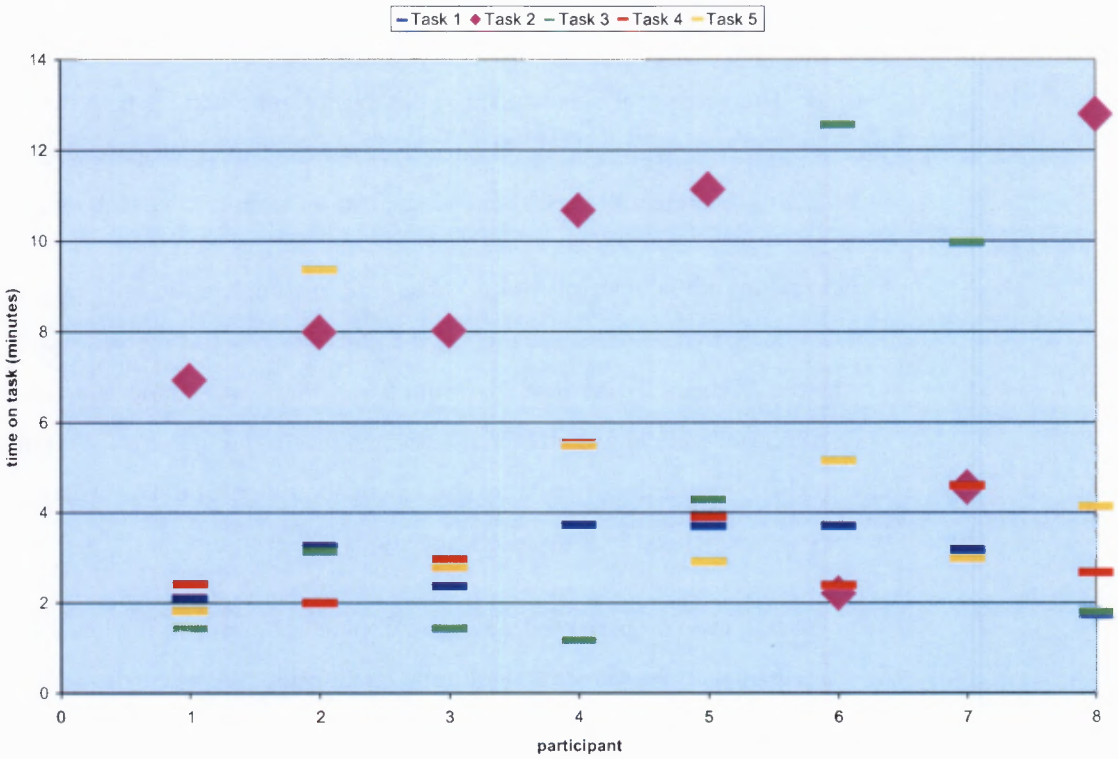


Figure 7: Time spent on task by participant

However, it is with task 3 (checking the answers to the questions) that two participants (6 and 7) took a lot longer to complete than the others. The video analysis reveals that both these participants failed to ever find the correct part of the website for checking their own answers. Instead they got around the problem by scrolling back and forth between the questions and the text in order to check their responses and this is what took so much longer. It is interesting to note that in the satisfaction questionnaires they did not find this frustrating and indicated that they still preferred website 1, finding the text in website 2 too long.

Task 4 (reading the text on website 2), like the equivalent for task 1, website 1, provided no unusual time differences between participants. However task 5 (answering and checking answers to the self-assessments) showed that one

participant (participant 2) spent 9.36 minutes on the task, more than double the average of the other participants who spent between 1.81 and 5.48 minutes on the task. The video analysis reveals that this participant asked for help twice with this website, once with task 4 and once with task 5. This participant also found website 1 to be preferable, again because the text on website 2 was too long.

Other reasons why the learners took more time to complete the tasks on website 1, when compared to website 2 include the number of self-assessment questions to answer. Website 2 had fewer questions and there was immediate feedback once responses were chosen by the user, which meant that there was no separate task to check responses. There were also essential differences in layout and design of the pages which led to navigation frustrations (see section 4.3).

Time on task was compared to learning achievement but due to the low numbers of participants, there were no significant relationships between the lengths of time it took to complete the tasks and the scores on the learning assessments. Table 10 shows the assessment marks and the time on tasks for website 1. It is interesting to note that participant 8 spent the least time reading the text on website 1 and scored the lowest on both the self-assessed test and also the externally moderated learning assessment. However this participant did not spend the least amount of time on the tasks 2 and 3.

The learners who reported 100% on the web test, did not get the highest score on the externally moderated learning assessment (30% or 40%), so a high mark in the web test cannot be used to predict better learning for the learning assessment. Nor did the length of time spent completing tasks predict a high score as the learner spending the longest time reading (3.74 minutes) got 35% on the learning assessment. However the learner with the highest learning assessment score did spend the longest time answering the questions, even though that did not result in the highest web test score (87.5%). The same was found for website 2; the

longer a learner spends on the site did not mean that more effective learning took place (see Table 11).

Participant Number	Self-assessed web learning task 1	Externally marked learning assessment 1	Time on Task 1	Time on Task 2	Time on Task 3
	12.5				
8		20	1.75	12.8	1.8
	43.75				
1		30	2.1	6.92	1.44
	87.5				
7		30	3.19	4.56	9.97
6		40	3.72	2.2	12.58
5		60	3.71	11.13	4.3
	93.75				
3		35	2.38	8.02	1.44
	100				
4		35	3.74	10.67	1.18
2		40	3.27	7.99	3.15
Grand Total			**23.86**	**64.29**	**35.86**

Table 10: Learning scores and time on task for website 1

Participant Number	Self-assessed web learning task 2	Externally marked learning assessment 2	Time on Task 4	Time on Task 5
	50			
8		35	2.4	1.81
	75			
1		45	1.99	9.36
6		60	5.55	5.48
5		70	3.9	2.9
	100			
2		25	2.67	4.13
4		40	4.59	2.98
3		50	2.38	5.14
7		70	2.97	2.78
Grand Total			**26.45**	**34.58**

Table 11: Learning scores and time on tasks for website 2

This shows that those who scored 100% in the self reported web learning task did not necessarily score the highest on the externally evaluated learning assessment (70%). The learner who spent the longest time reading the text (5.55 minutes) scored 60% on the learning assessment, which was the second highest score. The learner with the lowest score (25%) did not spend the least amount of time on the tasks.

