

UNIVERSITY OF KWAZULU-NATAL

The accessibility of websites for blind and visually impaired individuals

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University of KwaZulu-Natal

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Abstract

This study investigates the accessibility of web sites for blind and visually impaired individuals. The researcher's aim in this study is to highlight the different problems the individuals experience when interacting with websites.

A case study approach was adopted in order to investigate accessibility problems amongst blind and visually impaired people. This was investigated by conducting a user test, observation with the think aloud technique and interviews. The user test was made up of tasks where the participants had to visit four different types of websites and complete predefined tasks for each of these websites. The researcher also analysed the data by the use of automated web evaluations. This was used to compare the automated web evaluation results with the researcher's results.

Content analysis was used to identify frequencies and intensities with which themes and concepts appear in interviewee responses. In addition, correspondence analysis was used to help corroborate the findings of the content analysis and interpret the data.

Results revealed that blind and visually impaired individuals do experience many difficulties when interacting with websites. The findings identified certain technical and conceptual accessibility problems that were experienced by blind and visually impaired individuals. The results also indicate that there is a relationship between website design and accessibility problems experienced. Further, the results indicate that the use of an assistive technology has a positive effect on the performance of web based tasks.

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CHAPTER 1

Introduction

1.1 Introduction

According to Edwards (1996), “the World Wide Web ushered in a new wave of communication. It has since evolved into a dynamic mechanism for disseminating and managing information. A subset of the Internet, the Web is a virtual global space for interaction between individuals irrespective of their geographical location. Surfing the Web is the means of accessing, organising and moving through the Internet's huge repository of stored information.”

As the World Wide Web continues to grow it becomes a necessity to many people. However people with visual disabilities who access the Internet experience many difficulties and for this reason blind and visually impaired individual consider the World Wide Web to be a very difficult place to access information (Craven and Brophy, 2003). These difficulties pertain to the presentation, structure and interpretation of information that is textual and graphical. These problems will form the basis of this investigative study.

This research will focus on the accessibility of websites for blind and visually impaired people. To this end, multiple websites would be chosen, and blind and visually impaired individuals would be required to perform specific web-based tasks to test for accessibility problems. The researcher will also assess the effect of the graphical environment of the Internet and the difficulty it presents for people with visual disabilities attempting to access the web. People with visual disabilities are therefore required to use specific tools like Braille displays, speech synthesizers or screen magnifiers. The researcher will focus on typical accessibility problems faced by blind and partially sighted users and contributory factors that are related to these problems.

The following sections can be found in the remainder of this chapter: the background to the research problem is discussed in section 1.2, followed by the problem statement in section 1.3, the research objectives in section 1.4, scope of the study in section 1.5, followed by the research

questions in section 1.6, the importance/significance of the study in section 1.7, research design and methodology in section 1.8, section 1.9 discusses the limitations of this study and this chapter concludes with a discussion on the dissertation outline in section 1.10. and the linkage of the chapters is discussed under figure 1.1

1.2. Background and Context

According to Pash (1998), “the World Wide Web is a powerful resource for education, commerce, social interaction, arts, and entertainment.” However, not everyone has access to the resources available on the Internet. The blind and visually impaired individuals in particular have limited access to web-based resources.

The early development of the Internet had a standard computer interface which was largely text-based. This enabled blind and visually impaired users to easily gain access to the Web's resources using technology such as screen readers and screen magnifiers. However the graphical user interface (GUI) and the World Wide Web changed the environment of the Internet (White, 2005). The importance shifted from the distribution to the presentation of information that is more emphasis was placed on the way information was presented by using graphics, sound, video, animation and text (Pash, 1998). Users with good quality vision, fast connection speeds, and the latest computer hardware and software, found the Web to be a very exciting place. Unfortunately people with visual disabilities found the Web to be quite challenging as they had problems in gaining access to the content on the World Wide Web.

According to research done by screenreader.net (2007), there are 180 million visually impaired people worldwide. The visually disabled community thus comprises a significant portion of the world's population. According to a United Nations report (2006), approximately 1 in every 10 people in the world that is more than 500 million people have a disability. These numbers are inclusive of people with disabilities who are not directly affected by web accessibility issues such as paraplegics. However, the population of people with disabilities who are affected by web accessibility issues ranges in the tens of millions (White, 2005).

Hence, it is of great importance that web designers are very careful when designing websites as amidst other design issues, accessibility contraventions can render a site unreadable by a blind or visually impaired person.

According to the US Census Bureau (2005), disability is defined as “having a non-severe or a severe disability that involves experiencing difficulty or inability in performing functional activities, activities of daily living or instrumental activities.”

For different degrees of blindness or visual impairments, web accessibility poses varying levels of challenges given that it is a visual interface. The high graphical nature of the web is a problem for most blind or visually impaired individuals because it is hard for them to distinguish between colours. In addition if images appear on a web page, “ALT” Text should be made available for blind and visually impaired individuals who cannot see the image thereby providing a text alternative to enable the assistive technology to interpret the image.

According to the Assistive Technology Act (1998), “Disability is a natural part of the human experience and in no way diminishes the right of individuals to live independently; enjoy self-determination and make choices; benefit from an education; pursue meaningful careers; and enjoy full inclusion and integration in the economic, political, social, cultural, and educational mainstream of American society.” Thus websites must be designed in such a way that they take into consideration the needs of blind and visually impaired individuals and ensure that they are more easily accessible to these individuals.

The target group that will form the focus of the study will be blind students at the University of KwaZulu-Natal. In order to determine the level of accessibility of different websites, blind and visually disabled individuals will participate in user testing which is a technique designed to uncover accessibility problems whilst interacting with websites.

1.3. Problem Statement

According to Clark (2002), “text is not a feature of websites but a fundamental and unalterable component. The last couple years have seen the evolution of the rich graphical desktop with colourful icons, controls and buttons all around the screen, controlled by the mouse pointer

moving about the screen clicking and dragging.” This may be visually appealing to most individuals but it presents an unfriendly user environment for the blind and visually disabled (Burger and Stoger, 1996).

According to part three of the Disability Discrimination Act (1995), a service provider cannot refuse services to disabled and visually impaired people. Approximately 30 percent of visually impaired people use computers and the Internet. The World Wide Web’s growth has given people suffering from visual impairment the ability to enjoy the Internet with the help of synthesized speech and Braille display technology. This assistive technology also enables completely blind people to use the Internet. According to Howell (2006), for these technologies to be effective, web pages must be written and designed in correct HTML (hypertext mark-up language). This is the dilemma that most blind and visually impaired users are faced with that is websites are not designed in a format that can be understood by them. Most people with sight problems are unable to read online text the same way as fully sighted people. However, the needs of poor-sighted people vary, depending on how their eye condition affects their vision. In other words, some people need text to be large in order to read it while others can only read smaller letters. Also people with sight problems need a highly contrasting colour scheme, while some can only read yellow text on a black background (Howell, 2006). To cater for both sighted and visually impaired people websites should be designed with flexibility in mind thereby allowing an individual to alter the text and colour settings to suit their needs. People with very little or no vision requires the help of assistive technology to enable them to read and interpret websites.

The significance of this study lies in the importance of understanding factors that contribute to the accessibility of websites for blind and visually impaired people which is directly relevant to website designers.

According to Nielsen (2002), “people who have vision problems have the hardest time using the Internet.” This may be attributed to various problems that arise when a website is not designed to cater for both sighted and non sighted users.

According to Silverstone (2003), "The Internet is visual like the radio is audio. It is very difficult for anyone with vision problems to use the Internet." Many visually impaired people use

assistive technologies to make a website more accessible but using a screen reader is only half of the way of accessing web pages, the other half is making sure web pages have text that identifies graphics and icons otherwise they will not be accessible to people with visual disabilities. The Internet can be a huge and powerful tool that gives people with visual disability access to information that were once difficult for them to access. Making a website accessible to blind and visually impaired individuals is not good enough. Websites need to be user friendly and easy to use for blind and visually impaired people.

There is limited empirical evidence on accessibility problems experienced, how individual website design affects accessibility for blind and visually impaired people and how the use of assistive technology affects website the performance of web-based tasks.

1.4. Research Objectives

The objectives of the study are as follows:

- To determine the accessibility problems experienced by blind and visually impaired people interacting with selected websites.
- To understand how website design correlates to accessibility problems experienced by blind and visually individuals
- To understand how assistive technology used by blind and visually impaired individuals affects website accessibility and the performance of web-based tasks.
- To understand how the degree of visual impairment relates to the performance of web-based tasks.

1.5. Scope of the study

This study focuses on the accessibility of websites and will help to highlight certain difficulties faced by people with visual disabilities and how these problems can be overcome. The researcher will examine the different types of assistive technologies and how they support various degrees of visual disabilities, what design guidelines can be implemented to improve accessibility and the role of prior internet experience.

The literature survey will identify the many potential factors that impact on website accessibility for the blind and visually impaired individuals. It will also highlight previous studies on website accessibility in order to identify existing gaps that can be addressed in this study.

1.6. Research Questions

- What are the accessibility problems experienced by blind and visually impaired people interacting with selected websites?
- How does website design correlate to accessibility problems experienced by blind and visually impaired individuals?
- How does assistive technology used by blind and visually impaired individuals relate to website accessibility and the performance of web-based tasks?
- How does the degree of visual impairment relate to the performance of web-based tasks?

1.7. Importance/Significance of the Study

The study is significant because it will make web designers more aware of the importance of designing accessible websites for people with visual disabilities as well as the capabilities and limitations of assistive technologies. Websites that conform to accessibility design guidelines will enable blind and visually impaired individuals to access websites with ease and enjoyment. At present many websites do not follow these guidelines and thus accessibility is still a pressing issue. Various factors will be examined to determine the accessibility of websites such as the website's design, the type of assistive technology used to interact with websites, user's experience when interacting with selected websites, user's prior internet experience, degree of user's visual disability of websites, years of Internet use, degree of disability, etc. An understanding of the factors that contribute to the accessibility of websites for blind and visually impaired individuals will help website designers to develop more accessible websites.

1.8. Research Design and Methodology

The most appropriate method of evaluating accessible websites is the user testing technique. The researcher will therefore conduct the study by means of user testing accompanied by observation using the 'think aloud' technique and interviews. The expert evaluation technique would be used to complement the user testing technique to uncover additional accessibility problems.

Data from observations and interviews would be analysed qualitatively using content and correspondence analysis methods. For this study blind and visually impaired people will be used as the target group. They will be asked to perform a number of tasks while browsing different websites. The researcher will be using a multi-case study design where each of the websites selected for this study represent individual cases studied. They will be asked to state any difficulties and problems experienced whilst accessing the World Wide Web.

1.8.1 Ethical Requirements

Consent will be obtained from my target group (blind and visually disabled individuals) to conduct user testing of web-related tasks for selected websites. Any information supplied by them will be kept confidential and no harm will be brought to them. Ethical clearance will also be obtained from the University of KwaZulu-Natal to conduct user testing.

1.8.2 Representative Sampling

Purposive sampling will be undertaken. The researcher will compare the results of this study to previous studies. The researcher will then draw conclusions from previous accessibility studies to ascertain if the findings are supported or not on the accessibility of individual websites for blind and visually impaired individuals.

1.8.3 Data Analysis

To conduct the data analysis, the researcher will make use of the SPSS software program and Statistica. This would facilitate the accurate presentation and analysis of data gathered.

1.9. Limitations of the Study

1.9.1 Sample Size:

Since the focus of the study is on blind and visually impaired users, the sample size may be too small due to the small number of blind and visually impaired individuals at the University of KwaZulu-Natal (UKZN). This sample size will pose a problem for quantitative analysis. However, this limitation will be overcome by in-depth qualitative analysis to be conducted from data gathered.

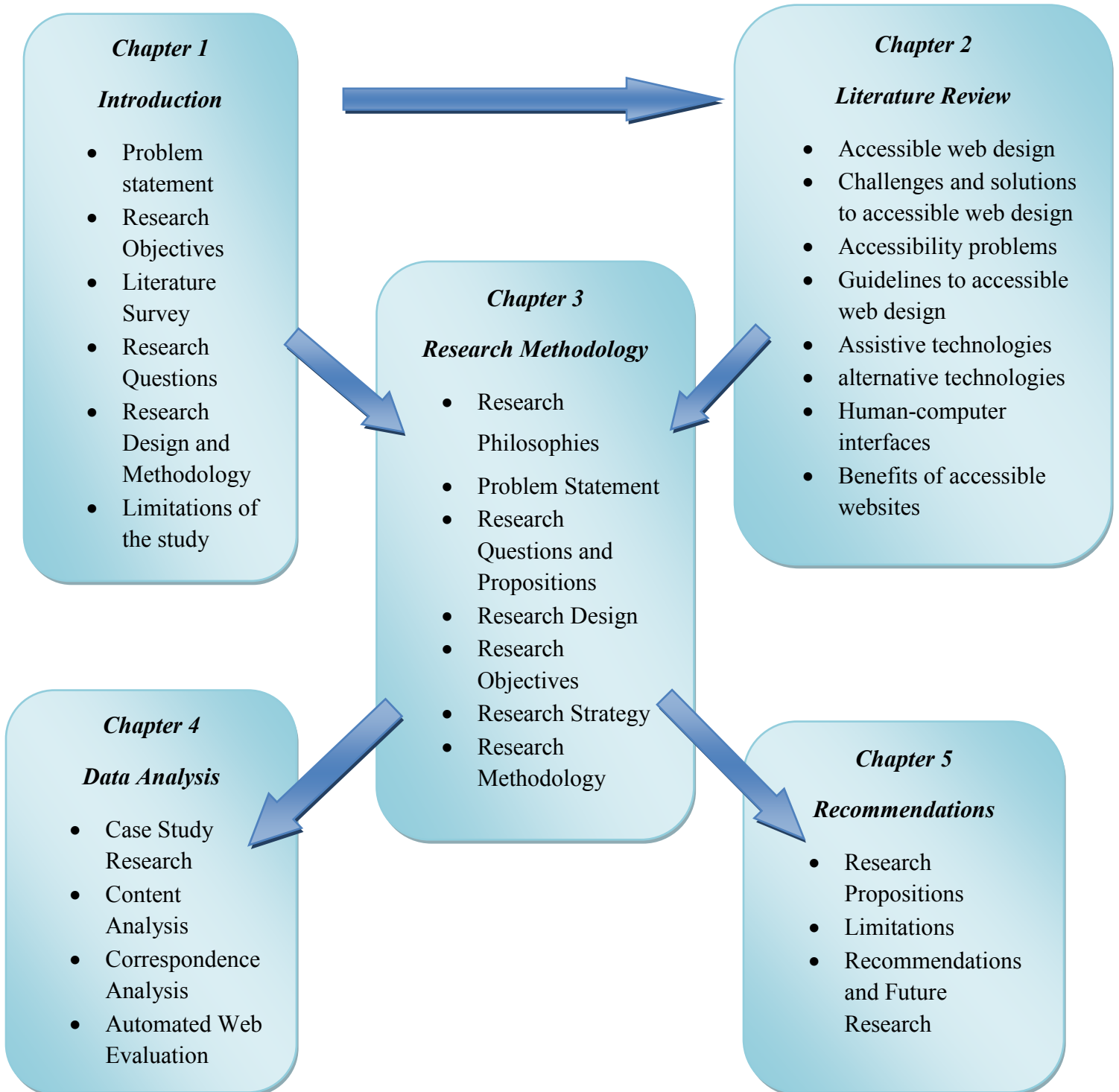
1.9.2 Campus Facilities:

The Westville campus only has one LAN for blind and visually impaired students and consists of only three computers with screen reader software. This limits the amount of users per test in this campus thereby increasing the amount of time required to conduct the user testing and to extend user testing to other campuses of the University of KwaZulu-Natal.

1.10. Overview of chapters

The purpose of the study is to determine to what extent websites are accessible for blind and visually disabled people. To achieve this, the researcher will conduct user testing accompanied by observation and interview blind and visually impaired students to obtain data about how accessible websites are. The researcher will review the literature behind accessible website design for blind and visually impaired individuals (Chapter 2). Thereafter different types of qualitative and quantitative data will be examined in order to decide which method/s would best suit this study (Chapter 3). The data would then be analysed using different statistical methods (Chapter 4). The researcher will conclude this research study by providing recommendations and guidelines for future research (Chapter 5). Figure 1.1 below depicts the linkage of the chapters.

Figure 1.1 Linkage of chapters



CHAPTER 2

Literature Review

2.1 Introduction

The overall objective of this study is to determine the accessibility of website for blind and visually impaired individuals. Blind or visually impaired users should have equal access to computer applications as sighted users. The assistive technology tools should provide the user with an interface that permits him to work with effectiveness, efficiency and satisfaction (Petrie and Keir, 2007). That is, even technically compliant sites can be inaccessible to the user, because they are so difficult to use (Gerber, 2002). Therefore it is crucial that accessibility laws and guidelines are followed to ensure all individuals have access to the same information. The researcher will use various methods to gather information by means of user test, observation and interview to determine if website are accessible for blind and visually impaired individuals.

To enable blind and visually impaired individuals to have a stress free Internet experience, web designers must consider the special requirements and needs of blind and visually impaired people when designing a website. This can be accomplished by developing policies, resources and planning services in such a way that blind and visually impaired people have access to the same range of services as everyone else.

The following sections will be discussed in the remainder of this chapter: accessible web design in section 2.2, challenges and possible solutions in section 2.3, general difficulties section 2.4, accessibility problems experienced by blind and visually disabled people section 2.5, designing accessible websites for blind and visually impaired section 2.6. Section 2.7 discusses blind and visually impaired individuals Internet use, assistive technologies in section 2.8, alternative technologies section 2.9, Human-computer interfaces section 2.10 and section 2.11 benefits of creating accessible websites.

2.2 Accessible web design

According to Samuels (2007), an accessible website is one which all people, regardless of age, disability or technology, can use successfully without discrimination. Thus web designers must create website that are flexible to cater for everyone in society whether you have a disability or not thereby eliminating discrimination towards blind and visually impaired individuals.

One of the hallmarks of a civilised society is its commitment to ensuring that all of its citizens can play a full part in its life and that none are excluded (Gerber, 2002). Exclusion takes many forms and must be countered in many different ways. Thus website should be accessible to everyone no matter what physical or visual disability they may have.

The term visually impaired is generally used to describe all those who have a seeing disability that cannot be corrected by glasses (Hopkins, 2000). Hopkins goes on to add that a blind person can be registered as either blind or partially sighted, although registration as blind rarely means total loss of sight. The degree of visual impairment and its effect on the performance of web based tasks relates to research question 4. The measure is based on the quality of distance and side vision as measured by consultant ophthalmologists (Hopkins, 2000).

Early papers on accessibility by Astbrink (1996), Dixon (1996) and Kerr (1997) offer practical advice on accessible web design stressing that correctly applied HTML will help ensure universal access and should be provided as "a right, not a favour".

Humans have five senses: vision, hearing, taste, smell and touch through which they gather data through. However vision plays the most important role when it comes to information seeking therefore the design of human-computer interfaces tends to concentrate primarily on vision first. Vision is a complex function, which not only involves the physical capture of light (including shade, colour and contrast) by the eye itself but also interpretation by the brain (NoVA Final Report, 2004). For example, the degree of visual acuity and visual field will impact on the quality of sight; a loss of visual acuity causes objects to become blurred. Therefore blind and/or visually impaired individuals make use of assistive technologies to enable them to view information on the Internet as limited vision will have an effect on the user's ability to view several pieces of information on one screen. Colour, hue, brightness, contrast and ambient light

will also add to the difficulties experienced by a blind or visually impaired individual (Craven and Brophy, 2003). As a result these individuals will have to make use of the other senses to assist them when interacting with website. The most important senses will probably be hearing (Screen reader) or touch (Braille). Sound can be used as a locator and as an alerting device, not just for visually impaired people but also for sighted people as "people respond more quickly to auditory signals than to visual signals" (Chan and Chan, 2006). The sense of touch can be most helpful for users who are blind.