In standard formal usability tests, high variability in the time it takes to complete a task is not good. A fast performer shows how quickly it was possible to complete a task and anything slower is the result of delays by usability problems (Nielsen, May 15 2006). In this case, however, as mentioned above, faster learning time did not necessarily mean better learning. Delays can be caused by usability problems, but can be due to time spent learning.

4.2.1 Discussion

The average time spent on the tasks showed that all the tasks on web page 1 took much longer. The average could have been made longer due to just two participants who failed to find the answers on the page with which to check their self-assessment responses. Although the reading text on web page 1 was shorter (200 words compared to 386, of website 2), the mean time on task for reading was 2.98 minutes, compared to mean of 3.31 minutes for reading the text on website 2 (see Figure 7). This is not a significant difference for a text almost twice as long. The difference in the layout may be the reason for the insignificant difference in reading time. The text on web page 1 was arranged across the whole screen, compared to a reading pane on website 2.

There were more questions to answer on website 1 which was evident in the total time spent answering questions (64.29 minutes, compared with 34.58 minutes). In this study the learners who spent more time on the tasks did not achieve more in the learning assessments. The extra time could have been due to the fact that Web page 1 had much more information on it, so that all the learners had difficulty locating the parts required to complete the task. This was noted by the evaluators and was clear from the satisfaction questionnaires. There was much advertising around the top of the page, so a number of learners were confused about where the reading began (obvious from the facial expressions captured on video). Many struggled to find the questions to complete or even find the answers to be able to check their responses (again this became clear from viewing the screens while learner-participants were interacting with website 1). The lack of instructions with the web page also confused the learners and many had to ask for help and commented on that as a point of frustration. The confusion that many learner participants felt over website 1 was captured on the recording of the

participants facial expressions (see Figure 8) and it was also visible when playing back the screen and mouse movement captured by the screen recording.

Figure 8: Screenshots capturing facial expressions

4.3 Effectiveness

Effectiveness was measured by looking at the markers 'C' (request for help) and the learning assessment scores. These were noted by the student evaluators and then logged on the video analysis. See Figure 9 for a distribution of markers requesting help during the use of web page 1 (tasks 1, 2, 3) and web page 2 (tasks

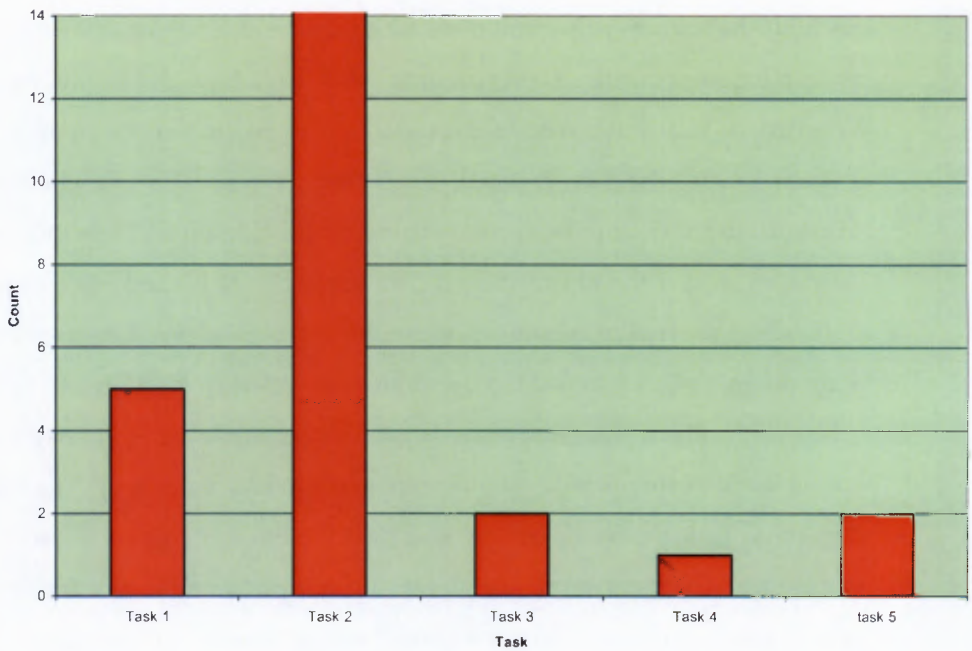


Figure 9: Distribution of help markers by task while using web pages 1 and 2

4 and 5). Most of the requests came when the learners were working on web page 1. This would indicate that web page 1 caused more confusion than web page 2 (see Figure 10).

Figure 10: Learner showing confusion over task 2

A total of 21 requests for help were made for website 1, whereas parallel tasks for website 2 only attracted five requests for help. It was noted by the evaluators and in the video capture that many learner-participants had difficulty navigating their way to the questions on website 1 (task 2) and this received the most calls for help.

The effectiveness of the two sites needs to be measured by:

1. how far the sites achieved their goals
2. the amount of difficulty users had in reaching those goals
3. the scores achieved on learning assessments

The learning assessment tool (see Appendix B) was designed in a similar way for each web page. Figure 11 shows the distribution of marks for each of the learning

assessments and web tests by participant. All learner-participants scored higher in the learning assessment for web page 2 than with web page 1, even if the increase in marks was only 5%. The only participant who scored significantly higher was participant 3 who increased from 35% on website 1 learning assessment to the highest score on website 2 learning assessment (70%).

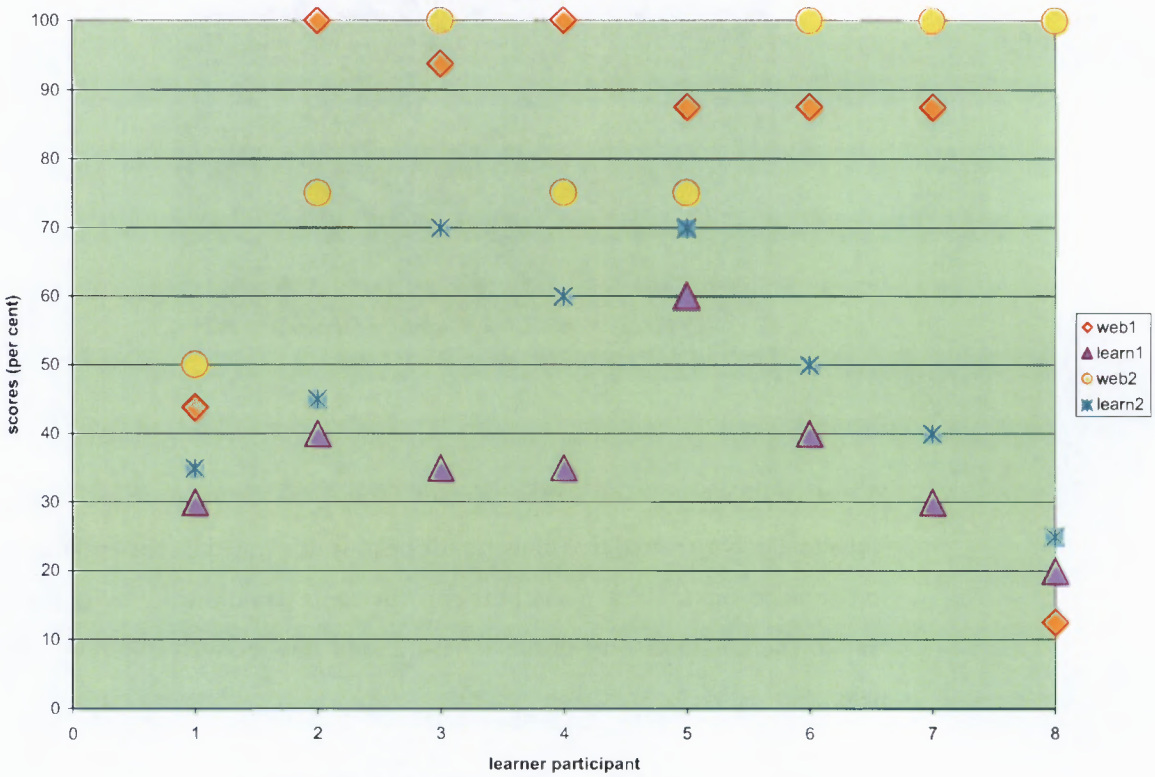


Figure 11: Distribution of marks for all learning assessments by participant

For web page 1, the marks for the web assessment ranged from 12.5% to 100%, with two students reporting 100%. On the externally moderated learning assessment, the marks ranged from 20% to a maximum of 60%. The two students who had scored the highest on the self-administered test did not score the highest on the learning assessment (one scored 45%, the other 30%). The average percentage scored in the learning assessment was 36%, compared with

77% for the self-administered test. Neither self-administered web test appeared to be a good predictor for scores in the learning assessment. Participant 8 in particular shows this, with a self reported score of 100% for website 2 self-assessment, but a low score of 25 % on the externally moderated learning assessment.

4.3.1 Discussion

The effectiveness of the two websites must be measured with the goal of the user in mind. If the goal was to learn independently, then the number of requests for help indicate that web site 1 was less effective than website 2. One of the main uses of web-based learning is its value in supporting self-directed independent learning (see chapter 2, on constructivism and its application to learning with educational technology). If the design of the interface is such that self-direction is at best difficult, or at worst not possible, then the value of using such a resource is questionable. There may be other reasons for using interfaces that are 'difficult' to navigate, especially for learners who are themselves learning design principles. If the goal is to learn the content on the page, as it was with this study, then the learning scores themselves will reveal how far that was achieved.

The learning assessment scores in this study show that on average there was better evidence of learning from website 2, than from website 1. The self-reported web learning tasks do not indicate accurate levels of learning. This may be explained by the inherent difficulty of self-reporting, and therefore may not be reliable. Also a consideration must be that passive assessments (multiple choice) may produce different results when compared with active production on the part of the learners.

4.4 Satisfaction

Satisfaction was measured through a satisfaction questionnaire consisting of 7 open questions (see Appendix B). Learners were asked which website was most satisfying or most frustrating to work on and to justify their answers. They were given an opportunity to list difficulties and make general comments about the layout and organisation of the pages.

There was no strong preference for either website amongst the learner-participants: four felt that website 1 was most frustrating and four felt that website 2 was most frustrating. Of the reasons for website 2 being more frustrating, three learners cited the length of the text as the reason. Only one felt that the layout was not preferable. The reading in website 2 was almost double the number of words of that in website 1, but it did not take them any significant amount of time longer to read (see section 4.2). Of those that felt the web site 1 was most frustrating, the reasons cited were all related to the layout and organisation of the page: lack of instructions and the inability to fill in the gaps on screen as the instructions indicated. The other difficulties that the learner-participants cited were the learning assessments that they said were difficult.

Given the size of sample, there can be no conclusions drawn as to the relationship between the preferences scores for the learning assessments. However it is interesting to note that all those who preferred website 2 rated their skills as 'good' and appeared to score lower marks on learning assessment for website 1 (see Table 12), achieving from 20% to 35% correct answers. This gave an average of 30%, compared with an average score of 42.5% for those that preferred website 1. On learning assessment 2, the assessment for their preferred site, the learner-participants appeared to score slightly better, getting an average of 47.5% which closed the gap with those who preferred website 1, whose average was 51.25%.

Website preference	Skills Rating	Score Learning assessment 1	Score Learning assessment 2	Time on task (minutes)				
				Task 1	Task 2	Task 3	Task 4	Task 5
1								
	poor							
		40						
			45	3.27	7.99	3.15	1.99	9.36
	fair							
		40						
			50	3.72	2.2	12.58	2.38	5.14
		60						
			70	3.71	11.13	4.3	3.9	2.9
	good							
		30						
			40	3.19	4.56	9.97	4.59	2.98
2								
	good							
		20						
			25	1.75	12.8	1.8	2.67	4.13
		30						
			35	2.1	6.92	1.44	2.4	1.81
		35						
			60	3.74	10.67	1.18	5.55	5.48
			70	2.38	8.02	1.44	2.97	2.78

Table 12: Website preference, skills and learning scores with time on tasks

Again the time spent completing the tasks do not appear to be related, other than to indicate that those who spent less time reading the texts appear to get least in the learning assessments. The skills rating cannot be used to predict achievement in learning, as those who rated their skills as 'good' did not score better than those who rated their skills as 'fair' or 'poor'.

Other qualitative comments that came from the satisfaction questionnaire were regarding the reading pane. The learner-participants had differing opinions about whether a reading pane was preferable or full screen width (see Figure 12 below). The learners that expressed a preference in the satisfaction questionnaire for having a reading pane liked the fact that the questions were visible at the same time as reading. Those that found it frustrating felt that it made the reading more difficult by having to scroll down the page.