As outlined in the NoVA Report (2004), these approaches all help to make information available by using a range of sense-data and thus compensating for impairment. However, the success of this approach is entirely dependent on whether both the content and the structure of the information object can be successfully translated in this way. The NoVA report was research conducted by Craven and Brophy (2003) to determine Non-Visual Access to the Digital Library (NoVA): the use of the digital library interfaces by blind and visually impaired people. The researcher did not carry out the user test with sighted users so the NoVA Report (participants made up of sighted and visually impaired users) will be used as a baseline study when comparing the user test results of blind and visually impaired individuals with that of sighted users.

According to the South African Government Gazette (2000), No person may unfairly discriminate against any person on the ground of disability. This means that website designers must be able to remove any obstacles that may hinder or restrict a person with disabilities from enjoying equal opportunities with respect to access of websites. Website should therefore be designed to accommodate the needs of blind and visually impaired people. This will enable blind and visually impaired individuals to enjoy the same opportunities that are available to sighted users when using the Internet. These opportunities include among others online shopping, completing an online degree and browsing web pages.

The Internet was originally created to allow an exchange of information (Castells, 2009). Thus the Internet was based on textual information. However there has been a great shift on the World Wide Web from basic text pages to the use of more complex information structuring techniques such as lists, tables and frames, image maps and video. These changes make the interface more attractive and enjoyable for sighted users but make life more difficult for blind or visually

impaired users. These changes are seen as a problem especially for blind and partially sighted individuals who cannot access the Internet without the use of assistive technology such as a screen reader to read information on a computer screen.

According to a test carried out by Katyal (2002), visually impaired individuals cannot see the words on a computer screen. These individuals include people who are blind and partially sighted.

According to Douglas (2007), applications for blind users often involve the mapping of information such as size (magnitude) from one sensory domain (vision) onto another (sound or touch). Thus the size of the text plays an important role when it comes to the accessibility of a website for blind and visually impaired individuals. One way to make website accessible to blind and visually impaired individuals is by presenting data using other technologies such as haptic which provides information by means of touch and hearing.

In order to make a website accessible to blind and visually impaired individuals a number of guidelines and design techniques must be used such as the use of the 'ALT' tag. This tag is used to provide a text alternative for an image. According to the University of Essex (2007), to cater for everyone, websites should allow individual users to customise their web browser to adjust the text and colour settings to suit their own particular needs and circumstances.

However, Park (2000) on the other hand feels that, the needs of people with disabilities still get trampled under the rush to expand the Internet and use it to transform all aspects of American life, from business to government to education.

2.3 Challenges and possible solutions to designing accessible website for blind and visually impaired individuals.

Web designers experience many challenges when trying to develop an accessible website. The simplest thing they can do is to offer a text-only alternative version of any page on a website, as text-based information is far easier to read with an assistive technology than with multimedia presentations (Venter, 2005). A lot of time and effort is required to design and develop accessible website. Web designers are under the impression that making their website accessible

to blind and visually impaired individuals will result in the sites becoming boring and uninteresting (Harper and Yesilada, 2008). Web designers also face the problem of not knowing how to convert a website to an accessible format. To overcome this dilemma, web designers can follow the accessibility guidelines provided by the World-Wide Web Consortium (W3C). These guidelines provide a set of recommendations for accessible website design and aim at making Website accessible to computer users with any kind of disability.

According to Michigan State University (2001), accessibility, in the context of the World Wide Web, means maximizing the ability of all users to access information, services, and resources. Thus a website that meets the above definition is one that considers the needs of its target audiences that is sighted and unsighted (blind and visually impaired individuals) users. This requires a mixture of design elements and simple HTML coding in order to make web pages more accessible to visually impaired individuals. Another way to make web pages more accessible is to make content available in flexible ways for example by not focusing entirely on describing the “look and feel” of a site to the user but instead focus on marking up content and trusting the browser to do its job. By making font sizes larger, avoiding poor color contrast and not relying on color to express information will help remove obstacles for blind and visually impaired users. Blind and visually impaired individuals make use of a screen reader to read web pages. However multi-column text, links and graphics with no ‘ALT’ text are obstacles to screen readers which make an individual’s Internet experience quite difficult.

2.4 General difficulties faced by blind and visually impaired people when using the internet.

In order for blind and visually impaired individuals to access the Internet these individuals usually have their own assistive technology (screen reader) or may use synthetic speech output or Braille, as well as non-keyboard typing systems (dictation software).

An assistive technology such as a screen reader only allows a user to read one line of the screen at a time. Therefore web designers must make sure that they take the needs of blind and visually

impaired individuals into account as nonstandard use of Hyper Text Markup Language can render a site unreadable by a blind or visually impaired person.

According to Moore (2000), humans obtain information using all of their senses but sight is the most important as we absorb as much as 80 per cent of information by means of sight. However blind and visually impaired individuals experience many difficulties when accessing information from the Internet due to their sense of sight being absent from the process of information gathering thus web designers should make these individuals lives a bit easier by making website accessible.

Blind and visually impaired people face many difficulties when it comes to obtaining information on the Web because of the additional technology they require to gain access to these materials. This additional technology is commonly known assistive technology. It has also been noted that blind and visually impaired individuals who are unable to access the same kinds of information on website compared to sighted users become victims of the Digital Divide (Smith, Fraser, McClure and Charles, 2000). Ultimately they are discriminated against because they cannot participate in the same opportunities given to sighted users who can access huge amounts of information from the Internet. In order to overcome this predicament web designers need to develop an interface that works hand-in-hand with assistive technologies to provide opportunities and prevent the digital divide. According to Moore (2000), in an information-intensive society we all need ready access to a wide range of information if we are to function effectively. However a blind and visually impaired person who lacks easy access to information on the information super highway is seen as one of the crucial factors of social exclusion.

According to part three of the Disability Discrimination Act (1995), a service provider cannot refuse a service to a disabled and visually impaired person. Thus information on the Internet should be available in alternative formats that are audio, large print fonts or the Braille version that can be read by people who are blind or partially sighted.

To cater for both sighted and visually impaired people website should allow an individual to change the text and colour settings to suit their needs. People with very little or no vision requires the help of access technology to enable them to read Website. Examples of access technology are (Thatcher, 2006):

- Synthesised speech software which reads the content of Web pages aloud through a speaker.
- Braille software which outputs to a retractable display, so that the Website can be read by touch.

According to Nielsen (2002), people who have vision problems have the hardest time using the Internet. A study conducted by Nielsen showed that the Web is three times easier to use for sighted users than for blind users.

The next section discusses accessibility problems experienced which is concerned with research question 1.

2.5 Accessibility problems experienced by blind and visually disabled people:

The researcher will discuss two types of accessibility problems: technical problems and conceptual problems (Archambault, 1999) in the following sub sections.

2.5.1 Technical problems

- **Links formulation**

The link formulation problem usually occurs when the text of the link does not provide clear information about the document. If a blind user reads the link that individual will not be able to understand the meaning of a link since the site layout cannot provide useful information about the link.

- **Images without the 'ALT' comment**

This problem is crucial especially when the images are used as a link or a heading. In this case an appropriate comment should be written for the images. The comment should describe the function of the image and not what the image looks like. Images must be limited in order to provide accessibility to visually impaired people.

- **Image maps**

These are often referred as an obstacle to accessibility thus the use of image maps should be avoided. The main problem with image maps is that screen readers cannot recognise them or the words and/or graphical instructions that they contain (Shumila and Richards, 2008).

- **Scripts, applets, and animated events**

Scripts cannot be displayed by all browsers. However, the web designers should make sure that whole information can be accessible without scripts or applets. However if an applet is necessary to understand the document, then the applet must be accessible.

- **Tables and multi-column texts**

Visually impaired users find tables to be a problem. Screen readers normally display information on a single Braille line on the screen. As a result, the blind user reads one line of each column of the table or of the multi-column texts. This text does not make any sense for the user. It is difficult to identify where each column stops. Also screen readers' reads lines of information from left to right. When text is displayed in columns, the screen reader would read across the lines thereby ignoring column breaks.

2.5.2 Conceptual problems

Conceptual problems are related to the way a site has been organised and who the target audience is (Archambault, 1999).

- **Frames**

Frames are a huge problem for blind and visually disabled people as the use of frames is centred on layout not structure. Screen readers have the ability to identify the number of frames on a web page; however they cannot track multiple events in these frames. They can only follow one frame at a time.

- **Multiple frameset**

Some sites use multiple frame sets therefore when a user selects a link, the frameset changes into another. Even if the frames are named correctly, a visually impaired person will find it difficult

to access the information. Also if a site uses frames, the frameset should be the same for the whole site in order for the assistive technology to interpret the information to a blind and visually impaired individual.

- **Site Organisation**

Some sites have a complex structure for example they may contain a lot of information. Thus the structure should be clear when a user enters the site.

- **Sites dedicated to one specific browser or configuration**

Most sites make use of Netscape Navigator or Microsoft Internet Explorer. Problems can arise when a user who works with another browser will not be able to access the same information or not even be able to enter the site.

The technical and conceptual problems will serve as themes for the content analysis. These themes will form the basis of the study. The next section discusses designing accessible websites which is concerned with research question 2.

2.6 Designing Accessible Websites for Blind and Visually Impaired

The following guidelines need to be taken into account to ensure accessible website design (adapted from The University of Michigan, 1999).

2.6.1 Text-Based Design

The following are some points that should be considered when it comes to the appearance and use of text and the way it should be laid out on a web page.

- Side by side presentation of text such as columns and tables should be avoided. If a website contains tables, the designer must make sure that each cell of the table makes sense.

- All sentences, headers, list items must end with a period or a suitable punctuation.
- All online forms must be accessible.
- Avoid/limit the use of bitmap images of text to a web page
- Numbers instead of bullets should be used to help a blind or visually impaired individual to remember items.
- Meaningful and descriptive text for hyperlinks must be provided. Try to avoid words such as "click here", rather say "Follow this link to the Home Page" as screen readers can search particularly for linked text, whereas "click here" provides no clue of where the link will take them (American Disability Act, 2001).
- Use heading tag (H1, H2, etc..) for varied font sizes, rather than specifying fixed font sizes
- Use , , and tags when presenting lists
- Avoid using uncommon punctuation (emoticons)
- Use standard HTML

Hypertext Markup Language (HTML) is the standard code used to create websites. Using standard HTML will ensure that the website content can be easily accessed by all browsers used by sighted as well as blind and visually impaired individuals. Also tags, features and plug-ins that only work with one brand or version of a browser should be avoided.

2.6.2 Frames

Use frames sparingly and alternatives should be considered. Some screen readers read from left to right thereby mixing up the meaning of information in frames. Although some blind and visually impaired individuals can interpret frame-based information, it is best to look at alternative ways to present the information to ensure that blind and visually impaired individuals can access the information.

2.6.3 Forms

Provide alternatives for forms. Some browsers and screen readers come across errors with nonstandard or complex forms. Thus forms should be tested.

2.6.4 Graphics and Images

Graphics and images can be a major problem for blind and visually impaired individuals as assistive technologies read out the text on a web page and not the images. Thus the following guidelines should be considered when using graphics and images on a web page:

1. Keep the number of colours in web pages to a minimum.
2. The file size and number of images displayed on a page should be kept to a minimum.
3. Graphical Image Maps should be avoided. However if used a client-side image map with 'ALT'-text tags for each of the links should be provided. Also a text-only list of links must be provided immediately below the map.
4. Avoid/limit the use of image maps.
5. Do not use tags such as BLINK or Marquee that cause the text to move
6. 'ALT' tag: Use the 'ALT' tag attribute with image files to provide meaningful text for all images or pictures. Although a blind and visually impaired individual uses a screen-reader to read and retrieve information from a web page, they can still experience accessibility problems if a web designer does not provide an 'ALT' text. An 'ALT' text should be written as a sentence or phrase with punctuation at the end.

The Table below serves as a guide when it comes to images on a web page (Source unknown):

Table 2.1: Design guidelines when using images on a web page

If an image is a...	Its 'ALT' text should...
Chart or illustration	Summarize and explain
Photograph or work of art	Describe the image's content
Graphic or button with text	Be the same as the image's text
Functional icon with no text	Describe the action to be taken
Background or other decoration	Contain an empty space (“ “)

2.6.5 Page layout

Maintain a simple, consistent page layout throughout your site. A consistent design and look makes it easier for blind and visually impaired individuals to retrieve information that they require.

2.6.6 Background

Backgrounds should be kept simple and there should be enough contrast to make sure that text can be clearly read against the background. Use font and background colours that are high in contrast (black on white or white on black work best). Blind and visually impaired individuals can have difficulty reading information at sites with dark backgrounds. Also some background images and colors make it difficult to understand and read text. Thus there should be enough contrast between the text and the background of the web page (Comden, 2007).

2.6.7 Audio/Visual Features

People who are blind cannot view the graphical features of a website. Thus they use speech output programs with nonstandard browsers such as IBM's Home Page Reader or graphical browsers with the feature that loads images turned off (Comden, 2007).

- Provide text transcriptions of all video clips. Multimedia formats that include audio can present problems for blind and visually impaired individuals. Therefore captions and transcriptions for these videos should be provided.
- Include captions or text tracks with a description or sounds of the movie.
- If there is a link to an audio file, inform the user of the audio file format and file size in kilobytes.
- Video clips are almost inaccessible to blind and visually impaired users. Therefore when using a video, a descriptive text transcript or timed or a closed captioning should be used in combination with the clip.
- A site map must be present to make navigation of the website easier by giving a blind user an idea of the layout of the site. Some assistive technology and software packages that blind people use cannot read image maps therefore it is important to make text links available as well.

2.6.8 Outlines

HTML writers should place a general outline at the point on the page where a screen reader would begin to read rather than guessing that users would be able to scan the web document and understand its structure. Outlines are important to users with visual disabilities because screen readers only provide information about a document's format on a piece at a time and screen readers do not notify blind users when there is a paragraph indentation, centred titles, underlined text, etc. According to Shumila and Richards (2008), outlines are also important because if a screen reader is used to read the whole screen, the program will wrap around lines, skip over

blank spaces, and ignore text attributes (footnotes). Outlines can also be adopted to identify features of the document such as its length, the number of hyperlinks it contains, etc.

2.6.9 Tags and lists

Tags can be used with outlines to provide information about page breaks and lists for example they can appear as ‘ALT’ Text within graphical page separators. Tags can also be used when labelling and constructing lists for example "- List with 7 choices -". Each of the 7 choices should be numbered to help readers to remember the numbers of the choices. The numbers are also useful in breaking up the text, thereby providing a different separation between each item.

2.6.10 Large Print

Large print is the least expensive alternative format material. Braille on the other hand is the most expensive. This is the simplest alternative format to produce and it is widely used to convey information to blind and visually impaired individuals. When producing a document in large print, one must take into account the font size and type. According to Disability resource (2002), most large print documents should be produced with the body text in 18-point type and major headings in 24-point type.

- **Font type:** Many blind and visually impaired individuals prefer serif fonts such as Times New Roman or Helvetica. However, people who have always read large print tend to prefer sans-serif fonts such as Arial (Disability resource, 2002). Therefore, large print documents may meet most people’s needs if the text is in Arial and with body text in Times New Roman. Also Italics should be avoided as well as bolding and underlining.

2.6.11 Additional considerations

There are some additional considerations that need to be practiced to ensure accessible website design besides the guidelines that were discussed above. These include:

- **Identifying the audience - Issues to address**

Before proceeding the web designer (or web developer team) need to know exactly what sort of audience a certain site has. By identifying difficulties they can make significant changes to suit that specific audience and make the website more accessible to them.

- **Browsing alternatives for visually impaired users**

Over the years, some browsers have been developed especially for people with disabilities. These include products with optical character recognition. Below are a few of them:

Braillesurf - BrailleSurf is an Internet browser for visually impaired users, which allows a simplified reading of the information available on the Web. BrailleSurf shows this information in a text form. This information can then be displayed on a Braille bar, or it can be spoken out by a speech synthesiser. The text can also be presented on the screen according to the needs of partially sighted people.

BrookesTalk - BrookesTalk is under development by Oxford Brookes University and is a function key driven Web Browser for blind and visually impaired users, providing keyboard only accessibility using the function keys. It also provides a configurable large text window for partially sighted users and a standard visual browser so that users can work together with sighted workers. Quick views of web pages are provided using information retrieval and natural language processing techniques.

ALVA Braille - Offering screen readers and Braille displays. A screen-reader is used to allow navigation of the screen presented by the operating system, using speech or Braille output.

Web pages designed for screen reader users should always be kept simple and concise. A screen reader reads every word thus web pages must be kept as simple as possible. The 'ALT' text needs to bring across the same message as the graphic for when the graphic is not accessible that is the message should not describe what this image is but convey the message of the image's content. Irrelevant information such as descriptions of page borders and graphics should be omitted. For visually impaired users, loading images are a waste of time because they do not improve their experience of a site. When designing a web page great thought should be put into

the size and colour of text and images, the level of colour contrast and the design of the document's background.

Visually disabled users encounter barriers such as poorly designed website that contain graphics, tables, frames, colours, no 'ALT' tags, poor font sizes, etc (Spencer, 2001). Other barriers include assistive technology that does not interface with website.

2.7 Blind and visually impaired individuals Internet use

The emergence of the Internet has helped blind and visually impaired individuals to carry out most of the activities of a sighted user via the Internet. However one must keep in mind that they use assistive technologies to assist them when using the internet. The following are some of the activities (Archambault, 1999):

- **Online Shopping**

Online Shopping has made it easy for a blind or visually impaired individual to purchase goods on the Internet. It is quicker than getting into a car and driving all the way to the mall. This facility allows these individuals to find bargains, compare the quality of a product in the comfort of their home even though they are blind or visually impaired. An example of an online company is Tesco. Tesco allows blind people to shop as efficiently as anyone else (www.tesco.com).

- **News**

Blind and visually impaired individuals are now able to read about the news via the Internet rather than waiting for the newspaper to be scanned in Braille.

- **Online Banking**

The advantages of online banking for blind and visually impaired individuals is the same of sighted users that is it saves time, they do not need to stand in long queues and online banking is open 7 days a week , 24 hours a day.

- **Media**

Blind and visually impaired individuals also use the Internet to get TV and radio listings as well as sports results.

- **Online/web based education**

More and more Universities and academic institutions are making online degrees possible. This gives blind and visually impaired individuals the opportunity to study in the comfort of their homes.

The next section discusses assistive technologies which are concerned with research question 3.

2.8 Assistive Technologies

Assistive technologies have transformed the lives of blind and visually impaired individuals to retrieve information with ease and to gain access to a large number of resources on the Internet who until now have been forced to rely on other people for information (Howell, 2006).

Assistive technologies are software or hardware that helps to improve the functional capabilities of individuals with disabilities when interacting with computers (Kamrul, 2008).

According to Shumila and Richards (2008), before the emergence of computers and computer adaptations, the main problem that visually impaired individuals faced was that manual means were required to translate large amounts of printed material into Braille or audio form. Therefore the need for assistive technologies such as Screen readers and Braille displays were designed to help these individuals read and view information on the computer screen. The different types of assistive technologies will be discussed below (Adapted from The University of Dublin, 2009):

- **Screen magnification**

Screen Magnification allows people with low vision to enlarge the text on their screen. These individuals can also make use of eye glasses to enlarge books and other objects.

- **Screen Reader**

This is a software application that is used to identify and understand what is on the computer screen which is presented to a blind or visually impaired individual with a text-to-speech output or by means of sound icons. Screen readers can be used with screen magnifiers. According to King (2004), “The purpose of a screen reader is to turn the visual output of the standard user interface into a format that is easily available to a blind user in order to take on the form as a sighted companion to the blind user by reading out what is happening on the screen.” The screen reader operates at 300 words a minute that is twice the speed of a human conversation and are run from the keyboard (Clark, 2002). There are many types of screen readers such as JAWS from Freedom Scientific, Window Eyes from GW Micro, LookOUT from Choice Technology and Narrator from Microsoft.