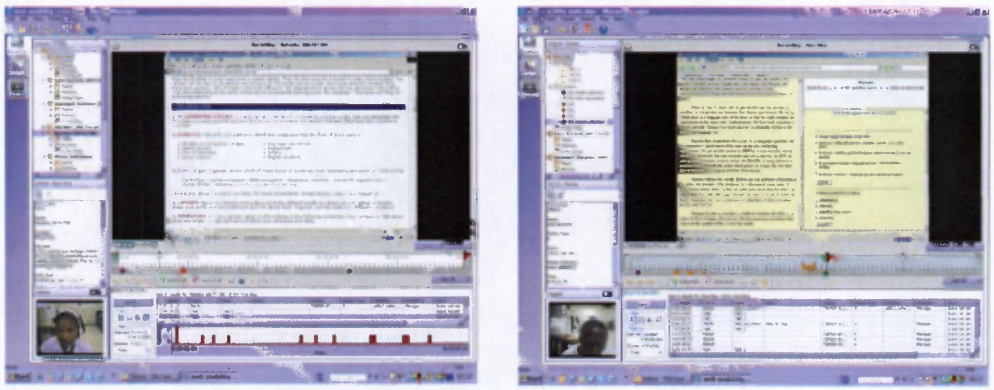


Figure 12: Screenshots in Morae manager: full screen & reading pane layout

Only one participant changed the width of the reading screen herself on website 2 so it resembled the width of website 1.

4.4.1 Discussion

Although 50% of the learner-participants felt that web page 1 was more frustrating and the same for web page 2, the illusion of having to scroll down to complete a reading may have had an impact on the learners' choices. The second web page was deemed to be harder but in fact ranked equivalent in terms of 4 readability standards (see chapter 3, section 3.2.2.4). The second web page text was longer, but it was maybe the scroll down necessity that caused student frustration. The fact that all students performed better on the testing of the

webpage 2 learning assessment gives rise to the possibility that the layout may have been preferable for learning even if the students did not appear to recognise this. To enable any further investigation into screen layout and reading skills, a larger sample would have to be tested.

4.5 Learner profiles

120 learner profile questionnaires were distributed as homework during classes between 8th and 10th October 2007. Ninety three questionnaires were returned by 14th October, giving a response rate of 78%. Part A (questions 1-20) of the questionnaire established the cultural profile and Part B (questions 21-32) established experience, skills, usage and demographic characteristics.

4.6 Cultural profile

The respondents showed low power distance; low uncertainty avoidance; femininity; individualism and low time orientation. Table 13 shows the numbers that showed low and high levels of each dimension. As can be seen from Table 13 (and in a similar manner to Ford, 2005) the learners did not show strong levels of a number of dimensions. With individualism, for example, 48 respondents measured as individualists on the dimension, but 45 as collectivists. It was really only with time orientation that the respondents showed strong tendencies with 63 (67.7% indicating strong long time orientation).

The learners' cultural dimensions were surprising given informal observations. A higher power distance and higher uncertainty avoidance could have been expected. This may be explained by the fact that the respondents are all student in full-time education and have not had sufficient time or opportunity to reflect on

their beliefs and management styles as they are not in management positions. Also surprising was the results for the masculine/feminine dimension as the society as a whole appear, superficially at least, to display greater masculine tendencies towards material possession.

Cultural dimension		*Number of respondents*	*Total*
Power distance	High power distance	37	93
	Low power distance	56	
Uncertainty avoidance	High uncertainty avoidance	34	93
	Low uncertainty avoidance	59	
Time orientation	Short time orientation	30	93
	Long time orientation	63	
Individualism	Individualist	48	93
	collectivist	45	
Masculinity	Masculine	34	93
	Feminine	59	

Table 13: Number of respondents showing levels of cultural dimension

See Table 14 below for a comparison between Ford's (2005) analysis of South African learners and Hofstede's original findings for South Africa. As with Ford (2005), the respondents showed Feminine cultural characteristics, unlike with the earlier Hofstede findings. Hofstede's analysis profiled mangers in South Africa who would have been predominantly white male. It would make sense that young Namibian students might have a different cultural outlook.

Cultural dimension	*Namibian learners*	*South African test subjects (Ford, 2005)*	*South African Managers (Hofstede, 1963)*
Power Distance	LOW	LOW	LOW
Uncertainty Avoidance	LOW	HIGH	LOW
Masculinity	FEM	FEM	MAS
Individualism	IND	IND	IND
Time orientation	*LTO*	*LTO*	N/A

Table 14: Comparison of cultural dimensions with Ford and Hofstede

Although the Hofstede's VSM can be used with a minimum of twenty respondents, the ideal number is 50. Below this number, the influence of individuals becomes too strong. In this study, only one language group had more than twenty respondents (Oshiwambo speakers). Therefore the sample was not large enough to be able to correlate the cultural dimensions to the home languages.

4.7 Learner characteristics profile

Part B (questions 21-32) established user characteristics that have been proved by previous research to have an effect on learning or performance (see chapter 3, section 3.3.2).

4.7.1 Age, gender, language

The majority (48%) of the learners are 18-19 years old, 28% 20-21 years old and the 22–24 year olds making up 23% of the student population in this module. The majority was female (62.4%). Objective culture was ascertained by asking for the home language: 66% Oshiwambo; 12% Rukwangali; 6% Otjiherero; 5% Silozi; 5% Other languages; 3% Nama/Damara; and 2% Afrikaans. This loosely corresponds to the language distribution in the rest of the country (Central Bureau of Statistics, 2003).

4.7.2 Disabilities

Very few learners had disabilities that would affect the performance with an interface: 95.7% had no physical disabilities; 90.3% had no colour/vision disabilities. 9.7% had colour blindness in some colours.

4.7.3 Experience

The learners were not very experienced with computers, and most (60.2%) learners had less than two years. However, despite relatively little experience, they felt that they had good computer skills; the majority of those who had less than one year's experience rated their skills as good, or fair (78.7%).

		Self-rated computer skills				
		poor	fair	good	excellent	Total
Years of computer experience	up to one year	7	13	13	0	33
	between 1 and 2 years	2	11	9	1	23
	between 2 and 3 years	1	4	4	3	12
	between 3 and 4 years	1	0	9	0	10
	more than 5 years	0	0	12	2	14
	null	0	1	0	0	1
Total		11	29	47	6	93

Table 15: Years of experience and computer skills

4.7.4 Attitude

The attitude towards computers was overwhelmingly positive: 90.3% felt that computers made their lives easier and 70% enjoyed the challenge of using computers. Even those who only sometimes enjoyed using computers still felt their lives were made easier.

The majority of learners (69.8%) enjoy using computers and 54.8% of them rate their skills as good or fair (29.2%). Most learners (64.6%) who use computers once a day or more, rate their skills as good or excellent. Those few learners who use the computer less than once a month have poor or fair skills.

4.7.5 Computer use

The respondents mainly use computers for typing assignments, internet searching and email, as shown in Table 16. Male students appear to have a slightly different pattern of use, compared to the female students in that they use the Internet to search slightly more than they use computers for typing assignments. Using the Internet for chatting and downloading music is the least common use.

Gender	UscTypeAss	Usesearch	UseEmail	UseWp	UseClass	UseSurf	Usegame	Usechat	UseMusic
female	142	131	130	111	111	106	75	71	64
male	77	85	73	63	58	62	42	40	45
Grand Total	**219**	**216**	**203**	**174**	**169**	**168**	**117**	**111**	**109**

Table 16: Frequent use according to gender

4.7.6 Summary of learner profile

The majority of learners in module 2 who responded to the profile questionnaire are Oshiwambo speaking, and over 60% are female. Very few learners have physical difficulties that would affect their computer performance, and there are few that have visual difficulties. The learners are relatively inexperienced with computers but the majority feel that their skills are good. Their attitude towards computers is very positive and the majority use computers daily. They use the computers mostly to type assignments, do Internet searches or e-mail. This profile is very positive for the potential of using computers and educational technologies as an aid to the curriculum for language learning.

For this study, as the number of participants in the usability study were so small, the learner profile could not be matched statistically to the performance on the learning assessments.

Chapter 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The purpose of this study was to investigate how the potential of one aspect of learning with technology can be maximized to better help students. The main objective was to determine the influence of interface design on learning, by using two web interfaces. The study was guided by three discrete objectives, to:

- Profile the learners at the Polytechnic of Namibia for cultural dimensions, computer experience, computer skills, usage patterns and demographic characteristics.

- Measure the usability of two web interfaces in an educational context with regard efficiency, effectiveness and satisfaction.

- Investigate levels of learner achievement attributed to interface design preferences, culture, experience, skills and demographic characteristics.

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 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 study was conducted using a controlled experiment in the form of a usability study, with some notable differences from standard usability studies. The dependent variable was student achievement from the learning assessment tool and the independent variables were culture, age, gender, attitude, frequency of use, usage patters, skill and experience.

The population for this study was taken from learners currently enrolled at the Polytechnic of Namibia. A purposive sample was used that included learners enrolled in Module 2 of the English Communication modules (n=120). These learners were profiled for cultural dimensions, experience, skills and demographic characteristics. Eight volunteer learners representing a mix of languages, genders, experience and skills were then participated in the usability study.

The first objective was to profile the learners at the Polytechnic of Namibia for cultural dimensions, computer experience, computer skills, usage patterns and demographic characteristics:

93 learners were profiled, 62,4% of whom were female, 48% 18-19 years old. 67% were Oshiwambo speakers; 12% Nam/Damara; 6% Otjiherero speakers; 5% Silozi related and other language speakers; 3% Rukwangali related language speakers; and 2 % were Afrikaans speakers. 95.7% have no physical disabilities, 9.7% have some visual impairments with regard colour. 60.2% had less than 2 years experience with computers, 15.1% over five years experience. 6.5% rated their skills as excellent. The attitude towards computers was positive: 90.3 % believing they made their lives easier and 70% enjoying the challenge of using computers. 37% use computers daily and 32% more than once a day.

The second objective was to measure the usability of two web interfaces in an educational context with regard to efficiency, effectiveness and satisfaction. In order to do this, two web sites were selected after extensive tests for comparative

text readability, appropriate context and length. The two sites were measured according to adapted heuristic criteria, one rating poorly and one highly on the test. Measurements of efficiency, effectiveness, and satisfaction were taken through a usability study that was attended by a group of 8 learners. Website 1 ranked low on the heuristic scale and was less efficient in terms of the time it took learners to complete tasks, when compared to website 2. Website 1 was less effective for the learners when it came to navigating in order to complete tasks unaided, with a total of 21 requests for help in comparison to identical tasks on website 2 which elicited 5 requests for help. Effectiveness with regard to learning was measured by two learning assessments; one self-reported and one externally moderated. Website 2 was most effective with regard learning, in comparison to website 1, with all learners achieving a higher mark (even if it was only by 5%) on the externally moderated learning assessment for website 2 than for website 1. Satisfaction was measured by open-ended questions, resulting in 50% learners finding website 1 more satisfying to use and 50% preferring website 2.

The third objective was to investigate levels of learner achievement attributed to interface design preferences, culture, experience, skills and demographic characteristics.

Preferences for website 1 resulted in a higher mean mark on the self-reported learning task, but not on the externally assessed assessment. In the usability study, there was no evidence of a significant effect of age, gender, skills or culture on the learning assessment scores, but this could be attributed to the small sample size.

5.2 Conclusions

The usability study of two web interfaces used for language learning was not merely a usability evaluation of a user interface, but an investigation into the possible influences on learning from one of the educational technology resources

that is becoming an increasingly important resource in the Namibian education system. The sample used in this study was not randomly drawn from the population of learners, but with this limitation in mind, the following conclusions can be drawn:

1. The website that measured higher on the heuristic evaluation, website 2, also measured more efficient in terms of time taken to complete tasks in comparison to the website 1 (that measured lower on the evaluation). Website 2 was also more efficient in terms of the amount of external help required to complete tasks. Website 1 and website 2 scored equal measures in terms of satisfaction.
2. The well-designed website that measured higher on the heuristic evaluation (website 2) appeared more effective for learning than the poorly-designed website (website1) which measured lower on the heuristic evaluation.
3. Participants in this study expressed a high degree of self-perceived computer skills, but had relatively little previous experience with computers. The more frequently the participants used computers; the more highly they rated their computer skills. The participants in this study expressed very positive attitudes towards using computers and enjoyed the challenge of using them.
4. The participants in this study displayed cultural characteristics of low power distance, low uncertainty avoidance, femininity, individualism and low time orientations. There was not sufficient evidence of the cultural dimensions being linked to the objective culture of the participants' home language due to the small sample size.
5. The participants in the usability study felt that relevant content is the most important feature of any website.
6. Participant preferences or satisfaction with website layout did not have any significant effect on learning achievement.

7. Self-reported learning achievement from website self-assessments did not correlate with externally moderated learning achievement.