- **Self-voicing applications**

These applications are similar to a screen reader in that it helps to provide output through synthesised or recorded speech. A self-voicing application is an application that provides an aural interface without requiring a separate screen reader (wikipedia, 2010).

A constraint of screen readers and self-voicing applications on the use of computers by blind users is that they rely on hearing, rather than sight. Also blind users have to listen to a large amount of text to give them the same amount of information as a sighted user might be able to gain in a quick glance. Even if a blind user moves from heading to heading, the individual has to wait for the screen reader which is much slower to speak out the information (King, 2004).

- **Scanners and Read Back software**

Scanners are used with Read Back Software. This software reads out the text on screen that is scanned in or opened from a file.

- **Voice Dictation Software**

Voice dictation software can allow complete hands-free access and control of a computer. Voice dictation software allows the contents of any document or web page to be read out to a blind and visually impaired person thus helping these individuals to have a trouble free Internet experience.

- **Keyboard guards and overlays**

This is a sheet of thick plastic with holes that helps blind and visually impaired people to guide their fingers to just the right key.

- **Digital Dictaphones**

Blind and visually impaired students can use the digital Dictaphone to record lectures, assignments, etc. Digital Dictaphones can also transfer recordings onto PC and even synchronise with some voice recognition software (Trinity College Dublin, 2009).

- **Braille Display**

For many people, Braille is perceived as the blind person's alternative to print (American Foundation for the Blind, 2009). Blind people make use of a Braille display by means of Nylon or metal pins that enable them to interpret information on websites. Characters are replaced either automatically at intervals or after a switch is pressed. Braille displays two to four lines of huge text equivalent to the 80-character-by-24-row screens of MS-DOS (Clark, 2002).

The difference between a screen reader and a Braille display is that a screen reader speaks onscreen text and interface elements while the Braille display gives system and status-line messages (W3C, 2010). This is useful and ideal for blind computer programmers.

However, according to Disability resource (2002), less than 10% of the visually impaired population in the United States reads Braille proficiently enough to prefer information in this format.

- **Text browsers**

These are an alternative to graphical user interface browsers. They can be used with screen readers for blind individuals.

- **Voice browsers**

Voice browsers allow voice-driven navigation with voice-input and voice-output. Some also allow telephone-based web access.

- **Refreshable Braille Pads**

Refreshable Braille pads are similar to screen readers except that the text on the screen is translated into Braille rather than speech. The pads are almost the size of a keyboard and are made up of hundreds of pins that are raised and depressed mechanically. These devices have the advantage of allowing the user to scan full sections of a document with less effort.

These assistive technologies may be quite impressive but they do have their drawbacks. Take for example a screen reader. Screen reading products allow a blind user to 'read' the screen using speech synthesis or Braille display hardware but most of these applications only allow the user to read one line of the screen at a time and the document is accessed sequentially. They are also general purpose and not specifically designed for Web use. However as graphical interface technology develops uninterpreted screen reading becomes less cost effective or effective (Zajicek and Powell, 1997).

Screen readers rely on HTML code being written in a standard and accessible manner. Sadly many websites provide codes which are not. According to Zajicek and Powell (1997), "It is argued that websites should be legally bound to provide only standard accessible HTML in the same way that buildings must be accessible for disabled people." Thus it is crucial that web designers develop websites that are accessible to blind and visually impaired people who make use of assistive technology to retrieve information from the World Wide Web.

2.9 Alternative technologies

There are a number of alternative technologies that can be used other than assistive technologies to help blind and visually impaired individuals to ensure the accessibility of websites. Three technologies are discussed below:

2.9.1 Augmented Cognition

Augmented Cognition aims to help users like blind and visually impaired individuals to improve their web browsing by working together with the assistive technology to improve information processing and decision making.

According to Schmorrow and Kruse (2004), “The field of Augmented Cognition is to research and develop technologies capable of extending, by a number of magnitude or more, the information management capacity of individuals working with 21st Century computing technologies.” Many blind and visually impaired individuals find website with new computer technologies to be a problem that is website are designed using the latest computer technologies. Blind and visually impaired individuals cannot access these website because assistive technologies such as a screen reader are not incorporated with website design when using new computer technology.

According to Schmorrow and Kruse (2004), “augmented cognition also helps blind and visually impaired individuals to increase their level of memory, learning, comprehension, visualisation abilities, and decision making via technologies that assess the user's cognitive status in real time.” These technologies will observe a blind or visually impaired individual whilst they are interacting with a website through behavioural, psychophysiological and/or neurophysiological data and then augment the computational interface to improve their performance of web browsing (Schmorrow and Kruse, 2004).

Figure 2.1 on page 31, illustrates the Components of an Augmented Cognition System as outlined by Schmorrow and Kruse (2004).

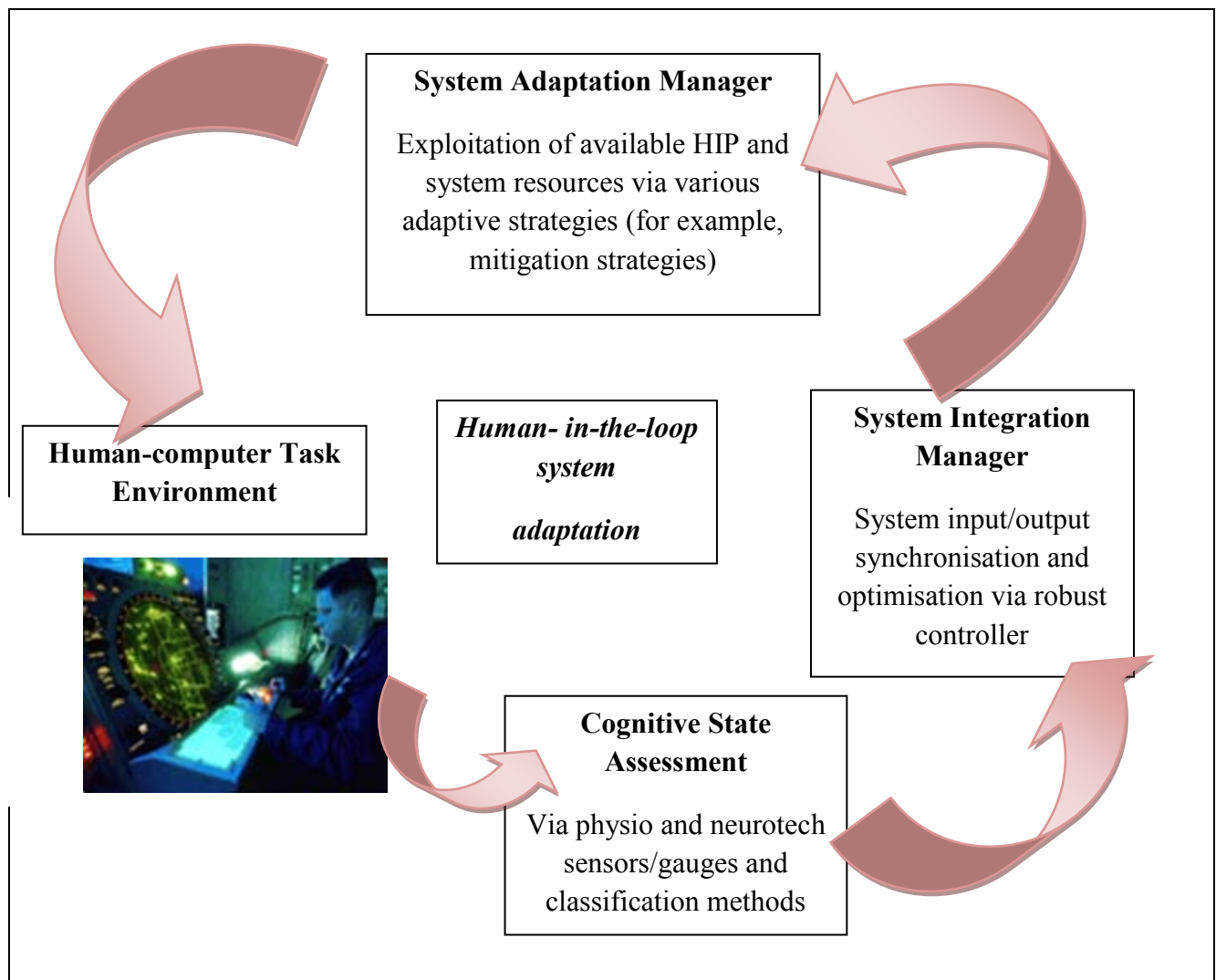


Figure 2.1: Components of an Augmented Cognition System (Schmorrow and Kruse, 2004).

The goal of the above systems is to assess, from the incoming sensor information, the correct state of the user and having the computer select an appropriate strategy to assist the user at that time (Schmorrow and Kruse, 2004). In order for a cognition system to come up with solutions for a blind or visually impaired individual is to identify at least one problem they have with inaccessible website for example font size.

The mitigation strategies are conveyed to the user through the system adaptation manager which may involve modality switching (between visual, auditory and haptic), intelligent interruption,

task negotiation and scheduling and assisted context retrieval. According to Schmorrow and Kruse (2004), when a user state is correctly sensed, an appropriate strategy is chosen to alleviate the problem, the interface is adapted to carry out the strategy and the resulting sensor information indicates that the aiding has worked – only then has a system “closed the loop” and successfully augmented the user’s cognition.

The goal of augmented cognition is to determine peoples’ cognitive state in order to enhance it (Reeves and Schmorrow, 2007). Thus the use of augmented cognition systems would help to improve a blind or visually impaired individual’s web browsing by providing an easier access to website.

According to Meijer (2005), blindness need not be conceptualized as a deficiency, but rather a style of life, with specific challenges, which benefits from the same things that benefit sighted people. He goes on to say that society designed the world for the eye. We use our eyes to see the roadways, the signs and symbols and vehicles, all of which is designed around the vision system.

2.9.2 Tactile

“Tactile” refers to the sense of touch whereas “haptic” includes touch as well as kinesthetic information, or a sense of position, motion and force (Fritz, Way and Barner, 1996). “Tactics” is a system that converts visual information, such as the computer images available on the Internet, into tactile information. With "tactile imaging" a blind or visually impaired individual is able to read and understand an image on a website. How you may ask? This is done by converting the picture into a touchable raised version of the image. According to (Fritz, Way and Barner 1996), “TACTICS” on an image of the planet Jupiter can enable a blind student to feel the immense swirling “eye” and the great patches of cloud cover, and gain new insight into the red giant.” This proves that the Tactics system can help a blind and visually impaired individual to experience Web browsing that has never been experienced before.

2.9.3 Haptic

According to Wikipedia (2008), haptic is a technology which interfaces the user via the sense of touch by applying forces, vibrations and/or motions to the user. In other words it is a technology

that applies touch sensation and control to computer applications. With the use of special devices such as a joystick or data glove, blind and visually impaired individuals will be able to get advice from computer applications in the form of felt sensations in the hand or other parts of the body (Hayward et al, 2004). Haptic computer interface will also help a blind and visually impaired individual to have the same opportunities of a sighted user for example to learn mathematics online by tracing touchable mathematical curves, playing haptic computer games and gaining better access to graphical user interfaces like Windows (Sjostrom, 2002). Haptic can also be a good tool to help blind and the visually impaired to allow easy navigation and understanding of a website.

2.10 Human-computer interaction

Human-computer Interaction is both an art and a science. Besides determining the accessibility of website and whether assistive technologies work well with a website another factor that plays an important role is the human-computer interface (HCI). According to Booth (1989), HCI is the study of the interaction between humans and computers. HCI considerations forms part of the researcher's study which goes beyond technical accessibility of websites for visually impaired and examines usability issues as well.

HCI is made up of three principles, namely (Design principles, 2006):

- **Psychological Principles**

Psychological studies of human-computer interactions have focused on attempts to understand the nature of human cognition and learning.

- **Graphic Design Principles**

The graphic design principles pertain to section 2.6.4 'Designing Accessible Websites for Blind and Visually Impaired'. These design principles focus on four areas:

- ❖ **Composition** Related to layout: weight, colour, positive/negative space, and balance.

- ❖ **Colour** Related to colour choices: colour combinations, coloured type, and the psychology of colour.

- ❖ **Type** Related to the choice of typeface: type styles, legibility, and the psychology of type.

- ❖ **Graphics** Related to the use of graphic elements: colour, placement, and use in an overall design

- **Evaluation Principles**

This refers to the evaluation performed by the author to determine the effectiveness of the design decisions made.

2.10.1 The following areas of HCI research are of particular importance (Faulkner, 1998):

- Users' methods of interaction and how these affect communication at the interface.
- How users interact with computer systems as a whole.
- How well systems meet users' task requirements and information needs.
- User centred design and development: improving the design and development of systems by placing the user at the centre of the design process.
- The impact of the computer on individuals within an organisation and on the organisation as a whole.

2.10.2 HCI Design for visually impaired users

A lot of research has been undertaken to provide both blind and sighted users with better systems to overcome graphical user interface problems. One solution was to offer a dual access system which can be used by both blind and sighted users at the same time. Some examples include *Outspoken* (Edwards, 1996), *Emacspeak* (Raman, 1996), *Mercator* (Mynatt and Weber, 1994), *GUIB* (Gill, 1993), *Soundtrack* (Edwards, 1996) and *HOMER* (Savidis and Stephanidis, 1995). By developing systems listed above, developers have to create features that will allow blind users to make use of non-speech auditory icons to help them navigate around a page for example

if the user wants to delete a file he/she will know when the file is deleted once they hear the sound of a dustbin lid crashing. In this example, sound is used to replace a graphical icon.

The use of non-speech sounds is felt by developers to be more useful than speech because they are less time consuming to listen to and can hold a great deal of information in a relatively short processing time (Petrie and Morley, 1997) . However Mynatt and Weber (1994) found that "although the auditory icons were readily learned, the intuitive nature of the interface suffered from the subjects' frustration with identifying the auditory cues".

There are other problems besides graphical icons that blind users find challenging such as controlling the mouse and locating the cursor. Substitutes for the mouse have been developed, including tactile displays (Ebina, 1999) , touch tablets (Mynatt and Weber 1994) and Braille characters (Petrie and Morley 1995). With regards to locating the cursor, non-visual methods have been developed to help users find information within a web page or parts of a page. These methods include quick navigation through the links on a page, headings for each section of a page together with quick navigation through headings (Petrie and Morley, 1997). The following basic principles recommended by Carey and Stringer (2000) can be applied to the design of navigation and search screens to enable easier use by visually impaired individuals:

- Synchronicity and integrity: information presented in a variety of formats (audio, visual, interactive) should be self-sufficient.
- Degrees of simplicity and complexity: users should have control over the way information is delivered to them (being able to change font size, etc.) and should be able to define the level of information required (basic, advanced etc).
- Multiplicity: establish a system to enable users to customise hardware, software and information systems to meet their individual needs.
- Over-ride: users should be able to over-ride the presentation of the original document on a temporary basis in order to render it accessible, but this should be done without changing the original document.

Graphical user interfaces (GUIs) are powerful tools for accessing computer systems but not for everyone. The rapid change from text-based interfaces (DOS) into graphics (Windows) and the

frequent use of colours, icons and other visual elements has created barriers for accessibility for users of Braille and synthetic speech (Becker and Lundman, 1998).

After taking all of the above into consideration, the researcher hoped to get greater feedback about inaccessible website by conducting a user test.

2.11 Benefits of creating accessible websites

There are many benefits in creating an accessible website. The following are some of the benefits acknowledged by Vosloo (2002):

2.11.1 Business benefits

A large part of the population is made up of disabled individuals. In South Africa 6% of individuals have at least one major disability. By creating accessible website businesses are opening up to the disabled population group. These users have a huge spending power for example the United States consumers with disabilities control more than \$175 billion in discretionary income each year while the United Kingdom has a figure that is in excess of £45 billion (Kolhatkar, 2010).

2.11.2 Technology benefits

Most of the South African online population that make use of low-bandwidth connectivity experience greater benefits from accessible website because the download speed is much faster than traditional websites. Accessible website also provide a wider range of technologies and software both old and new to blind and visually impaired individuals. An example of older technologies and software are previous versions of Microsoft Internet Explorer which is very common in South Africa. Newer technologies include hand-held computers and internet-enabled phones.

2.11.3 Usability benefits

An accessible website is a more user friendly website for both sighted and unsighted users. Accessible website offer many advantages such as clearer navigation; users can customise their view of the web pages by increasing the size of the screen text, etc. On a low speed link or on a

heavily loaded website, an accessible design can make the difference between something usable or unusable (Vosloo, 2002).

2.11.4 Publicity benefits

Research has shown that organisations who welcome users with disabilities are more likely to be regarded positively by the wider community than those who exclude them (Vosloo, 2002). This helps to improve their public image as they practice social responsibility and they can get useful feedback from blind and visually impaired individuals.

2.11.5 Society benefits

Through web accessibility more people are able to become members of the online community. This is a good way to expand the growth of the Internet.

Many blind and visually impaired individuals find themselves in a predicament when it comes to the viewing of website that are not easily accessible to them. Visually impaired individuals are tired of having to strain their eyes to read small text on a computer screen. For example a visually impaired individual, Corono replaced his computer screen with a 19-inch television which would enable him to view text on the screen. He also went to the extreme and pulled a cardboard box over his head and the monitor to block out the light. And when light did come through he lined the makeshift hood with black paper to cover the cracks. Now, looking at this scenario, one comes to the conclusion that there is not much done to ensure that blind and visually impaired individuals have an enjoyable Internet experience like a sighted person would. Thus many blind and visually impaired people find themselves in Corono's situation because many web designers do not take these individual needs into account when it comes to accessible web design. They also do not follow guidelines set out by the W3C and other organizations.

Today, in the twenty first century we find the Internet has revolutionised in such a big way that it is not just a place to gather information but one where we can shop from the comfort of our homes, do online banking, and talk to a friend in another country. All these advances in the Internet may seem very nice but to a blind and visually impaired individual the Internet is not a

“bed of roses”. The reason for this is because web designers add too much of animation, video and images to their web pages to make it attractive and appealing, however they are doing the complete opposite as blind and visually impaired individuals become frustrated rather than impressed by such design.

Many computer and software companies promise to provide better Internet experience for blind and visually impaired individuals by making sure that their website are designed with accessibility in mind.

When we talk about accessibility we do not just mean being able to provide sighted users to be in easy reach of the vast amount of data on the Internet, we also mean being able to cater for blind and visually impaired individuals (Moore, 2000). Just as one should not discriminate against race or gender, one should also not discriminate against the disabled community.

According to Park (2000), “Ninety percent of the Internet pages have some problem with accessibility and inaccessible information is just as much a barrier as a set of steps is to a person in a wheelchair.”

With the help of corporate policies and government regulations the problem of inaccessible website can slowly become less of a threat to blind and visually impaired individuals, however this is yet to be seen. Everyday more and more new features are added to website to make them more attractive and appealing. An example would be cable modems and DSL. These high-bandwidth connections persuade web designers to create sites with complex features like streaming audio and video, animation and flash which make it difficult for a blind and visually impaired individual to browse a web page without any problems (Park, 2000).

The issue of accessibility is not at the top of the list when it comes to the design of a website but rather the attractiveness of a website.

Websites contain a large amount of advertisements, links and images which can be quite troublesome for blind and visually impaired individuals because it takes them a long time to find the information they were searching for. Also images without a descriptive text are a huge problem for a blind or visually impaired person as they do not know whether the image is a logo, link, video, etc.

According to the University of Essex (2009), “more than 750 million people worldwide have a disability, 15% of people between the ages of 22 to 44 have a disability and most people during their lifetime will have a disability or experience a limitation that will temporarily or permanently affect their lives.” Thus it is crucial that web designers cater for sighted, blind and visually impaired individuals as everyone in society should be treated equally.