It can be concluded that:

H_1 is retained: a poorly-designed website will negatively affect learning.

H_2 is retained: a well-designed website will positively affect learning.

5.2.1 Implications

Objective 1: Profile the learners at the Polytechnic of Namibia for cultural dimensions, computer experience, computer skills, usage patterns and demographic characteristics.

Conclusions: Participants in this study expressed a high degree of self-perceived computer skills, but had relatively little previous experience with computers. The more frequently participants use computers, the more highly they rated their computer skills. They expressed very positive attitudes towards using computers and enjoyed the challenge of using them. They displayed cultural characteristics of low power distance, low uncertainty avoidance, femininity, individualism and low time orientations.

It was expected from the researcher's own lecturing experience that there would be a positive attitude amongst the learners towards computers and that this could then be harnessed for language learning. The fact that the students are inexperienced with computers but rate their skills quite highly, even after a relatively short period of time of frequent usage, is another testament to how positively the learners feel towards the use of this aspect of educational technology.

The learners' cultural dimensions were somewhat surprising in some respects. With the general observations with regard to levels of management, types of

leadership and attitude to superiors, a higher power distance and higher uncertainty avoidance could have been expected. This may be explained by the fact that the respondents are all student in full-time education and have not had sufficient time or opportunity to reflect on their beliefs and management styles as they are not in management positions. Also surprising was the results for the masculine/feminine dimension. Like Ford (2005), this may again be explained by the students current roles in their lives, but the society as a whole appear superficially at least to display greater masculine tendencies towards material possession. The long-term time orientation result appears to fit with superficial observations of the unequal relationships between the generations.

Objective 2: Measure the usability of two web interfaces in an educational context with regard to efficiency, effectiveness and satisfaction.

Conclusions: The website that measured higher on the heuristic evaluation, website 2 also measured more efficient in terms of time taken to complete tasks in comparison to the website that measured lower on the evaluation. Website 2 was also more efficient in terms of the amount of external help required to complete tasks. Website 1 and website 2 scored equal measures in terms of satisfaction.

When using a well-designed web page, learning achievement was higher than when using a poorly-designed web page. A well-designed website is more effective for learning than a poorly designed website. A well-designed website does not affect the website preference of participants. Participant preferences or satisfaction with website layout did not have any significant effect on learning achievement.

The measures of satisfaction for website 1 were surprising to the researcher, especially given the amount of external help required to complete tasks and the

visual displays of confusion and frustration on the video recordings. Although the learner-participants were not very detailed in their feedback, the full screen layout may have had more to do with the dissatisfaction than any other aspect of the design. The learning achievement scores as a measure of effectiveness fit with the aspects of the website 2 that were thought to be very positive for reading skills; a reading pane, feedback to answers, and an explanation of where the learner might have gone wrong in their reasoning. Although each learner achieved more in the website 2 learning assessment, even if it was a very small increase, it may have been the content of the reading that appealed more to the learners. The level of readability and the types of questions were applied similarly, but the content may have had more of an effect than the researcher had allowed for. It is also reasonable to assume that a more effective website will be also more efficient and both of those would impact positively on learning.

Objective 3: Investigate levels of learner achievement attributed to interface design preferences, culture, experience, skills and demographic characteristics.

Conclusions: Participant preferences or satisfaction with the websites did not have any significant effect on learning achievement. Self-reported learning achievement from website self-assessments did not correlate with externally moderated learning achievement.

The participants in the usability study all had very positive attitudes towards computers, as expected for learners who had volunteered to take part in a computer based research session, so it was not possible to measure less positive and learner achievement. The demographic and usage patterns could not be measured for their effect on the learning assessment scores on either web page, due to the small sample size. More computer experience did not mean a higher score was achieved in the usability study, but a larger sample size might produce different results. Age, gender and skills did not have any significant pattern of

effect on the learning assessment scores, possibly because the sample was too small.

5.3 Recommendations

Based on the findings of this study, the following recommendations were made for further research:

1. This study could be replicated using procedures that allow for a higher degree of randomisation and a larger number of participants. This would enable enough data to be collected to make valid statistical analyses which would also be more generally applicable. The sample of this study was purposively selected; to do a study that would allow for more generalisability would be of particular use for school learners. The roll-out of equipment as part of the implementation plan of the ICT for education policy will mean that more school learners will be becoming more exposed to the medium of web interfaces. The training plan for educators will require a substantial investment of time and therefore dissemination of guidelines from empirically tested research could be of value in the short-term.

2. A longer term study would be valuable, involving a pre- and post test for knowledge gained through a course of study using software/web interfaces. It would be necessary to design a study so that learning from an interface could be assessed discretely from any other source or external resource.

3. A more in-depth look into the effect of Namibian culture and languages on reading patterns, writing styles and the development of local software and

web interfaces would be of great value to the Namibian education system. Although this study found no correlation between learning and cultural dimension, the size of the sample was too small for statistical analysis.

4. This study did not look at cognitive patterns. A study that involved more learners would enable a more serious analysis of learning and cognitive patterns as recommended by Masemola & De Villiers (2006).

The contribution of this research to the body of knowledge about usability testing in a learning environment is particularly important for Namibia. It should, however, be regarded as showing the way forward for more extensive research. Larger samples from more random populations need to be investigated, as do methodologies to accommodate the cultural and education context specific users.

To maximise the positive attitude towards computers and use them effectively and regularly as part of learning strategies, would greatly strengthen the response of the education system to the issues of insufficient teachers and resources. It would be especially good for the Polytechnic of Namibia software engineering students to become involved in piloting locally developed language learning software or web interfaces. Further research into the effects of culture on writing patterns and reading interpretations would also be extremely valuable to inform and help address the language learning issues that Namibian learners face. If this knowledge could be harnessed within local interface design projects, the burden of insufficient English language learning during the school years could be eased.

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Appendix A

Learner Profile Questionnaire

We are conducting a research study on student learning and interface design. The purpose of this study is to assess the impact of the design of an interface on learning.

This questionnaire will be used to create your profile which will be later used to match your design preferences. It is important that you answer all the questions and that you put your student number in the box provided so that your profile can be matched during the study. Your participation in the study is confidential, but your identity is necessary to match your details with the information you provide. Please remember that your identity will never be revealed and your responses are confidential and will not be used for any other purpose than for this academic study.

This questionnaire is only for research and is not part of your marks for the semester.
There are no right or wrong answers to the questions. **Please answer honestly and answer all 32 questions.**

There is no foreseen risk of physical, psychological or economic harm to any participants. Should you be selected for the entire study, you will be asked to complete a set number of tasks on web sites and take a 'learning' assessment. You will also be asked about your design preferences and have a short interview in which you can express your views after the study.

You will be offered a small reward as compensation for your time and willingness if you are selected to participate in the main study.

Your participation is completely voluntary and there is no penalty for not participating. For any questions please contact:

Ms.Tamsin Bowra
Cell: 081 261 1337

PART A

For each of the following statements, please show how you feel about each one by putting a tick the appropriate box, a) strongly agree - e) strongly disagree

strongly agree	agree	not sure	disagree	strongly disagree	
					1. If a lecturer says something that I disagree with, I will challenge the lecturer **during** the lecture/class
					2. Social acceptance is more important to me than self-respect
					3. I am more comfortable in a learning environment with structured timetable slots and precise learning objectives, than in an open-ended learning environment
					4. Competing with my fellow students is NOT important to me
					5. If I do a favour for someone I expect that person to do a favour for me in return at the time when I need it
					6. If a lecturer says something that I disagree with, I will challenge the lecturer **after** the lecture/class
					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
					8. I have no problem working on an assignment even if the objectives are not clear at first
					9. A lecturer who is friendly is better than a lecturer who has a strong academic reputation
					10. I believe in living my life for the moment rather than planning for the future
					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
					12. I would rather work on an assignment on my own than as a group
					13. Unfamiliar situations make me feel uncomfortable
					14. I prefer to discuss lecture material with fellow students rather than with lecturers
					15. When I am learning something new and difficult, I persevere until I understand it
					16. I often discuss lecture material with my lecturers outside of lecture times
					17. Money and opportunities for advancement are more important to me than the caring and social roles in a job
					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
					19. I think that the correct answer is more important than an original/creative answer
					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

PART B Student number: ☐

Family name:_____ **First name:**_____

**** please note that your names are only used to match you to the information you provide: your name will never be published. It is the software interface that we are researching, not you.*

21. Gender: a) female ☐ b) male ☐

22. Age: a) 18-19☐ b) 20-21 ☐ c) 22-23 ☐ d) 24+ ☐

23. Degree/diploma: _____

24. Home language:

a) Afrikaans	☐	g) ovaHimba/ovaZimba	☐
b) English	☐	h) ruKwangali & related	☐
c) German	☐	i) a San language	☐
d) Nama/Damara	☐	j) siLozi, ciFwe, siSubia, other Caprivi	☐
e) Oshiwambo	☐	k) Other	☐
f) Otjiherero	☐	Please specify_____	

25. How often do you use a computer?:

a) less than once a month	b) once a month	c) once a week	d) once a day	e) more than once a day

26. How many years experience with computers:

a) 0-1 years	b) 1-2 years	c) 2-3 years	d) 3-4 years	e) 5 years+

27. What do you mainly use computers for?

	1. rarely	2. sometimes	3. often
a) Searching for information on the Internet			
b) Internet Chat rooms			
c) Internet surfing			
d) Typing assignments			
e) Word processing			
f) Games			
g) Downloading music			
h) Work during classes			
i) E-mail			

28. How do you rate your own computer skills?:

a) none	b) poor	c) fair	d) good	e) excellent

29. How have computers affected your life?:
a) made life easier ☐ b) no effect ☐ c) made life harder ☐

30. Do you enjoy using computers?:
a) Yes, usually it is challenging ☐ b) Sometimes ☐ c) No, it is frustrating ☐

31. Are you colour blind?:
a) Yes, in red and green ☐ b) Yes in some colours ☐ c) No ☐

32. Do you have any disabilities that affect your work on a computer?
a) No ☐
b) Yes, I have difficulty hearing ☐
c) Yes, I have difficulty moving my fingers, wrists, elbows or shoulders ☐
d) yes, I am in a wheelchair ☐
e) yes, but the handicap is not listed ☐

THANK YOU VERY MUCH FOR YOUR PARTICIPATION

Appendix B

Usability Study Tools: Task Sheet and Learning Assessment

Usability session: 2 Date:20/10/07 Student number:_____

HCI Usability Test Task Sheet:

Exercise 1

1. Select the website about '*Laptops for $100*' from the pre-loaded pages:

http://www.breakingnewsenglish.com/0510/051001-mit-e.html

2. Read the passage.

3. Answer the gap fill questions below the passage.

4. Check your answers

4. Write in the box how many questions you answered correctly ___/15

5. Minimize the screen and turn over the page to answer the questions on the passage. Please answer the questions without looking back at the webpage

Learning assessment 1

Web page 1: $100 laptops

Answer the following questions:

question	answer
1. What is the text about? 2. How are the laptops powered?	1. 2.
3. How will the laptop affect learning for children? 4. Why is the product unusual?	3. 4.
5. Briefly summarise the passage	5.

Exercise 2

1. Select the website about '*Thomas Edison*' from the pre-loaded pages:

http://depts.gallaudet.edu/englishworks/exercises/main/reading.html

2. Read the passage.

3. Answer the questions next to the passage.

4. Check your answers

4. Write in the box how many questions you answered correctly

5. Minimize the screen and turn over the page to answer the questions on the passage. Please answer the questions without looking back Webpage 2: New Services

Learning Assessment 2

Thomas Edison

Answer the following questions:

question	answer
1. What is the text about? 2. What did Thomas Edison invent?	1. 2.
3. What made Edison begin experimenting? 4. How did he manage to work and keep on doing experiments?	3. 4.
5. Briefly summarise the passage	5.