A blind person requires text transcriptions for the images on a website. The reason for this is because a screen reader cannot read the image. Also visually impaired individuals find it difficult to use a mouse because it requires hand and eye coordination thus they have to find their way through a website by means of the keyboard. This shows us that a blind and visually impaired individual experiences difficulties with images and a mouse, so imagine how much more frustrating it must be for them to try and view website that are not easily accessible or do not work with an assistive technology.

Blind and visually impaired individuals have different needs for example some may find large text to be easier to read while others may find smaller text to be less problematic, some may need an assistive technology to enable them to read and view information on a website while some may just need the background colour and the text colour to be highly contrasted. Thus each individual's need should be carefully examined to design website that are accessible to blind and visually impaired individuals.

According to Morris (2007), unsympathetic websites usually feature five common mistakes, which are:

- Missing or wrong text captions for images
- Page headings not marked up within the HTML code
- Badly designed tab and return navigations through a web page
- ‘Click here’ links that do not contain any text
- Self-triggering’ drop-down menus that automatically redirect users without the ir knowledge or consent

Therefore by considering the above mistakes before designing a website can help to create website that will be easily accessible to blind and visually impaired individuals. A literature

survey on previous empirical studies together with user testing of websites by blind and visually impaired will be conducted.

2.12 Conclusion

This chapter started off by defining the term web accessibility. Thereafter it focused on the accessibility problems and difficulties that blind and visually impaired individuals experience with websites (section 2.5) which is one of the themes being investigated. This ties up with research objective 1. The researcher also looked at the benefits of accessible websites discussed in section 2.11. The second theme relates to designing for website accessibility which covers perceived benefits, achieving goal orientated tasks, and recommendations for improving website accessibility covered in section 2.6. Section 2.8 discussed the different assistive technologies and how they help blind and visually impaired individuals to access websites. Assistive technology is discussed in section 2.8 and relates to research objective 3. The degree of visual impairment discussed in section 2.2 relates to research objective 4.

In Chapter 3 the researcher will address certain aspects such as the research design and methodology, what is quantitative and qualitative research. Features of quantitative and qualitative research will also be discussed, empirical research, research philosophies and research approach. The focus will then move on to HCI research methods and techniques, data collection methods, sampling and reliability and validity.

CHAPTER 3

Research Methodology

3.1 Introduction

The purpose of this chapter is to outline the research design and methodology for the research problem being investigated with a review to answering the research questions identified in Chapter 1. The main aspects that will be discussed later in this chapter are research philosophies in section 3.2 followed by the research problem in section 3.3 and research questions in section 3.4.

3.2 Research Philosophies

Under research philosophies, the researcher will outline the different types of research philosophies such as positivist research, interpretive research and critical research.

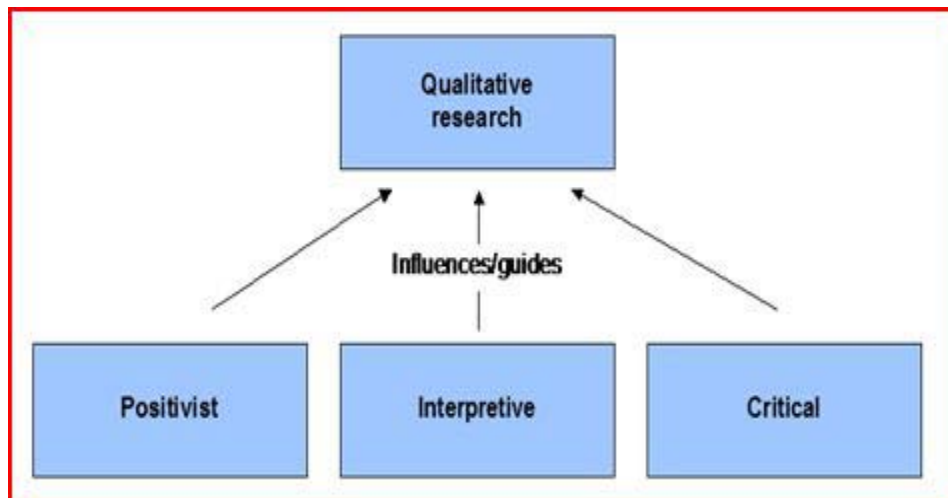


Figure 3.1 - Underlying philosophical assumptions

3.2.1 Positivist research

Positivist qualitative research assumes that there is an objective reality and you can get to know that reality (Olivier, 2004). The disadvantage is that it is not always possible to measure positivist research. Positivist studies generally attempt to test theory, in an attempt to increase the predictive understanding of phenomena. Orlikowski and Baroudi (1991), defines research as positivist if there is evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from the sample to a stated population.

3.2.2 Interpretive research

According to Myers (2000), “interpretive studies assume that people create and associate their own subjective and intersubjective meanings as they interact with the world around them.” Interpretive researchers thus attempt to understand phenomena through accessing the meanings participants assign to them. The aim of interpretive research is to understand that of which is being studied (Olivier, 2004).

3.2.3 Critical research

This research deals with the way the parties influence one another. Critical research focuses on the opposition, conflicts and contradictions in contemporary society and helps eliminate the causes of alienation and domination (Myers, 2000). The researcher is not focussing on social aspects that empower blind and visually impaired individuals but rather on how website design and assistive technologies affect accessibility for blind and visually impaired individuals. Hence the critical philosophy was not followed.

This research study will combine the positivist and interpretive research philosophies. An interpretive philosophical approach would be used to interpret and classify interviewees' responses and observational data with 'think aloud' protocol into themes using the qualitative analysis technique called content analysis.

A positivist philosophical approach would be used to understand the relationship/correlation between website design and accessibility problems encountered (identified using content analysis

technique) and how the use of assistive technology affects website interactions. This would be achieved by testing research propositions/hypotheses as proposed by Yin (2003) with an explanatory case study approach.

3.3. Research problem

The research problem is that many websites are being designed without considering people with disabilities such as blind and visually impaired individuals. Many of these individuals make use of an assistive technology to enable them to read and interact with websites, however many assistive technologies do not work well with certain websites and as a result blind and visually impaired individuals end up missing out on opportunities that are available to sighted users.

The goal of this study is to determine if websites are accessible for blind and visually impaired individuals who make use of assistive technologies to retrieve information from websites.

3.4 Research Questions

- What are the accessibility problems experienced by blind and visually impaired people interacting with selected websites?
- How does website design correlate to accessibility problems experienced by blind and visually impaired individuals?
- How does assistive technology used by blind and visually impaired individuals relate to website accessibility and the performance of web-based tasks?
- How does the degree of visual impairment relate to the performance of web-based tasks?

The research questions formulated from the research problem are empirical in nature as they are descriptive and explanatory. The next section will describe the types of empirical questions.

3.5 Empirical research

Empirical research is carried out to answer a specific question or to test a hypothesis to help the researcher get a better understanding of the study. Empirical Research can also be defined as “research based on experimentation or observation (evidence)”.

3.5.1 Empirical research questions

The type of empirical research that the researcher will be following is an explanatory and descriptive approach.

- **Explanatory**

Explanatory research answers the questions of "why" and "how" something happened. It establishes a cause and effect relationship between two variables.

- **Descriptive**

Descriptive research design is a scientific method which involves observing and describing the behaviour of a subject without influencing it in any way. This method allows the researcher to get a general overview of the subject. According to Kopper (1999) researchers who use this method for their research usually aim at: “Demarcating the population (representative of the universum) by means of perceiving accurately research parameters and recording in the form of a written report of that which has been perceived.”

3.6 Research Design

In this section, the researcher will address the question ‘What type of study will be undertaken in order to provide acceptable answers to the research problem or questions?’ (Mouton, 2001). The main aspects that will be covered in this section are quantitative verses qualitative studies and the different types of qualitative and quantitative methods.

3.6.1 Quantitative verses Qualitative studies

In this subsection the researcher will be discussing the terms qualitative and quantitative research as well as the features and differences of these two research methods.

3.6.2 Qualitative research

Qualitative research is a generic term for investigative methodologies described as ethnographic, naturalistic, anthropological, field, or participant observer research (Key, 1997). It emphasizes the importance of looking at variables in the natural setting in which they are found. According to Key, 1997 (cited by Smith, 1983), “qualitative research differs from quantitative research which attempts to gather data by objective methods to provide information about relations, comparisons, and predictions and attempts to remove the investigator from the investigation.”

Qualitative research is a type of scientific research that aims to find answers to a question. Qualitative research is made up of the following characteristics (Key, 1997):

- Systematically uses a predefined set of procedures to answer the question
- Collects evidence
- Produces findings that were not determined in advance
- Produces findings that are applicable beyond the immediate boundaries of the study

In other words qualitative research tries to find the answers to a given research problem from the viewpoint of the population it involves by acquiring information about the people's opinions, behaviours, experience, etc. The qualitative method investigates the *why* and *how* of decision making, not just *what*, *where*, *when*. Hence, smaller but focused samples are more often needed, rather than large random samples (Nielsen, 2000).

The significance of qualitative research is that it provides information about the “human” side of an issue in other words the contradictory behaviours, beliefs, opinions, emotions, and relationships of individuals (Leedy, and Ormrod, 2005). Qualitative research involves analysis of data such as words by means of an interview, pictures such as video or objects such as an artifact whereas quantitative research involves analysis of numerical data (Neill, 2007).

3.6.3 Quantitative Research

Quantitative research is the systematic scientific investigation of quantitative properties and phenomena and their relationships (Balnaves and Caputi, 2001). It is an iterative process where results are evaluated and theories are refined. Quantitative research is generally conducted using scientific methods, which can include (Wikipedia, 2010):

- The generation of models, theories and hypotheses
- The development of instruments and methods for measurement
- Experimental control and manipulation of variables
- Collection of empirical data
- Modelling and analysis of data
- Evaluation of results

Table 3.1 Features of Qualitative & Quantitative Research (Neill, 2007)

Qualitative	Quantitative
The aim is a complete, detailed description.	The aim is to classify features, count them, and construct statistical models in an attempt to explain what is observed.
Researcher may only know roughly in advance what he/she is looking for.	Researcher knows clearly in advance what he/she is looking for.
Recommended during earlier phases of research projects.	Recommended during latter phases of research projects.

The design emerges as the study unfolds.	All aspects of the study are carefully designed before data is collected.
Researcher is the data gathering instrument.	Researcher uses tools, such as questionnaires or equipment to collect numerical data.
Data is in the form of words, pictures or objects.	Data is in the form of numbers and statistics.
Subjective - individuals' interpretation of events is important ,for example, uses participant observation, in-depth interviews etc.	Objective – seeks precise measurement & analysis of target concepts, for example, uses surveys, questionnaires etc.
Qualitative data is more 'rich', time consuming, and less able to be generalised.	Quantitative data is more efficient, able to test hypotheses, but may miss contextual detail.
Researcher tends to become subjectively immersed in the subject matter.	Researcher tends to remain objectively separated from the subject matter.

This study will combine elements of qualitative as well as quantitative research. This will be discussed in more detail in the sections to follow.

3.6.4 Qualitative Research Methods

In this section the different types of qualitative research methods are discussed in order to see which method would best suit this study.

3.6.4.1 Action research

Action research is an iterative method where you determine the current situation of interest and then make an intervention (Olivier, 2004). According to Rapoport, 1970 (cited in Hopkins, 1985) goes on to state that the aim of action research is to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework.

3.6.4.2 Ethnographic research

Ethnographic research focuses on the sociology of meaning through close field observation of sociocultural phenomena. Ethnographers immerse themselves in the lives of the people they study and seek to place the phenomena studied in their social and cultural context (Harvey, 1997). The researcher will use observation with the 'think aloud' protocol technique.

3.6.4.3 Grounded theory

Grounded theory begins by observing the field of interest and then allows the theory to emerge from what is observed (Olivier, 2004). Theory is developed inductively from a corpus of data acquired by a participant-observer. According to Martin and Turner (1986), grounded theory is "an inductive, theory discovery methodology that allows the researcher to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observations or data."

3.6.4.4 Case study research

Case study research attempts to get a greater understanding on a phenomenon by studying in depth a single case example of the phenomena. The case can be an individual person, an event, a group, or an institution (Morse and Richards, 2002). According to Yin (2002), a case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. A case

study research method is a careful study of an individual by means of interviews, observation, experiments and tests.

The researcher's main research strategy is the case study method. Therefore the researcher will follow a case study research, according to the interpretive paradigm by using observations and interviews for fieldwork.

3.6.5 Quantitative research methods

In this section a brief overview of quantitative research methods will be given.

3.6.5.1 Experiments

Experimental researchers manipulate variables, randomly assign participants to various conditions and seek to control other influences.

3.6.5.2 Surveys

Conducting research using a survey involves going out and asking questions about the phenomenon of interest. In survey research, the researcher selects a sample of respondents from a population and conducts a questionnaire amongst them. The questionnaire or survey can be administered in any one of the following ways: a written document that is completed by the person being surveyed, an online questionnaire, a face-to-face interview, or a telephone interview.

3.6.6 Methods and Techniques in Information Systems

Olivier (2004) proposes that the methods and techniques used in information systems research are dependent on the goals of the research. He goes on to state that there are three primary types of research goals in information systems research, namely technical, social and philosophical goals. Technical goals are defined as dealing with the implementation aspects of systems, whilst philosophical goals deal with responsibility, accountability, legal aspects and the implications of

using computer systems. Social goals are defined as those that focus on the people side of computers. Social goals are most frequently achieved through empirical methods (Olivier, 2004). The goal of the study is social and therefore the need for empirical method. The researcher will use case study research as the empirical method. In contrast, technical goals are supported by creative methods and philosophical goals are achieved through the use of tautological methods.

3.6.7 Methods and Techniques in HCI

Human-computer interaction (HCI) is the study of interaction between people (users) and computers (Dix, Finlay and Abowd, 2004). This interaction occurs at the user interface which includes both software and hardware. However the Association for Computing Machinery defines human-computer interaction as "a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them (Baecker, Card, Gasen, Perlman and Verplank, 1996). HCI is also sometimes referred to as man-machine interaction (MMI) or computer-human interaction (CHI). The main goal of HCI is to improve the interactions between users and computers by making computers more usable and friendly to the different user's needs. HCI is concerned with creating the best interface for everyone to use by using techniques for evaluating and comparing these interfaces. According to Carroll (2003), a long term goal of HCI is to design systems that minimise the barrier between the human's cognitive model of what they want to accomplish and the computer's understanding of the user's task.

The following sub section provides an overview of the main techniques used in HCI:

3.6.7.1 Usability Inspection Method

Usability inspection is the generic name for a set of methods that are all based on having evaluators inspect a user interface aimed at finding usability problems in the design (Nielsen, 2005). The following are the usability inspection methods described by Jakob Nielsen that the researcher will be using (2005):

- **Heuristic evaluation** is the most informal method and involves having usability specialists judge whether each dialogue element follows established usability principles (the "heuristics"). The goal of heuristic evaluation is to find the usability problems in the design so that they can be attended to as part of an iterative design process.
- **Cognitive walkthrough** uses a more explicitly detailed procedure to simulate a user's problem-solving process at each step through the dialogue, checking if the simulated user's goals and memory content can be assumed to lead to the next correct action.
- **Feature inspection** lists sequences of features used to accomplish typical tasks, checks for long sequences, cumbersome steps, steps that would not be natural for users to try, and steps that require extensive knowledge/experience in order to assess a proposed feature set.
- **Formal usability inspection** combines individual and group inspections in a six-step procedure with strictly defined roles to which elements of both heuristic evaluation and a simplified form of cognitive walkthroughs.
- **User testing** is a common usability inspection method proven effective for finding accessibility problems (Nielsen, 2005). The Nielsen Norman Group has published extensive findings on the nature of user studies with participants with disabilities. These studies are quite effective because they find the problems actual users have with an interface. However the downside of user testing with blind and visually impaired individuals is more time consuming than other methods.
- **'Think aloud' protocol** is a popular technique used during usability testing where the participant is asked to vocalise his or her thoughts, feelings, and opinions while interacting with the product; in this case a website (Dumas and Redish, 1999). By thinking aloud while attempting to complete the task, the participant can explain their method of attempting to complete the task, and express any difficulties they encounter in the process.

The usability inspection method that the researcher will be using is user testing and 'think aloud' protocol.

3.7 Empirical research

Empirical research is carried out to answer a specific question or to test a hypothesis to help the researcher get a better understanding of the study. Empirical Research can also be defined as “research based on experimentation or observation (evidence)”. According to Olivier (2004), the quality of empirical research depends on the accuracy of observations and degree to which observed results can be generalised to other cases.

3.8 Selection of research strategy

The following table will be used as a means to justify the techniques and methods adopted for this study.

Table 3.2 Research strategy characteristics and the research questions [adapted from (Van der Merwe Kotze and Cronje, 2005)].

Approach	Characteristics	Research question 1	Research question 2	Research question 3
<i>Action research</i>	Focus on what practitioners do			
	Explicit criteria			
	Practitioners and researchers with mutual goals			
	Apply theory with goal to enhance			
<i>Case study</i>	Investigator has little control	✓	✓	✓
	Contemporary phenomenon with real-life context	✓	✓	✓
	Explores a single entity or phenomenon bounded by time and activity		✓	✓
	Study life cycles	✓	✓	✓
<i>Content analysis</i>	Study of written documentation or texts	✓	✓	✓
	Study of authorship, authenticity and meaning			
	Explores undefined number of variables	✓	✓	✓

<i>Ethnographic research</i>	Active participation			
	Observational data		✓	✓
	Social contact with participants			
	Extended depth study			
	Limited to one field study			
<i>Experiments</i>	To study the effect of an influence on a carefully controlled sample			
	Observational measures of dependent variable			
	Manipulation of variable to determine level and kind			
<i>Grounded theory</i>	Start with a phenomena			
	Data sampling with perspective			
	Theoretical account of the general features			
	Generation of theories of process, sequence, and change pertaining to organisations, positions, and social interaction			
<i>Survey-based research</i>	Aimed at producing reliable statistics on specific issue		✓	
	Description of data characteristics			
	Used to identify cause based on data			
<i>User test</i>	Users interact with websites by performing specific tasks.	✓	✓	✓

The researcher will follow an empirical approach with a combination of case studies (Yin, 2003) which is a social science research; user testing, observation using the ‘think aloud’ protocol and an interview to determine if websites are accessible or not. According to Gerber (2002) a combination of methods, in particular focus groups and individual interviews, works best with the blind and visually disabled population. The researcher chose 10 participants to take part in the research. These students are not necessarily representative of the total population and were selected based on convenience and access (Khurana and Aggarwal, 2009). According to Nielsen (2000) generally five users is a sufficient sample size to determine 80% of the site level usability, however there are some exceptions to this "rule”.

The only other research to date conducted with people who are blind or visually impaired was a pilot study. In this research Barnicle (2000) identified a number of important questions, such as: How must the testing techniques be adapted to accommodate the needs of participants; Would the study yield useful (that is, generalisable) data; and how the researcher will know if the obstacles encountered were due to the mainstream software application, the assistive technology or the unique characteristics of an individual user? The pilot study can be accessed at (<http://www.csun.edu/cod/conf2000/proceedings/0073Barnicle.html>)

3.9 Strengths and weaknesses of research strategies

3.9.1 Strengths of user test, observation and interview

The strengths of user testing and observation are that the researcher can watch how an individual interacts with a website and view first hand any problems that may encounter. The interviews would help the researcher to get a further explanation from the participant as to why they chose to do the task a certain way in the user test or get a clearer understanding of what happened during the user test.

3.9.2 Weaknesses of user test, observation and interview

The disadvantage of the user test and observation is that some individuals will feel uncomfortable to have the researcher watch their every move and therefore make mistakes when performing the user test. With regards to the interview an individual may not be totally honest about the problems they experienced in the user test because they would not want to come across as being incompetent.