Usability Study Tools: Satisfaction Questionnaire

Please complete the following questions based on your experience with interacting with the websites

1 a) What was the most frustrating web site to work on? website 1 ☐ website 2 ☐

b) Why:_____

_____

2 a) What was the most satisfying website to work on? website 1 ☐ website 2 ☐

b) Why:_____

_____

3. How confident are you that you succeeded in the tasks?

_____

4. How did you find the response time of the website?

_____

5. How easy was it to navigate around the websites? Explain

_____

_____

6. List any difficulties you had in completing the tasks

_____

_____

7. Do you have any other comments (please think about the layout, organisation and navigation of the websites you have visited in this study)

_____

_____

_____

_____

THANK YOU FOR YOUR PARTICIPATION

Appendix C

Heuristic evaluation sheet (adapted from Keevil, 1998)

Usability Index (calculated by Excel as a per cent)			
What is the name of the Web site?			
What is the location (URL) of the Web site?			
What is the main purpose of the site?			
What is the style of the site?			
Checklist Questions			
Finding the Information **Contents**	**N/A**	**Yes**	**No**
Contents list included?			
Links in contents list correct?			
Site Map			
Site map included?			
Links in site map correct?			
Headings labelled correctly?			
Two or three highest heading levels included?			
Capitalization, spelling, and punctuation correct?			
Acronyms avoided where possible?			
Headings (Choose one page at random)			
Headings brief and informative?			
Headings stand out on the page?			
At least one heading on every page?			
Each heading accurately reflects tasks or information?			
Search			
Search tool included for sites with over 20 pages?			
Choose a topic at random -- can you find it?			
Index			
Index included?			
Entries in alphabetical order?			
Up-to-date information			
Is the date of the last update indicated?			
Finding an answer			
Are the instructions clear for finding answers to the questions?			
Can the user input their answers and get them evaluated?			
Glossary			
Glossary included?			
All specialized terms in site included?			
Definitions consistent with site definitions?			

Terms and definitions copied from organizations credited?			
Overview Page			
Purpose and uses of site described?			
About This Site Topic (for 50-page sites)			
Topic "Organization of this site" included or implied?			
Topic "How to use this site" included?			
Topic "Who should read this site" included?			
Topic "Related Publications" included?			
Topic "Getting Help" included?			
Organization of the Site			
Structure of lists parallel?			
Structure of procedures parallel?			
Structure of examples parallel?			
Each paragraph has main idea, described in topic sentence?			
Presentation moves from general to specific?			
Presentation moves from simple to complex?			
Information complete?			
Information limited to appropriate and necessary topics?			
Information in correct sequence?			
Procedures task oriented?			
Summary included and accurate?			
Style (Choose five pages at random)			
Style conforms to desired style?			
Editorial comments added or otherwise resolved?			
Active and passive voices used appropriately?			
Second person used appropriately?			
Present tense predominates?			
Reading level acceptable?			
One-sentence paragraphs used sparingly?			
Sentences simple but not terse?			
Latin words and abbreviations eliminated where possible?			
Transitions between topics smooth?			
Instructions in imperative mood?			
Positive expressions and expressions predominate?			
Abbreviations, acronyms, and symbols used sparingly?			
Abbreviations and acronyms in prescribed style?			
Imprecise (vague) words replaced with precise ones?			
Jargon avoided?			
Redundant and extraneous words removed?			
Coining of verbs, adjectives, and nouns avoided?			
Noun strings limited to maximum of three words?			
Examples			
Examples included?			

Examples relate well to tasks?			
Examples tested and approved?			
Complexity of examples appropriate for audience?			
Figures			
Figures consistent in font, layout, and style?			
Figures flow in an obvious manner?			
Figures easily interpreted?			
Figures suit information presented?			
Figures useful?			
Figures sufficient in number?			
Figures appropriately titled and numbered?			
Each figure title unique?			
Figures referenced in preceding text?			
Titles, callouts, and annotations informative?			
Figures correctly integrated with the text?			
List of Abbreviations			
List of abbreviations included?			
Entries in alphabetical order?			
Style correct, concise, and readable?			
Terminology			
Approved terminology used?			
Terminology based on standards?			
Sources of specialized terminology listed in bibliography?			
General terms used as defined in Webster's dictionary?			
Naming conventions applied correctly and consistently?			
Highlighting conventions consistent and correct?			
New terms highlighted and defined when first used?			
Synonyms avoided after meaning of terms established?			
Meaning of each term consistent throughout each site?			
Meaning of each term consistent throughout set of sites?			
First occurrences of abbreviations follow spelled-out words?			
Level of technical terms appropriate to audience?			
Depreciated, restricted, and forbidden words avoided?			
Difficult-to-translate words avoided?			
User-Oriented Tasks			
Does the title of the site represent a major task?			
Is there a procedure for a basic, getting started task?			
Does each task have an introduction?			
Are the tasks described using action verbs?			
Tasks			
Choose a task - can you complete the task in 10 minutes?			
Interactive Tasks			
Are reply forms shorter than one page?			

Does the site use QuickTime movies?			
Information Updates			
Is the date of the last update indicated?			
Is there an automatic update notification mechanism?			
Is new information indicated?			
User Questions			
Are Frequently Asked Questions (FAQ) included?			
For example - How to install the software?			
For example - How to start the application?			
For example - How to exit from the application?			
For example - Where to get help information?			
Display Speed (Choose three pages at random)			
Home page displays within 10 seconds with a 33.6 modem?			
If not, is there feedback indicating the delay?			
Are graphics under 25K in size?			
If more than 5 graphics on a page, are they 15k or smaller?			
For URL (URI) links, is the final slash included?			
Are WIDTH and HEIGHT attributes included on all images?			
Are WIDTH and HEIGHT attributes included on all tables?			
Are complex tables split into simple tables?			
Links			
Is there advance notice before downloading large files?			
Are thumbnail pictures at least 1 x 2 inches (2.5 x 5.0 cm.)?			
Is there at least one link on every page?			
Is the color of the link correct?			
HTML Format (Choose one page at random)			
Do pages display on small 2 x 3 inch (5.0 x 7.5 cm.) terminals?			
Is standard HTML code used?			
International Format			
Are international audiences recognized?			
Are meeting times international?			
Are icons international?			
Are metaphors international?			
Text Format (Choose three pages at random)			
Text left justified and ragged right?			
Format consistent throughout the site?			
Figures and tables aligned correctly?			
White space used effectively?			
Information presented in readable blocks?			
Major topics begin on separate pages?			
Bad line breaks corrected?			
Sentences not continued across pages?			
No widowed headings?			

No orphans?			
Mechanics (Choose five pages at random)			
Spelling correct?			
Punctuation correct?			
Grammar correct?			
Cross-references used only when necessary?			
Cross-references to other parts of site use "see"?			
Cross-references to other sites use "refer"?			
Changes marked accurately with correct revision characters?			
Spelling checker runs error free?			
Readability checker indicates appropriate level?			
Lists			
List formats appropriate for items listed?			
Lists punctuated correctly?			
Messages			
Messages (for example, errors) included and accurate?			
Message format correct?			
Message style consistent?			
Messages as brief as possible?			
Trademarks			
Trademarks acknowledged correctly?			
Appendixes or References			
References included and correctly placed?			
totals			
usability index calculation (total 'yes' marks, as a % of total score)			