The researcher will try to overcome these weaknesses by reassuring the participants that the results of the user test and interview will be kept confidential and their identities will not be mentioned anywhere in the research. Also the researcher will reassure the participants by explaining to them that the aim of the research is to measure the accessibility of websites and not how competent they are in using the Internet or computers.

3.9.3 Strengths and weakness of case study method

The case study method is a good source of hypotheses; however vital information may be missing, making the case hard to interpret.

3.9.4 Appropriate methods and techniques for this study

- **Observation using ‘think aloud’ protocol** is appropriate for collecting data on naturally occurring behaviours in their usual contexts. The researcher chose this method to easily retrieve information about the different tasks while the participant was performing the user test.
- **In-depth interviews** are optimal for collecting data on individuals’ personal histories, perspectives, and experiences, particularly when sensitive topics are being explored. Interviews were chosen to get a better understanding of any difficulties that the participant may have experienced that may not have been expressed during the user test and observation.
- **User testing** is used to gather information on task completion, satisfaction and effectiveness. This method was used to measure the accessibility of website with regards to certain factors like task completion and to determine how effective assistive technologies are in achieving accessibility.
- **Automated web evaluation** is software that automates the collection of interface usage data (automated capture) or the identification (automated analysis) and the resolution (automated critique) of potential problems (Ivory and Hearst, 2001). This technique is used to identify violations of web accessibility guidelines discussed in Chapter 2, section 2.6. The researcher will also use this technique to do cross comparison with findings of the user tests conducted.

3.10 Themes and categories

The researcher will use content analysis in Chapter 4 to categorise/summarise concepts and themes in order to describe accessibility problems that participants would have experienced during the user test. The problems will be separated according to two types of accessibility problems that is technical problems and conceptual problems. The researcher will classify problems reported by participants according to themes. These problems and themes will form the basis of content analysis tables which will then be used to show relative frequencies and percentages of each problem occurrence.

3.11 Data measurement

In order to estimate the usability in real terms, the user performance is measured. The ISO 9241-11 standard (1994) defines the usability in the following way: A system is usable when it allows the user to achieve the task with effectiveness, efficiency (with a minimum of resources required) and satisfaction (the system is pleasant to use).

Therefore, usability depends on 3 variables:

- **Effectiveness:** Check whether the objectives of the user are achieved.
- **Efficiency:** Measure the resources required to achieve these goals, for example the time needed to achieve the task.
- **Satisfaction:** Determine if the system is pleasant to use, for example by counting negative remarks said by users during the test.

The standard defines the usability on the basis of these 3 characteristics. For each instruction given to the user, measurements are done in order to calculate the above variables. In this way, the researcher is able to evaluate the usability in real terms.

The researcher will be using content and correspondence analysis to measure the data collected.

3.12 Research methodology

In this section, the following aspects will be described, namely user testing in section 3.11.1, observation in section 3.11.2 and interview in section 3.11.3.

3.12.1 User testing

For this study 10 students from the University of KwaZulu-Natal (Howard College and Pietermaritzburg campuses) ranging from blind to visually impaired volunteered to participate in this research. The researcher used the disability unit at the Howard and Pietermaritzburg campus to obtain the blind and visually impaired students' contact details. A purposive sampling method will be used. The data collection process will be conducted by using 3 research methods: unstructured interviews (Kvale, 1996), user testing (Dumas and Reddish, 1999) and observation together with the 'think aloud method' (Baron, 2000). Because part of the data will be collected through observation, participants were requested to 'think aloud' while they perform the required web-based tasks. This technique will allow the researcher to understand uncertainties and difficulties encountered whilst performing tasks. The 10 participants were involved in the user testing of 4 different websites in an effort to gain a greater understanding of web accessibility problems encountered by blind and visually impaired people.

The blind and visually impaired individuals that participated in the user testing accessed the selected websites using screen readers and screen magnification technologies (accessibility tools). The websites involved were Google (South Africa), OLS, Woolworths and Computicket. These websites were chosen because the researcher wanted to test if South African websites used accessibility design guidelines. The web-based tasks participants were required to perform were as follows: search for information using Google on how to make a kite; view and save lectures slides on OLS which is an academic website; perform online shopping on the Woolworths website and buy a bus ticket from the Computicket website to any place in South Africa. The user test was performed individually; each participant performed the task alone. This was because the researcher did not want the participants to communicate with one another or to ask each other for help when one could not perform a task. Also it was easier for the researcher to keep track of the time of completion of a task and to observe an individual performing the task

alone rather than watching two or more individuals perform a task. It would have been confusing to make notes and monitor more than one individual at a time.

The Google task was chosen because it is popular amongst students. The majority of students make use of Google to search for information whether it is an assignment or for research purposes. It is the student's personal preference to use Google for academic purposes. Since this website is used most often it would be appropriate to check if Google follows accessibility guidelines.

The OLS task was chosen because students at UKZN make use of this educational web-based course management system on a daily basis to retrieve their lecture material and other academic information. Students are compelled to use OLS. Also the researcher wanted to investigate if this website falls within the W3C web design guidelines.

Woolworths is a very popular store that is available online and has a physical existence. The aim of this task was to check if Woolworths provides the same services online that it normally does at their stores and to determine if the online shopping facility is easy to perform for blind and visually impaired individuals and if it is user friendly.

The Computicket task was chosen because many of the students do not live in Durban and therefore require transportation to get back home during the midterm breaks. Computicket was used to determine if it provides a ticketing system that is fast and easy for blind and visually impaired individuals to use in order to purchase a bus ticket.

OLS and Google will fall under the category academic.

3.12.2 Observation

Observation was used with the 'think aloud protocol'. This method was chosen to enable the researcher to study the participants whilst performing the user test. The researcher would be able to notice certain things from the user test that the participant may not express during the interview such as any frustrations or problems they may experience whilst engaging in the tasks.

This will allow the researcher to get a better understanding of the tasks that would not be conveyed in the interview.

3.12.3 Interview

An interview was chosen to get a better understanding of the tasks performed during the user test for example problems that may have been experienced, task satisfaction, etc. The researcher formulated a list of questions to be asked during the interview, the interview schedule can be found in the Addendum A. The interview begins with demographic questions such as age, gender, race, type of disability, etc. These questions are asked in order to get background information about the participants in the study. Thereafter questions relating to the participant's Internet use are asked such as number of years of Internet use, frequency of Internet usage, what they use the Internet for, etc. These questions aim to get an understanding of the participant's Internet usage and experience. After that, questions based on the tasks in the user test are asked such as problems experienced and how long it took for the completion of a task, etc. The purpose of these questions is to tie it up with the data retrieved from the observation in order to get a better understanding of the user test findings.

A pilot study was conducted to ensure that the questions formulated would yield the results that the researcher is looking for and to determine if a blind or visually impaired individual would be able to perform the user test tasks. The pilot study conducted comprised of three individuals, two blind students and one visually impaired student at the Pietermaritzburg campus.

3.12.4 The case study protocol

The case study protocol is both the instrument, with which the case study will be conducted, and the general rules and procedures with which the work is carried out (Lubbe, 1998). At the centre of the case study protocol is the interview questions that reflect the actual enquiry (Lubbe, 1998). The questions are reminders to the investigator regarding the information that should be collected. It is expected that each question will initiate a discussion on the issue at hand. The interview questions and rationale behind each question is laid out in Appendix. The sections to follow will give a detailed discussion on the case study research method.

The type of case study the researcher will use is a combination of explanatory and descriptive research.

3.12.5 Recording tasks

A combination of techniques namely audio recording and note-taking were used to record observations of participants performing tasks during user testing and with post-task interviews. The researcher did not give any instructions to the participants while they were performing the respective tasks. However when the participants showed signs of stress, the researcher provided a "hint" to enable the user to continue. According to Nielsen (1993), (cited by Craven 2003) this type of intervention is necessary in certain circumstances, as is prompting a user to ensure the transcription is accurate. Post-task interview questions were asked in order to gather data of a more qualitative nature. This enabled the researcher to get greater feedback from the participant as to why they performed the given task in a particular manner during the user test.

3.12.6 Data Analysis

Data will be collected from the interview, user test and observation with the think aloud protocol by analysing participants' interactions with websites by using content and correspondence analysis.

3.13 Case study research design

The researcher will conduct a case study inquiry covering both descriptive and explanatory type research questions. Since the researcher is testing the accessibility of different websites as cases, the unit of analysis for the case study is a website's accessibility. A multiple case study design will be used for the purpose of this study.

The figure below shows the theoretical framework used for this study.

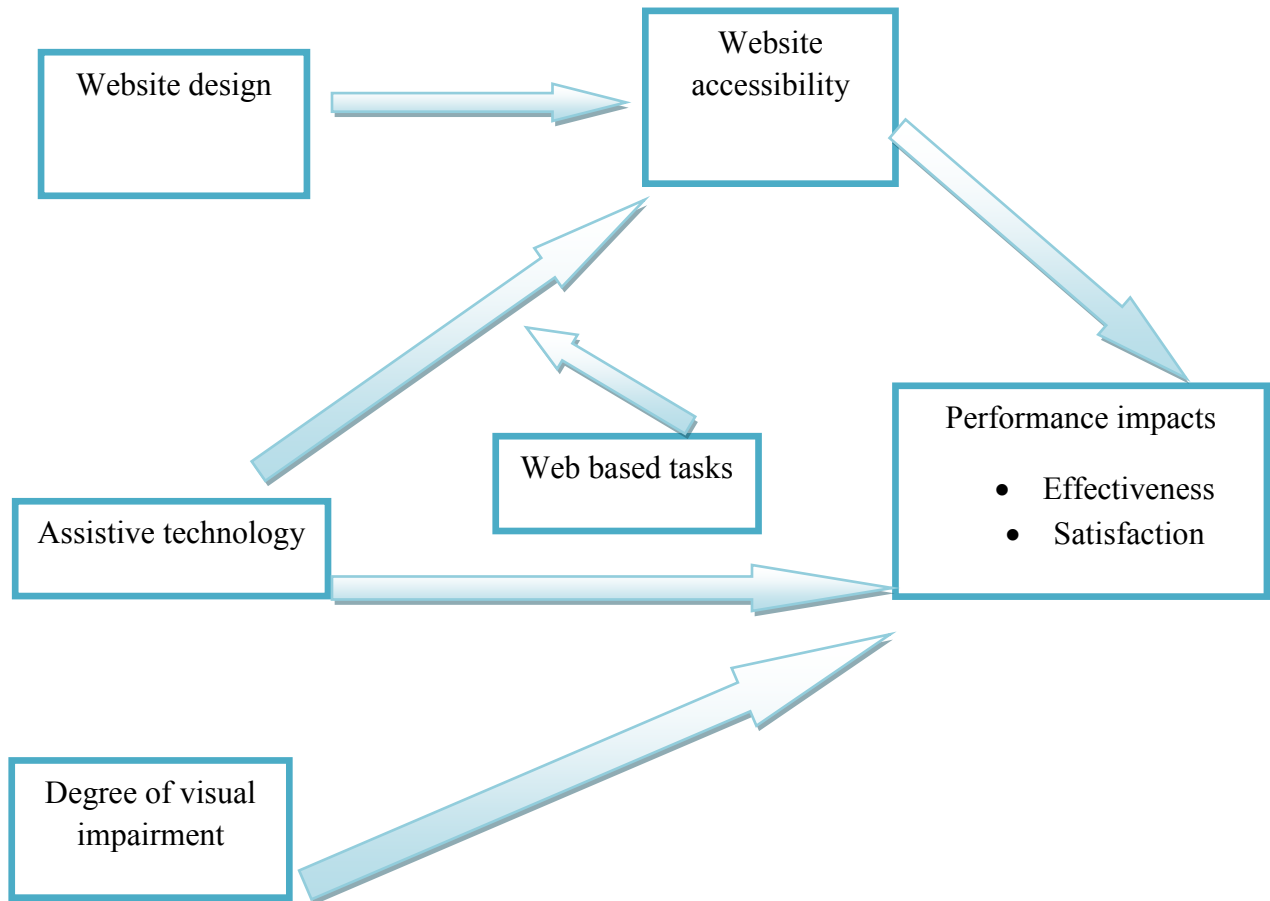


Figure 3.2: Theoretical framework

The framework provides a theoretical lens for the study being conducted. The framework will be used to formulate research propositions that are described in the following sub-section.

3.13.1 Research propositions

A research proposition is a statement about the concepts that may be judged as true or false if it refers to observable phenomena (Cooper and Schindler, 1998). The researcher decided to use research propositions because the study is of an explanatory nature and the research is not based

on previous models and can therefore be approached from a more pragmatic view. This will allow the researcher to provide more meaningful results by examining the relationships between factors being investigated.

The research propositions follow from the theoretical framework presented in Chapter 3, section 3.13 and allows the researcher to ascertain whether predicted relationships are either true or false. They help to answer the broad research questions presented in chapter 1, section 1.6. Correspondence analysis was the primary technique used to test the research propositions.

However it must be noted that unexpected correlations may be missed because of the conceptual lens implied by the propositions.

The following research propositions will be tested in this study:

- There is a correlation between website design and accessibility problems experienced
- There is a correlation between assistive technology used and accessibility problems experienced for individual web-based user tasks
- There is a correlation between assistive technology used and accessibility problems experienced irrespective of task
- There is a correlation between assistive technology used and task satisfaction
- There is correlation between assistive technology used and successful task completion
- There is a correlation between the type of visual disability and successful task completion
- There is a correlation between the type of visual disability and task satisfaction

3.14 Unit of analysis

The four websites selected for user testing will form the unit of analysis for the research that is website accessibility.

3.14.1 Modes of analysis

Two modes of analysis will be used in this research that is content analysis and correspondence analysis. The areas of the data that were analysed using content and correspondence analysis were correlated between assistive technology used and accessibility problems experienced for individual web-based user tasks.

- **Content analysis**

According to Mouton (2001), “content analysis deals with studies that analyse the content of texts or documents.” Content analysis will be used to identify frequencies and intensities with which themes and concepts appear in interviewee responses. Content categories will be set up for counting the number of occurrences of these categories in the case study data.

The researcher will count the number of occurrences according to the number of participants that experienced a certain problem. The researcher can not analyse the data by the number of occurrences of a certain problem because the aim of the research was to determine the number of people that experienced a specific problem and not the number of times a problem was experienced. Participants were not given a time limit to complete a task and as a result a participant who took a longer time to complete a task could experience more of one problem as compared to a participant who took a shorter time to complete a task. Therefore the data would not be accurate, therefore the researcher was only interested in finding out if a participant experienced a specific problem rather than the number of times a participant experienced a single problem. The researcher also did not ask the participants in the interview how many times they experienced a specific problem so the content analysis could not be analysed according to number of occurrences of a specific type of problem.

Content analysis is potentially one of the most important research techniques (Krippendorff, 2004). It is defined as a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding (Stemler, 2001). Content analysis enables researchers to sift through large volumes of data with relative ease which also allows

inferences to be made which can then be corroborated using other methods of data collection such as correspondence analysis. Content analysis is also useful for examining trends and patterns in documents (Stemler, 2001).

Content analysis extends far beyond simple word counts, however. What makes the technique particularly rich and meaningful is its reliance on coding and categorising of the data and it has the attractive features of being unobtrusive, and being useful in dealing with large volumes of data (Stemler, 1998).

- **Correspondence analysis**

According to Statsoft (2010), Correspondence analysis is a descriptive/exploratory technique designed to analyse simple two-way and multi-way tables containing some measure of correspondence between the rows and columns. Correspondence analysis provides a graphic method of exploring the relationship between variables in a contingency table. The researcher will then use correspondence analysis to determine if there are any multivariate correlations in the data. The frequencies of concepts and perceptions that recur in the total population of interview responses will be analysed to determine if any meaningful inferences can be made from it.

3.15 Sampling

In the sections to follow the researcher will discuss the sampling technique and data collection method chosen for this study.

3.15.1 Sample design and sampling methods

Sampling can be a powerful tool for accurately measuring opinions and characteristics of a population. The researcher will be using purposive sampling technique which is popular in qualitative research. This sampling technique targets a particular group of people, in this case blind and visually impaired individuals. Purposive sampling is also used when the desired population for the study is rare or very difficult to locate and recruit for a study (Patton, 1990).

Purposive sampling is a sampling technique and therefore can be subject to bias and error. The participants approached to partake in this study were informed that their contribution towards the research was on a voluntary basis.

The researcher conducted the research among 10 participants. According to Jakob Nielsen (2000), 'tests achieved with 5 users allow to raise at least 80% of the usability problems.' Increasing the number of users does not allow to find more issues because the issues are related to the software, not to the users. Testing with a greater number of users will increase the cost of the test, not the relevance of the results. Rather than achieving a test with 15 users, Jakob Nielsen considers that it is preferable to make 3 tests with 5 users, and to improve the interface between each test.

3.15.2 Evidence behind the theory

Nielsen (2000) states that elaborate usability tests are a waste of resources. The best results come from testing no more than 5 users and running as many small tests as you can afford. However, Research info (2011) confirms that a study of 10 users is a sufficient number to yield results.

Early research by Nielsen (2000) showed that the number of usability problems found in a usability test with n users is:

$N(1-(1-L)^n)$ where N is the total number of usability problems in the design and L is the proportion of usability problems discovered while testing a single user. The typical value of L is 31%, averaged across a large number of projects studied. Plotting the curve for $L=31\%$ gives the result on page 66.

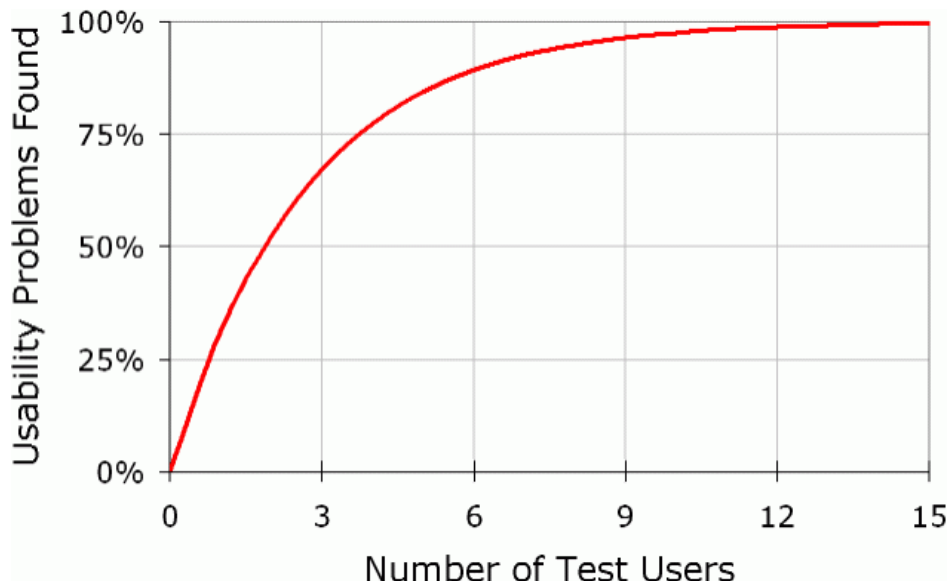


Figure 3.3: Number of participants per Usability test

From the graph above, it can be deduced that zero users give zero insights.

Once data is collected from a single test user, the researcher would have already learned almost a third of all there is to know about the usability of the design.

When the second user is tested, the researcher will discover that the user does some of the same things as the first user, so there is some overlap in the findings. However people are also different so there will be something new that the second user does that was not observed with the first user. So the second user adds some amount of new insight, but not nearly as much as the first user did.

The third user will do many things that have already been observed with the first user or with the second user and even some things that have been seen twice. The third user will generate a small amount of new data, even if not as much as the first and the second user did.

As more and more users are tested, the researcher will learn less and less because the same/similar data will come up. Thus, there is no real need to keep observing the same thing multiple times.

Even when the groups of users are very different, there will still be great similarities between the observations from the two groups. Also, many of the usability problems are related to the way people interact with the Web and the influence from other sites on user behavior.

In testing multiple groups of different users, one does not need to include as many people of each group as one would in a single test of a single group of users. The overlap between observations will ensure a better outcome from testing a smaller number of people in each group. Nielsen (2000) recommends:

- 3-4 users from each category if testing two groups of users
- 3 users from each category if testing three or more groups of users (you always want at least 3 users to ensure that you have covered the diversity of behavior within the group)

3.16 Reliability and validity

This section will distinguish between reliability and validity as well as the different types of reliability and validity.

3.16.1 Reliability

According to Krishnaswamy, Sivakuma and Mathirajan (2003), “reliability of a measure is an indication of the stability and consistency with which the instrument measures the concept and helps to assess the “goodness” of measure.”

The researcher has chosen three research instruments because the use of multiple methods increases the reliability of the research. The use of several data sources and different methods is called triangulation (the more agreement of different data sources on a particular issue, the more reliable the interpretation of the data). Thus reliability addresses how accurate the research methods and techniques produce data.

3.16.2 Validity

Is the extent to which an instrument measures what it purports to measure (Elasy and Gaddy, 1998). Validity addresses whether your research explains or measures what you said you would be measuring or explaining (Mason, 1996).

There are different types of validity:

- **Internal validity**

It refers to the extent to which the research results accurately represent the collected data.

- **External validity**

Is when the research results can be generalised or transferred to other contexts or settings.

3.16.3 Validity test

Validity tests can be grouped under three terms:

- *Content validity*

Is a function of how well the dimensions and elements of a concept have been delineated.

- *Criterion-validity*

Is established when the measure differentiates individuals on a criterion it is expected to predict.

- *Construct validity*

Is established when the scale discriminates individuals who are known to be different that is they should score differently on the instrument.

3.17 Data collection methods

In this section the researcher will discuss the different types of qualitative research methods used in the study.

3.17.1 Interview

The interview method of research involves a face-to-face interaction between an interviewer and the interviewee where a series of questions is asked to the interviewee. With interviews the researcher tries to understand something from the subject's point of view and to uncover the meaning of their experiences (Kvale, 1996). In other words an interview allows the participant to express to the researcher a situation from their own perspective and in their own words. The researcher compiled a set of questions which started off with background information about the participants and then moved on to ask the participants about their Internet activities and thereafter about any problems experienced during the user test.

3.17.2 How did the researcher conduct the interview?

- Interview questions were prepared in advance
- A tape recorder was used to record the interview.
- After the interview, the researcher transcribed the interview on paper

3.17.3 Observation with 'think aloud' protocol

In observational research the observer does not intervene at all. The researcher is invisible and works hard not to interrupt the natural dynamics of the situation being investigated (Patton, 2002). The researcher did not interfere in the observation or tell the participant how a task should be done or where to go to perform the task. The 'think aloud protocol' was used with observations so that the researcher could understand any frustrations or problems that the participant may have experienced.

The data collection method was conducted using 3 research methods: semi-structured interviews

(qualitative), user testing and observation/“Thinking aloud method”. Because the data are gathered through observation, participants are asked to “think aloud,” telling the researcher what they are doing and why, as they perform a variety of tasks. The 10 students were individually assessed by means of a user.

The following are the reasons why user testing, observation and interview were chosen as the data collection methods:

- **User testing**

User testing was chosen because it is the most effective method for evaluating usability for blind and visually impaired individuals. This method allows the researcher to directly observe the user when he/she is using a website.

- **Observation**

Observation was chosen because the researcher would be able to study the participants in their normal environment thereby generating practical and theoretical truths about human life grounded in the realities of daily existence (Jorgensen, 1989).

- **Interview**

The researcher has chosen interview research method because this will enable the researcher to obtain the best results with this method due to the verbal interaction between the researcher and the participant. Interviews are useful because it helps to get the participant’s experiences. Interviews may be useful as follow-up to certain respondents, in this case to further investigate their responses from the user testing. Also, interviews are a far more personal form of research than questionnaires and the data can be easily analysed, gathered and summarised. With easy data analysis the researcher will be able to draw conclusions at a faster speed and interviews and user testing are inexpensive. The three methods mentioned above provide data by means of field notes, audio and/or video recordings, and transcripts.

The research will aim to gather data on the interviewee’s attitudes and beliefs about the accessibility of websites and the impact of inaccessible websites on blind and visually impaired individuals. A combination of techniques were used for the study. Secondary data using a

literature survey (Phase 1) to establish accessibility problems, web accessibility guidelines, assistive technologies etc. Primary data using techniques such as user testing, observation with ‘think aloud protocol’, interviews and from the automated web evaluation (Phase 2).

Techniques	Focus	Research Question 1	Research Question 2	Research Question 3
Interviewing	Semi-structured	✓	✓	✓
Observation	‘Think Aloud’ protocol	✓	✓	✓
User Testing	Web-related Tasks	✓	✓	✓

Table 3.3 Research techniques and research questions

3.18 Data Analysis

The following are the techniques the researcher will use to analyse the data:

- **Descriptive statistics** by means of a frequency table to summarise the responses as frequency counts and percentages from the user test
- **Inferential statistics** such as Pearson *Chi-square* will be used to draw conclusions from the user test results
- **Content analysis** used to analyse the data from the interview
- **Correspondence analysis** used to analyse the data from the interview

3.19 Triangulation

Triangulation is a technique that is associated with reliability and validity in qualitative research. This method entails using more than one research method to yield results. There are different types of triangulation:

- **Method triangulation:** using multiple methods of data collection and analysis
- **Data triangulation:** collecting data from several sources and/or at different time periods.

- **Research triangulation:** multiple researchers collect and/or analyse the data
- **Theory triangulation:** multiple theories and/or perspectives are used to interpret and explain the data.

The researcher will use method triangulation to yield results by means of observation, user testing and an interview.

3.20 Limitations of the study

The following section will discuss the different limitations that the researcher was faced with.

3.20.1 Campus Facilities

The University only has one LAN for blind and visually impaired students. This limits the amount of users per test thereby increasing the amount of time to conduct the user test.

3.21 Ethical considerations

Ethical issues such as informed consent, confidentiality and consequences for the interviewee were taken into account before conducting the research and participants were informed about the purpose of the investigation. Before commencing the evaluation, participants were briefed about the study and procedures to be used and their written consent was obtained. They were assured that the evaluation was of the websites, and not their ability to use the Web. With their permission, sessions were recorded using a tape recorder. Participants were given the tasks one at a time and were asked to “think aloud” as they performed the tasks in order to ascertain whether there were any accessibility problems experienced with the chosen websites.

3.22 Conclusion

This chapter presents the research methodology and explains the case study approach that will be followed in this study. It addresses issues such as the data that will be collected, sources of data,

data collection method, data processing and case study protocol. The findings and analysis of the data will be discussed in Chapter 4.

CHAPTER 4

Data Analysis and Results

4.1 Introduction

The aim of this chapter is to present the findings and analyses from the user testing, observation using the ‘think aloud protocol’ and semi-structured interviews and automated web evaluation conducted in this research study. The findings and analyses are presented for each research sub-question. The researcher’s endeavour is to understand how blind and visually impaired individuals use a website with assistive technologies and whether the websites are accessible. The information seeking behaviour of visually impaired people has been explored in this study to develop a deeper insight and understanding of their interaction and experience with web based resources. The researcher makes reference to research questions and associated research propositions when analysing the results. The results are linked to theory in Chapter 2 and research design and methodology in Chapter 3.

4.2 A synopsis of the case studies

Four websites (Google, OLS, Woolworths and Computicket) were chosen to investigate the accessibility issues encountered by blind and visually impaired individuals. The design that the researcher will be following is a multiple case study design based on the four websites mentioned above.

4.2.1 Characterisation of website used in case study 1: Google

Google is a very informative search engine and was chosen because it is popular among students and most students are familiar with the website.

4.2.2 Characterisation of website used in case study 2: OLS

OLS is an academic website that students use to access module materials such as lectures slides, tutorials and practical and laboratory based work. Most students are familiar with this website because they use it on a daily basis.

4.2.3 Characterisation of website used in case study 3: Woolworths

Woolworths is a South African shopping website. Woolworths was chosen because it is a highly recognised and successful company in South Africa that sells quality foods. The researcher chose Woolworths to investigate if a South African shopping website follows accessibility design guidelines to cater for blind and visually impaired individuals.

4.2.4 Characterisation of website used in case study 4: Computicket

Computicket is a South African online ticketing website. The company offers the purchase of tickets for movies, sporting matches, travel tickets, etc.

4.3 Analysing the case studies

The accessibility of websites was tested with blind and visually impaired individuals. The research instruments used to collect the data were by means of interviews, observation and user testing. The data was then analysed in order to determine concepts and themes by means of content analysis and correspondence analysis. The areas of the data that were analysed were correlation between assistive technology used and accessibility problems experienced for individual web-based user tasks.

The researcher established themes and categories from the literature survey and participants' interview responses. The participants had to report whether the problems they experienced were of a technical or conceptual nature in order to analyse the findings for content analysis. This data is the researcher's qualitative data as participants will use words, feelings and perceptions when reporting on their experiences. The results of the content analysis were divided into six main

content themes grouped under content category A (Users' experiences of accessibility problems). Content category A was divided into technical and conceptual problems. Technical problems were categorised as; links formulation (A1), images without the 'ALT' comment (A2) and tables and multi-column texts (A3). Conceptual problems were categorised as multiple frameset (A4); site organisation (A5) and sites dedicated to one specific browser or configuration (A6).

Each category has different themes grouped under it. The themes grouped under content category A (Users' experiences of accessibility problems) for example were numbered as A1, A2, A3, etc. The feelings, perceptions and issues raised by participants were classified under these themes. Frequency tables were drawn up. A Frequency Table is a table that lists items and uses tally marks to record and show the number of times they occur (iCoachMath, 2010). However it should be noted that the frequency counts in this study are not a reflection of the number of occurrences of themes as verbalised by participants and recorded but rather of the number of participants that experienced a certain problem during the case study interviews and observation with 'think aloud' technique.

The researcher gathered baseline data on the accessibility of four websites by means of a user testing technique followed by observation using the 'think aloud protocol' which was then concluded with an interview. The goal was to classify all of the significant problems that blind and visually impaired users encountered when using these websites. This would give the researcher a baseline data set, as well as information about problems experienced and its impact on blind and visually impaired users.

The user test required the participants to visit four different types of websites that they would use to perform typical activities in the students' daily lives such as searching for information, viewing and saving information, and purchasing of products. These included a shopping website (Woolworths), an online ticketing website (Computicket), an educational web-based course management system called Open Learning System (OLS) and a search engine (Google South Africa).

These websites were chosen because they are South African websites and the researcher wanted to investigate if South Africa follows international design guidelines to ensure that websites are accessible for blind and visually impaired individuals.

OLS was chosen because students at the University of KwaZulu-Natal use this web-based system almost every day to access their lecture slides, tutorial material, etc. The researcher's aim was to determine if OLS catered for blind and visually impaired individuals who use this system to access their lecture materials on a daily basis; Google was chosen because it is a search engine and many students use Google to gather information for their studies; Computicket was chosen because UKZN has many students who are not from Durban and during the vacation they travel back home. Since Computicket sells bus tickets, the researcher felt that this website would be easier for students to purchase a ticket to their home town. The Woolworths website was selected for the purposes of this study because it is a very popular company in South Africa that sells quality food and unique clothing that can be purchased online. The researcher's aim was to find out if online shopping was accessible to blind and visually impaired individuals. The participants were timed to determine how long it took an individual to perform a task inferring that the longer an individual took to complete a task the more inaccessible the website. There was no time limit on each task in order to observe the difference in task completion times of blind and visually impaired individuals.

4.4 The Sample

All potential participants approached were screened for visual impairment. The researcher recorded each participant's degree of visual disability. The research required these individuals to participate in a user test and interview. Users were not given a time limit to complete each task in the user test. At the beginning of the session they were told that they could stop the task at any time. The post-task interviews consisted of a set of semi-structured questions based on Nielsen's and Coyne's method of evaluating users (How to Conduct User Evaluations for Accessibility, 2001). Interviews began with a set of user profile questions to help draw up a profile of user characteristics. Questions included details such as age, registered degree, frequency of Internet usage and length of internet usage measured in years, age and race have

been used as an indication of demographic spread rather than to analyse behaviour. The semi-structured interviews, however, were used to collect data on a participant's prior internet experience which could have a moderating effect on the accessibility problems experienced with websites.

4.5 Demographic Data

This section describes the user profile of the participants with regards to age, race, gender and Internet use in days, assistive technology used, degree being studied and number of years of Internet use of the participants.

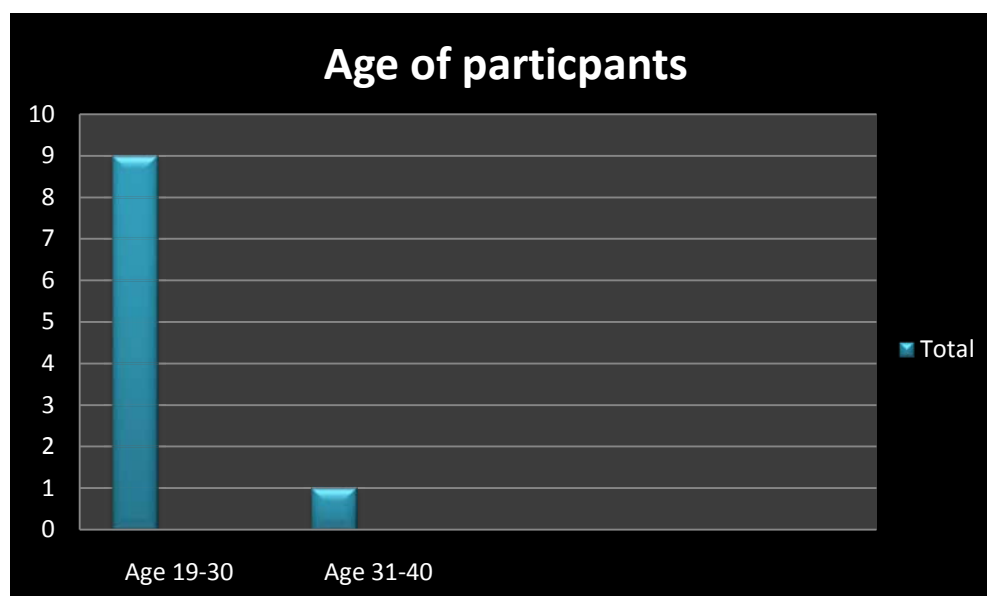


Figure 4.1 showing the different age of the participants

The sample was made up of three blind and seven visually impaired students who were chosen on a voluntary basis. Participants ranged in age from 19 to 40 years old. The blind and visually impaired sample included nine users who were in the range 19-30 and one user in the range 31-40. A graphical depiction of the age range of users in both samples is illustrated in Figure 4.1. The sample had an equal number of males and females that is five males and five females.

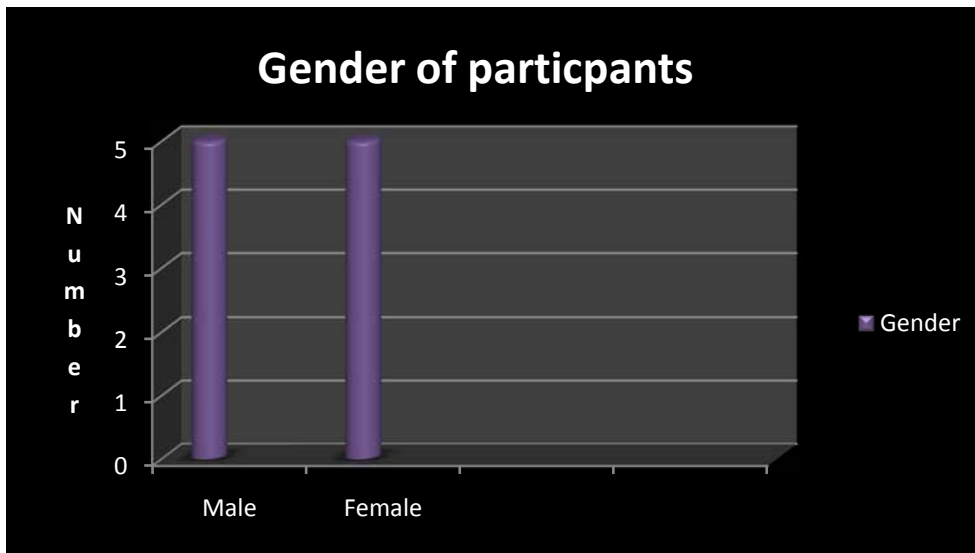


Figure 4.2 showing the gender composition of the participants

As depicted in Figure 4.3 on page 78, the race groups that participated were made up of three Indians and seven Africans.

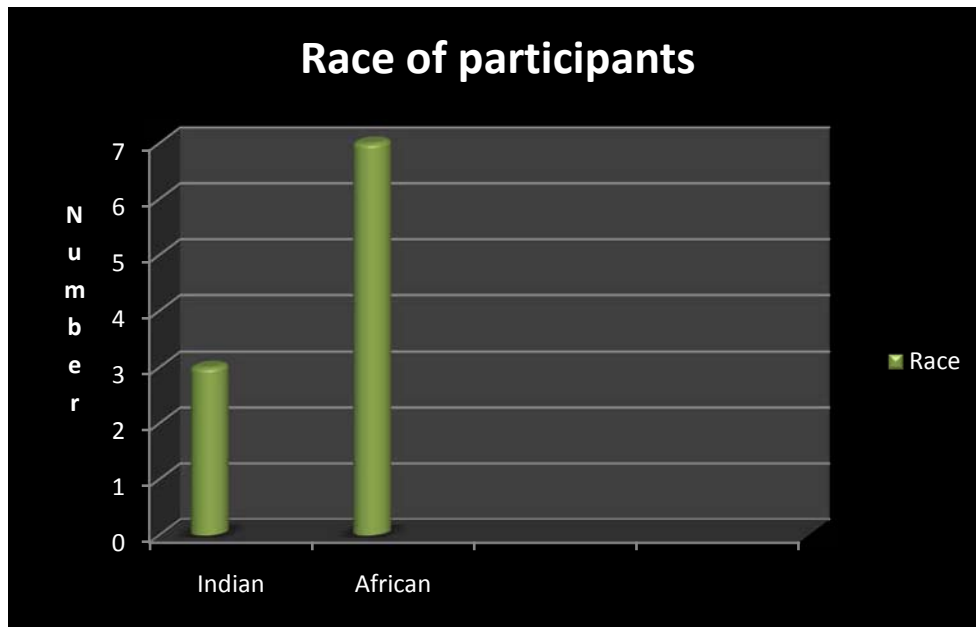


Figure 4.3 showing the race groups involved in the research

As depicted in Figure 4.4 below, the students were registered for different degrees and were made up of 1 Law student, 8 B.A Social Science students and 1 B.Com student.

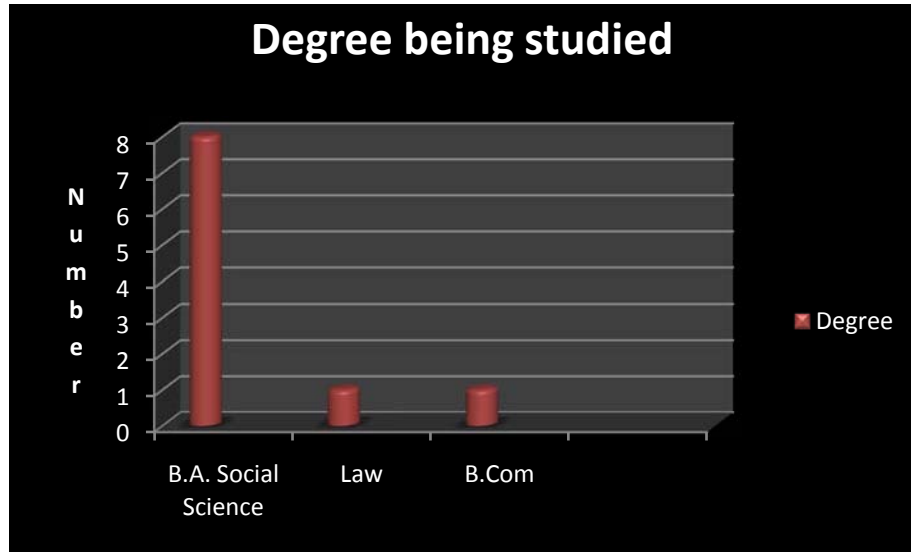


Figure 4.4 showing the different degrees of the participants

Figure 4.5, on page 79 shows that the participants make use of the Internet often and therefore they would be able to give positive feedback on the user test since they are familiar with the Internet. From the 10 participants three said they used the Internet every day, four said every 4-5 days and three said between 2-3 days a week.

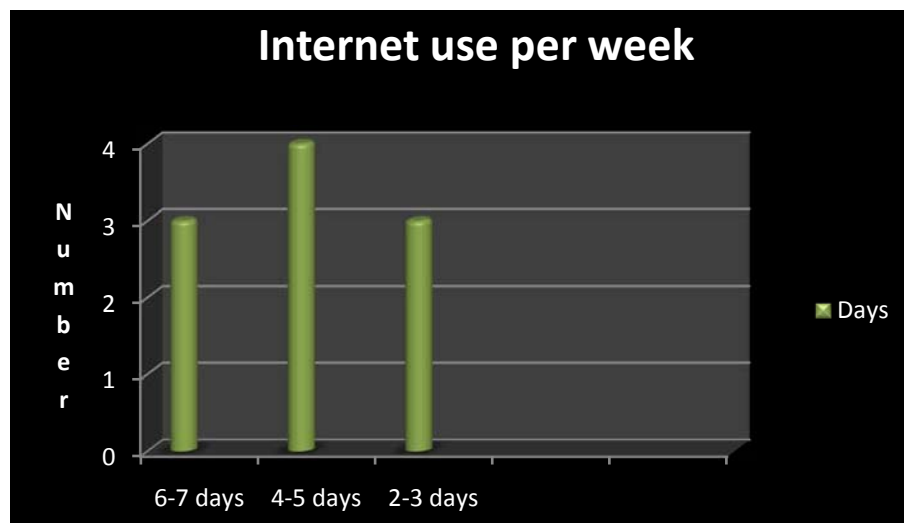


Figure 4.5 showing the number of days a week that the participants use the Internet

The main Internet activities performed by participants were related to academic work, e mail, chatting and reading online news.

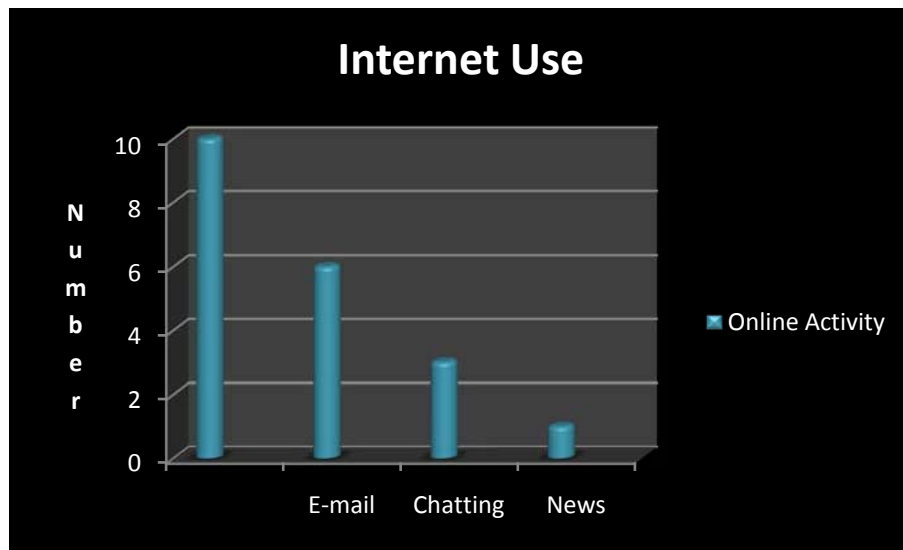


Figure 4.6 showing the different Internet activities

Three participants in the blind category needed an assistive technology to be able to read and view information on the Internet. The main assistive technologies used for this study were a screen reader for blind individuals (three) and four visually impaired users needed screen magnification to interact with websites (Figure 4.7, below). The other three users needed to be extremely close up to the standard screen to be able to read it.

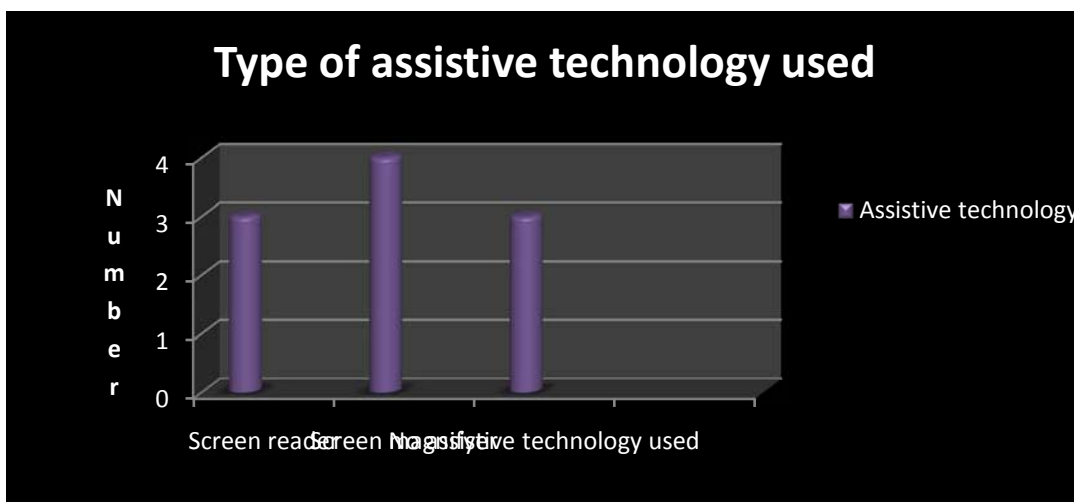


Figure 4.7 Types of assistive technologies used

Figure 4.8 indicates that the participants have been using the Internet for quite a long time and can therefore give the researcher feedback that is any changes positive or negative that has

transformed since they first starting using the Internet for example if websites have become more accessible or not.

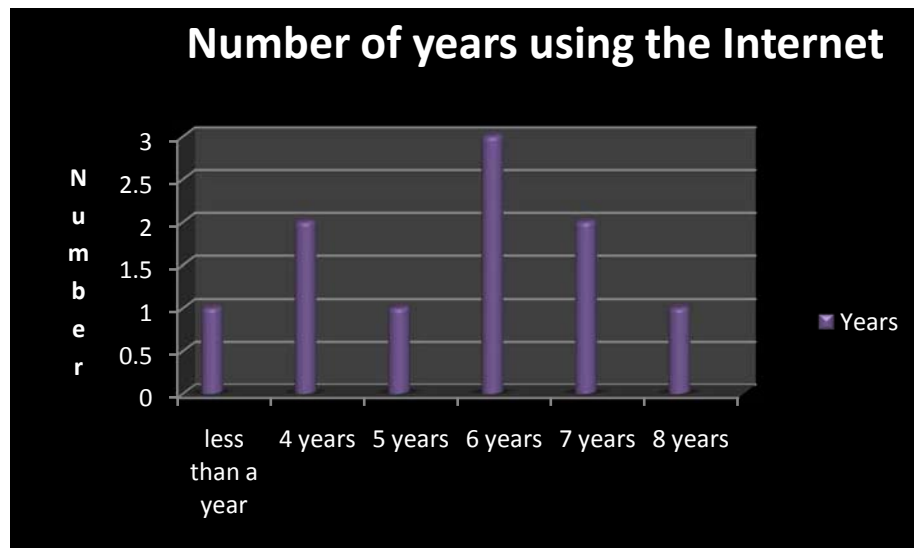


Figure 4.8 showing number of years of Internet use

4.6 Findings from user testing and observation

In this section the researcher describes the results of the user testing by means of observation using the think-aloud method.

When performing the user test tasks participants were measured according to three factors that is effectiveness (the time it took a participant to complete a task), efficiency (whether the participant completed the task) and task satisfaction (if the participant enjoyed the task). Completing a task refers to the time logged from the moment the researcher asked the user to proceed with the task to when the user accomplished the task.

The time taken indicates how long the individual spent on each task. The times taken to complete each task are described below.

4.6.1 Case study 1: Google

Task: To search for information on how to make a kite.

Blind users took between 1.5 minutes and 10 minutes to complete the task. The reason for this was due to a number of factors. The blind users found the links on Google to be very confusing as if they were “jumbled” and the links did not provide sufficient information (Addendum B). In addition, the participants stated via the ‘think aloud protocol’ that the text colour on the website was too light and there should not be so many search results on one web page.

Visually impaired users took between 1 minute and 3 minutes to complete the task. Although these individuals were fast in completing the task they did experience some problems. These included:

- The layout of the website. The links from Google results did not provide clear information and the images (appeared on the web page after clicking on a result link) from Google results link were difficult to recognise as there was no contrast in the colours used.
- The images should be in a different colour from the background colour. Backgrounds should be kept simple and there should be enough contrast. Use font and background colours that are high in contrast (black on white or white on black works best). Blind and visually impaired individuals can have difficulty reading information on websites with dark backgrounds.

Thus there should be enough contrast between the text, the image and the background of the web page.

According to NoVA final report (2005), when they had conducted their user test, they had found that sighted users took between 1.5 minutes and 15 minutes to complete the search engine task while blind and visually impaired users took between 2 and 45 minutes to complete the task. This shows that blind and visually impaired individuals take a longer time to complete a task as compared to sighted users. Therefore the researcher can conclude that blind and visually impaired users were both efficient and effective as they not only completed this task but they also took a short time to complete it.

4.6.2 Case study 2: Educational web-based course management system (OLS)

Task: Finding and saving of lecture notes.

From the three blind users, one blind user took 5 minutes to complete the task. The other two blind participants do not use OLS as the lecture slides are normally emailed to them; as a result they were unable to participate in this task. The blind user that performed the task reported that she was losing sight of the cursor due to the bright textual colours used in the Web-based system.

The visually impaired users took between 2 and 3 minutes to complete the task. From the 7 visually impaired participants 4 completed the task and 3 did not. From the three that did not complete the task, 2 blind users were unable to complete because they do not use OLS because their lecture material is emailed to them and therefore there were no slides for them to save from OLS so they could not complete the task. The other one visually impaired individual's reason for not completing the task was because of the problems experienced on OLS. The only problem that one visually impaired participant experienced was that the text size was too small; besides this they enjoyed the task and found it easy to complete. According to Disability resource (2002), most large print documents should be produced with the body text in 18-point type and major headings in 24-point type. Many blind and visually impaired individuals prefer serif fonts such as Times New Roman or Helvetica. However, people who have always read large print tend to prefer sans-serif fonts such as Arial (Disability resource, 2002). Therefore, large print documents may meet most people's needs if the text is in Arial and with body text in Times New Roman. Also Italics should be avoided as well as bolding and underlining.

These results were compared to the findings of the NoVA report. In the NoVA report the sighted users took between 1 and 5 minutes to complete the task. The task was similar to that of the researcher's task. The blind and visually impaired users took between 5 and 25 minutes to complete the task. The minimum time taken by blind and visually impaired individuals was the maximum time that a sighted user took to complete a similar task. Similar completion rates between the 2 groups may be attributed to length of internet experience of blind and visually impaired participants. However it should be noted that the maximum time taken to complete the task by visually impaired participants was 5 times the maximum for sighted users which more or

less correlates with Nielsen's suggestion that the web is 3 times easier for sighted users (refer to Chapter 4, section 4.6).

4.6.3 Case study 3: Online ticketing website (Computicket)

Task: To purchase a bus ticket to any place in South Africa.

Blind users took between 2.5 minutes and 5 minutes to complete the task. From the three blind participants only two completed the task, one participant gave up without completing the task. This user tried two times to complete the task but was unsuccessful due to the screen reader (JAWS). The participant found that JAWS read the information incorrectly thus misleading the user by not providing clear information as to where to go to purchase a bus ticket. Nothing was mentioned by JAWS about a travel link therefore the participant could not purchase a bus ticket. This user took 5 minutes to find information on the Home page relating to purchasing a bus ticket and then terminated the task.

The visually impaired users took 3 minutes to complete the task. From the 7 visually impaired participants only five completed the task, the other two gave up after 3 minutes. The reason given by participants that did not complete the task was the poor layout of the website. There was too much of information on the Home page with no clear information given on how to purchase a bus ticket. This confused the participants which had an effect on the completion of the task. A simple, consistent page layout throughout a website should be maintained. A consistent design and look makes it easier for blind and visually impaired individuals to retrieve information that they require.

The participants found the interaction with Computicket to be more demanding as they were required to perform more steps to accomplish the task as compared to Google and OLS.

4.6.4 Case study 4: Online Shopping (Woolworths)

Task: To purchase food using Woolworth's online shopping facility.

The blind users took between 13 and 15 minutes to complete the task with one participant not completing the task. These individuals took a long time to complete the task as they experienced a few problems with the Woolworths website which was brought to the researcher's attention

during observation with the 'think aloud protocol'. There were too many links for these individuals to go through before they could actually start shopping; the information on the home page was not clear as to where to click on to start shopping; the online shopping process was too long as the user had to register first before shopping; there were too many steps to perform before member registration is completed and the colour scheme (text and background colour) also contributed to the slow progression of the purchase.

The visually impaired users took between 2 and 3 minutes to complete the task with one participant not completing the task as the user did not know where to click on to perform online shopping (noted during observation) and was unaware that he had to register as a member before he could start shopping. The other participants also agreed when interviewed that there was no clear information about registering first and then shopping. Other problems reported were the small size of the text, the use of light text colour (grey) and the layout of the website was confusing as the register link should have been at the top of the web page.

The participants also found the interaction with Woolworths to be just as demanding as Computicket as they were required to perform more steps to accomplish this task as compared to Google and OLS.

According to the Nielsen Norman Group (2001), "the web is about three times easier for sighted users than for users who are blind or visually impaired." These numbers clearly demonstrate just how poorly the web is designed for people who are blind or visually impaired. The above results show that blind and visually impaired individuals do take a long time to complete tasks and therefore is in agreement with the Nielsen Norman Group.

4.7 Summary of cross case findings and analysis

This section will discuss the findings from the interview, user test and observation such as the difficulties experienced in the four website.

The interactivity on websites with order forms and shopping carts (Woolworths and Computicket) posed serious difficulties for blind and visually impaired participants in the study.

These included problems such as links formulations, 'ALT' text missing and site organisation problems such as the layout of the website.

Some of the participants interviewed felt that the following should be considered for website design:

- Make the tab order follow logically; put one item per line and make sure it is labelled correctly.
- Consider longer times before being "timed out" and the ability to "page back" without losing all entered data as it becomes quite frustrating to enter all the details again.
- Place the submit button close to the last entry as visually impaired individuals find this to be very helpful when performing online shopping.

Many of the participants felt that a website should be tested for accessibility before being put on the Internet.

Participants mainly experienced images without the 'ALT' comment in the category of technical problems encountered. They encountered this problem when they had to search for information on *how to make a kite*. The image of a kite did not have an 'ALT' comment so when the participants moved the cursor over the image they did not get any information about the image but instead they got information that there was an image displayed on the web page. Blind participants were also affected as they had no audio transcription of the image. Two participants experienced links formulation problem with the Woolworths and Computicket website. With the Woolworths website this was evident when the participant had to click on the link to perform online shopping and with the Computicket website this occurred as a result of the links not being labelled correctly. This is depicted in Figure 4.9 below.

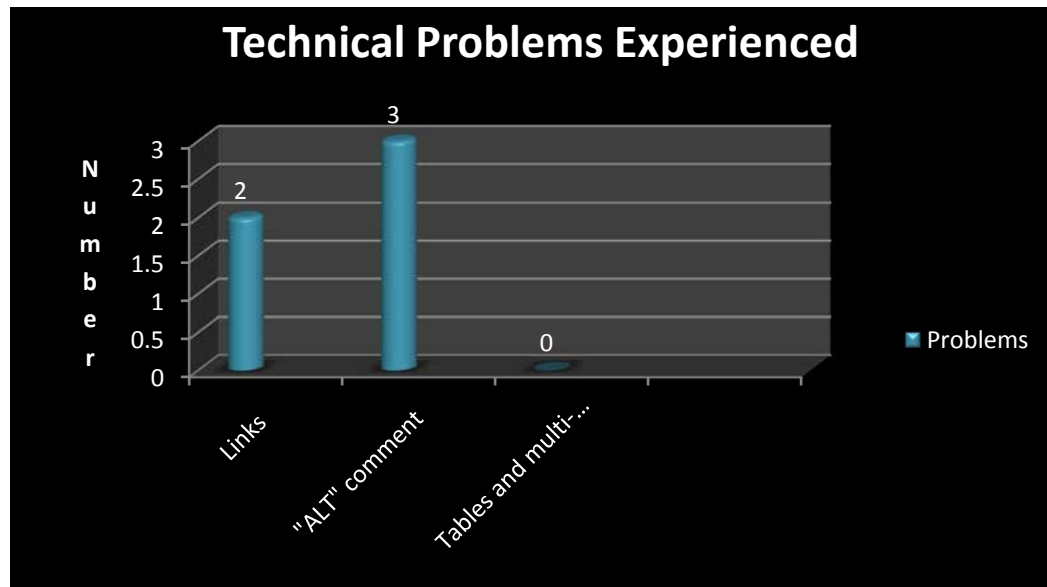


Figure 4.9 Technical problems experienced

The main conceptual problem (Figure 4.10) was site organisation which occurred with the Woolworths and Computicket websites. Participants felt that not enough information was given on the home page of Woolworths website to let participants know where to go to perform online shopping. Also they felt that it was not obvious that they had to register first before they could actually start shopping.

The Computicket website was very confusing as it contained too much of information and links on the home page. There was no indication on the home page as to where the user must click on to purchase a bus ticket. Seven out of ten participants experienced problems with this website which shows that this website was not usable for blind and visually impaired individuals.

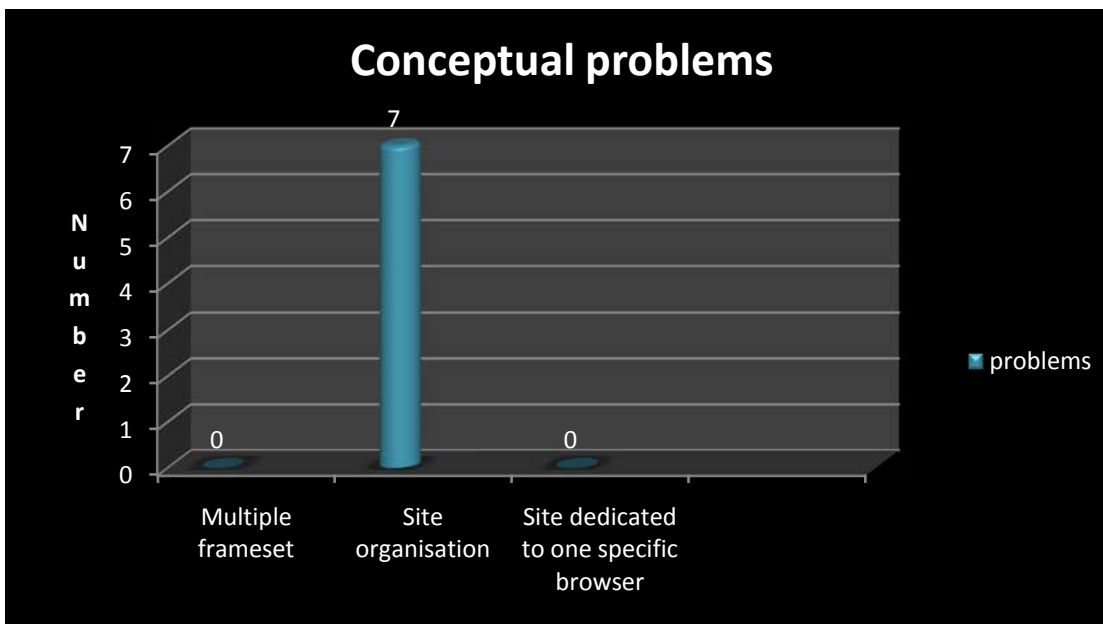


Figure 4.10 Conceptual problems experienced

Once the user testing was completed, the researcher conducted one-to-one interviews with the participants. The interview schedule can be found under the Addendum A. The schedule shows the questions that were asked as well as the purpose for each question.

The purpose of this interview was to solicit information from blind and visually impaired individuals regarding the accessibility of websites and to get a greater understanding of their Internet experience.

Content analysis was used to analyse the meanings and relationships of data and in this case the relationships of themes/category in Table 4.1-4.4. These themes originated during the literature review and were refined after interviews were completed. Content analysis relies on content categories being used and the researcher's role is to count the number of occurrences of these categories (Lubbe, 1998).

Correspondence analysis was used to support the findings of the content analysis and to understand the relationships. Correspondence analysis is a descriptive/exploratory technique designed to analyse simple two-way and multi-way tables containing some measure of correspondence between the rows and columns (www.statsoft.com). Thus the researcher felt this method would best support the data obtained from observations of user testing with the 'think aloud protocol' and interviews. The researcher used the content analysis to establish how the

themes were related to each other and to the different websites as well as to the blind & visually disabled groups participating in the study.

The tables below displays content analysis showing the different accessibility problems that were experienced by individuals that participated in the user testing.

4.8 Interpretation of content analysis results

In this section the researcher explains the different themes as well as the occurrences of the theme/concept encountered by and verbalised by the participants. Thereafter correspondence analysis was conducted.

4.8.1 Accessibility problems (Content category A)

This content category summarises concepts and themes that describe accessibility problems that participants experienced during the user test. It provides data on two types of accessibility problems that is technical problems and conceptual analysis. Technical problems were broken down into links formulation, images without 'ALT' comment and tables and multi-column texts while conceptual problems were broken up into multiple frameset, site organisation and sites dedicated to one specific browser or configuration. The researcher classified problems reported by participants according to themes listed in tables 4.1 -4.4. Each website was examined to determine which problems were experienced by each participant and how many participants experienced the same problems. These problems and themes are displayed in the content analysis tables below showing the relative frequencies and percentages of each problem occurrence.

CASE 1: Google

	Themes/Concepts	Theme code	Total	%	Accum %
	Users' experiences of accessibility problems with Google website.				
	<i>Technical Problems:</i>				
1	Links formulation	A1	2	22	22
2	Images without the 'ALT' comment	A2	2	22	44
3	Tables and multi-column texts	A3	0	0	0
	<i>Conceptual Problems:</i>				
4	Multiple frameset	A4	0	0	0
5	Site organisation	A5	5	56	100
6	Sites dedicated to one specific browser or configuration	A6	0	0	0
	<i>Totals</i>		9		

Table 4.1: Content analysis showing relative frequencies and percentages for accessibility problems experienced with Google.

Table 4.1 shows that in the transcript of the case study interview the following themes were encountered:

Theme A1: Links formulation

This theme relates to the formulation of links where not enough information is provided about a link for example what the link is about and where the link will take the user when it is clicked. This allows the blind and visually impaired individual to understand the link. There were 2 participants (blind) that experienced problems relating to links formulation when performing task

on Google. These individuals felt that the search result links to the information relating to kites were not clear.

Theme A2: Images without 'ALT' comment

This theme relates to the images on the Google website which did not provide 'ALT' comment when it came to the kite picture. As a result two blind individuals could not recognise the kite image. 'ALT' comment is when a text label is put on any graphic for a blind or visually impaired user because access technologies cannot read graphics. Therefore, by adding text to images, the blind or visually impaired individual will know what image is on the website. This is a key web accessibility guideline but is not always followed by web designers. If the 'ALT' text does not clearly describe the image, a blind user will have difficulties.

Theme A3: Tables and multi-column texts

This theme relates to tables and multi-column texts. No participant experienced this problem as Google did not contain tables and multi-column texts when it came to searching for information on making a kite.

Theme A4: Multiple frameset

This theme relates to multiple frameset. A frameset is a web page which defines a collection of at least two other separate web pages, which are combined in the same visual space (WebAIM, 2010). There were no participants who experienced this problem as Google did not contain multiple frameset.

Theme A5: Site organisation

This theme relates to the way a website is organised. Five participants did not like the way Google was designed as they experienced difficulties when it came to interpreting the results of the search as they felt the results should have been displayed more clearly. In addition, they were unhappy with the font size of the results and the layout. The results should not have been displayed down the page as it is easier to read the text across the page with a screen reader.

Theme A6: Sites dedicated to one specific browser

This theme relates to websites that use one browser to display the website for example where a website only uses Mozilla Firefox or Internet Explorer. If another browser is used then the website will not be displayed on the screen. Participants did not experience this problem as Google is not dedicated to one specific browser.

CASE 2: OLS

	Themes/Concepts	Theme code	Total	%	Accum %
	Users' experiences of accessibility problems with OLS website.				
	<i>Technical Problems:</i>				
1	Links formulation	A1	0	0	0
2	Images without the 'ALT' comment	A2	0	0	0
3	Tables and multi-column texts	A3	0	0	0
	<i>Conceptual Problems:</i>				
4	Multiple frameset	A4	0	0	0
5	Site organisation	A5	0	0	
6	Sites dedicated to one specific browser or configuration	A6	0	0	0
	Totals		0	0	0

Table 4.2: Content analysis showing relative frequencies and percentages for accessibility problems experienced with OLS.

From Table 4.2, 8 participants did not experience any problems with OLS. Two participants did not perform this task as they do not use OLS. Both blind and visually impaired individuals enjoyed the OLS task without any difficulties.

CASE 3: Computicket

	Themes/Concepts	Theme code	Total	%	Accum %
	Users' experiences of accessibility problems with Computicket website.				
	<i>Technical Problems:</i>				
1	Links formulation	A1	3	37.5	38
2	Images without the 'ALT' comment	A2	0	0	
3	Tables and multi-column texts	A3	0	0	0
	<i>Conceptual Problems:</i>				
4	Multiple frameset	A4	0	0	0
5	Site organisation	A5	5	62.5	100
6	Sites dedicated to one specific browser or configuration	A6	0	0	0
	<i>Totals</i>		8		

Table 4.3: Content analysis showing relative frequencies and percentages for accessibility problems experienced with Computicket

Theme A1: Links formulation:

From the 10 participants only 3 participants experienced problems with the links on Computicket. These individuals could not find the link to purchase a bus ticket as they felt that the link was not made clear on the website as to where to go to purchase a bus ticket.

Theme A2: Images without 'ALT' comment

None of the participants experienced this problem. The task did not require the participants to work with images on the task but the Computicket website contained images.

Theme A3: Tables and multi-column texts

None of the participants experienced this problem because Computicket did not contain tables and multi-column texts.

Theme A4: Multiple frameset

None of the participants experienced this problem because the website did not contain frames.

Theme A5: Site organisation

Half of the participants experienced this problem. These individuals did not like the way the links and images were displayed on the homepage. There was too much of information on one page which ended up confusing the individual. The screenshot can be found in the Addendum C.

Theme A6: Sites dedicated to one specific browser

None of the participants experienced this problem.

CASE 4: Woolworths

	Themes/Concepts	Theme code	Total	%	Acum %
	Users' experiences of accessibility problems with Woolworths website.				
	Technical Problems:				
1	Links formulation	A1	1	14	14
2	Images without the 'ALT' comment	A2	2	29	43
3	Tables and multi-column texts	A3	0	0	0
	Conceptual Problems:				
4	Multiple frameset	A4	0	0	0
5	Site organisation	A5	4	57	100
6	Sites dedicated to one specific browser or	A6	0	0	0

	configuration				
	Totals		7		

Table 4.4: Content analysis showing relative frequencies and percentages for accessibility problems experienced with Woolworths.

Theme A1: Links formulation:

One participant experienced problems with the links on Woolworths. This ended up frustrating the user as he did not know where to go to perform online shopping.

Theme A2: Images without ‘ALT’ comment2

Two participants experienced problems with the images on Woolworths. They could not understand the images as it was not clear because there were no text available for the images.

Theme A3: Tables and multi-column texts

No participants experienced this problem because Woolworths did not contain tables and multi-column text.

Theme A4: Multiple frameset

No participants experienced this problem when performing the required task as Woolworths did not contain multiple framesets.

Theme A5: Site organisation

Four participants experienced this problem. They did not like the layout and design of Woolworths as the home page contained too much of information and it was not clear where to click on to perform online shopping.

Theme A6: Sites dedicated to one specific browser

No participants experienced this problem.

4.9 Summary of content analysis results

The results displayed in Table 4.5, below illustrates the common problems blind and visually impaired individuals experienced when accessing websites.

From the 10 participants, 6 participants experienced links formulation when it came to all four websites. Most of the participants experienced this problem when visiting the Google, Woolworths and Computicket websites. Four participants in total experienced images without the 'ALT' comment with Google and Woolworths.

Tables and multi-column texts are a problem for blind and visually impaired individuals because some assistive technologies display information normally on a single Braille line (Spencer, 2001). As a result, the blind user reads one line of each column of the table or of the multi-column texts. This text does not make any sense as it ends up confusing a blind or visually impaired individual as they did not know where the column ended. However, none of the participants were affected by this problem because the tasks they had to perform did not contain any tables.

From the three conceptual problems, participants only found site organization to be a problem. Fourteen participants in total experienced this problem with Google (5), Woolworths (4) and Computicket (5) websites. Participants felt Woolworths and Computicket's website was not well organised. In the Woolworths website, participants were dissatisfied with the layout of information and the fact that insufficient information was given about performing online shopping. With the Computicket website participants reported that they were not satisfied with the way the information was provided for the user. There was too much of information on the Home page about all the different purchasing options (purchase of a bus ticket, movie ticket, cricket match). Blind participants assisted by a screen reader found that it was confusing to navigate on the Computicket website as the assistive technology does not follow the information in a coherent manner but rather jumps from one section of the website to another.

	Themes	Google	Woolworths	OLS	Computicket	Totals
	Users' experiences of accessibility problems					
	<i>Technical Problems:</i>					
A1	Links formulation	2	1	0	3	6
A2	Images without the 'ALT' comment	2	2	0	0	4
A3	Tables and multi-column texts	0	0	0	0	0
	<i>Conceptual Problems:</i>					
A4	Multiple frameset	0	0	0	0	0
A5	Site organisation	5	4	0	5	14
A6	Sites dedicated to one specific browser or configuration		0	0	0	0
	Total	9	7	0	8	24

Table 4.5: Summary results of content analysis for category A

4.10 Combining findings from Observation with 'think aloud' and interviews

4.10.1 Correspondence Analysis

Correspondence analysis is a descriptive/exploratory technique designed to analyse simple two-way and multi-way tables containing some measure of correspondence between the rows and columns (Statsoft, 2010). The following tables display the results of the content analysis discussed above (content category A):

Correspondence Table

Theme	Website			
	Google	Woolworths	Computicket	Active Margin
T1 (Links formulation)	2	1	3	6
T2 ('ALT' comment)	2	2	0	4
C2 (Site organisation)	5	4	5	14
Active Margin	9	7	8	24

Table 4.6: Showing correspondence analysis for content category A (Users' experiences of accessibility problems)

4.10.2 Correspondence analysis 1: Is there a correlation between website design and accessibility problems experienced?

Under content category A (Users' experiences of accessibility problems) content analysis revealed that the case study participants experienced three major themes. Correspondence analysis was used to determine how the themes were related to each other and to the different websites. The data matrix includes only those rows and columns that have some values greater than zero. Thus OLS, T3, C1 and C3 are excluded from the analysis. OLS was excluded from the matrix because none of the participants experienced any problems with OLS and conceptual problem 1 and 3 was eliminated because none of the participants experienced these problems with any of the websites. The values under row T1 represents the number of participants that experienced link formulation problems with Google, Woolworths and Computicket website. The same goes for T2 and C2 as they represent the number of participants that encountered these problems. The table above shows that site organisation conceptual problem was the most frequently experienced amongst the websites tested and images without "ALT" text was found to be the least frequently experienced problem.

The results revealed that many blind and visually impaired individuals experience technical and conceptual problems with website design. Taking all three websites into account the following were revealed: a total of six individuals experienced links formulation problem; four users experienced images without ‘ ‘ALT’ ’ comment and fourteen individuals experienced site organisation problems. Thus the results indicate that blind and visually impaired individuals experience accessibility problems to a certain extent that is not all the technical or conceptual problems were encountered.

Dimension					Proportion of Inertia		Confidence Singular Value	
	Singular Value	Inertia	Chi Square	Sig.	Accounted for	Cumulative	Standard Deviation	Correlation 2
1	.351	.123			.994	.994	.126	
2	.028	.001			.006	1.000	.198	
Total		.124	2.982	1.000 ^a	1.000	1.000		

a. 15 degrees of freedom

Table 4.7: Summary of inertia against dimension

The first axis accounts for 99.4% of the inertia. Thus the result is essentially uni-dimensional.

There is one eigenvalue for each dimension and in this case it is labelled inertia for that dimension. The term *inertia* in correspondence analysis is used by analogy with the definition in applied mathematics of "moment of inertia," which stands for the integral of mass times the squared distance to the centroid (Statsoft, 2010). Inertia is defined as the total Pearson *Chi-square* for the two-way divided by the total sum. The first dimension always explains the most inertia that is variance and has the largest eigenvalue, the next the second-most and so on (Krauss, 2006). The number of eigenvalues that can be extracted from a two-way table is equal to the minimum of the number of columns minus 1 and the number of rows minus 1 (StatSoft

Inc, 2010). Therefore from the four cases presented in table 5, only two dimensions are reflected in Table 4.7 above as produced by Statistica.

Table 4.7 shows that one dimension will explain 99.4% of the total data variability and two dimensions will explain 100% of the total variability. Thus the result is essentially uni-dimensional.

In correspondence analysis, the row and column totals of the matrix of relative frequencies are called the row mass and column mass, respectively (StatSoft Inc, 2010). Inertia and row and column profiles: If the rows and columns in a table are completely independent of each other, the entries in the table (distribution of mass) can be reproduced from the row and column totals alone, or row and column profiles in the terminology of correspondence analysis (StatSoft Inc, 2010). In order to compute the Chi-square statistic for two-way tables, the expected frequencies in a table, where the column and rows are independent of each other, are equal to the respective column total times the row total, divided by the grand total (StatSoft Inc, 2010). Any deviations from the expected values will contribute to the overall Chi-square.

Overview Row Points^a

Theme	Mass	Score i Dimension		Inertia	Contribution				
		1	2		Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		Total
		1	2		1	2	1	2	
T1	.250	-.631	-.227	.035	.284	.466	.990	.010	1.000
T2	.167	1.220	-.145	.087	.706	.127	.999	.001	1.000
C2	.583	-.078	.139	.002	.010	.407	.800	.200	1.000
Active Total	1.000			.124	1.000	1.000			

a. Symmetrical normalization

Table 4.8: Showing row coordinates of inertia and themes

Overview Column Points^a

Website	Mass	Score i Dimension		Inertia	Contribution				
		1	2		Of P oint t o Inertia of Dimension		Of D imension to Inertia of Point		
		1	2		1	2	1	2	Total
Google	.375	.249	-.203	.009	.066	.559	.950	.050	1.000
Woolworths	.292	.609	.195	.038	.307	.401	.992	.008	1.000
Computicket	.333	-.813	.058	.077	.626	.040	1.000	.000	1.000
Active Total	1.000			.124	1.000	1.000			

a. Symmetrical normalization

Table 4.9: Showing column coordinates of inertia and task

Examining the tables above to find those variables that are important to the determination of the axes we find for axis 1: T2 (Images without the ‘‘ALT’’ comment) on the positive is opposed to T1 (Links formulation) on the negative. C2 (site organisation) does not really contribute to the inertia of the axis at all. In terms of websites, Woolworths on the positive opposes Computicket on the negative. Google does not contribute significantly to this axis. Thus it could be said that Images without the ‘‘ALT’’ comment and Woolworths occupy a similar space (positive dimension); in the same way, links formulation and Computicket occupy similar spaces (negative dimension).

Row and Column Points

Symmetrical Normalization

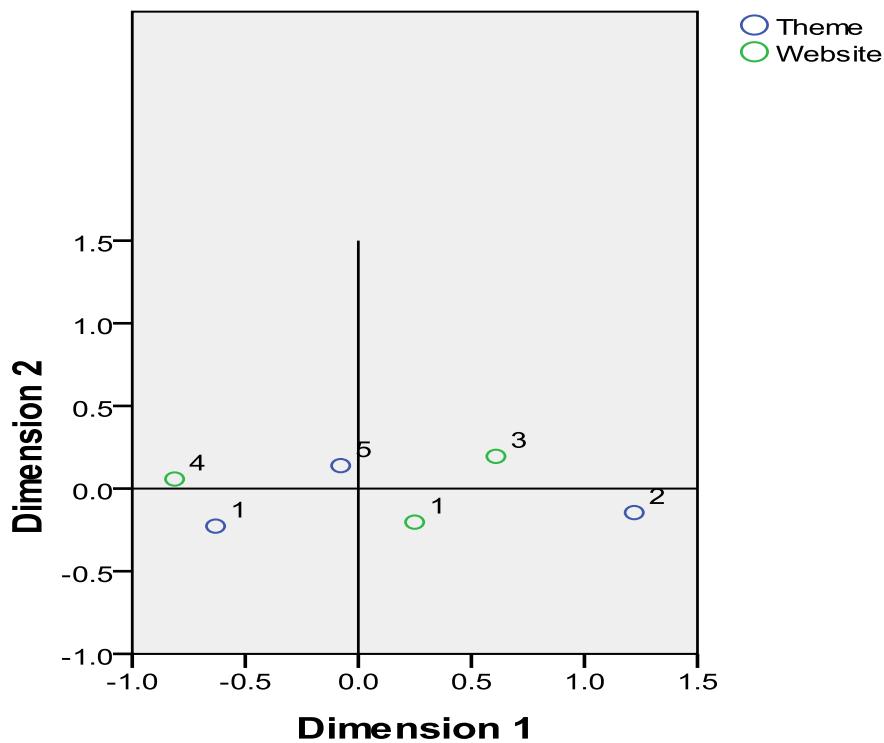


Figure 4.11: Perceptual map showing relative distances of accessibility problems experienced

Key for graph

According to Statsoft Inc. (2010) the distance between row variables and the distance between column variables is meaningful and may be interpreted, but the distance between row and column variables cannot be interpreted. However one can make general inferences about the nature of dimensions based on which side of the origin particular points fall. The perceptual map is the key product of correspondence analysis and it shows how row and column variables may be grouped.

From the perceptual map it can be deduced that Images without ‘ALT’ comment (2) is associated with Google (1) that is participants experienced images without ‘ALT’ comment when interacting with Google. Google contained problems relating to images without ‘ALT’ text that is ‘ALT’ text were absent and the Computicket website contained site organisation problems that is the site is not designed correctly for blind and visually impaired individuals.

4.10.3 Correspondence analysis 2: Assistive technology vs. Problems (with Tasks detailed)

Problems	Assistive technology																						Active Margin
	ZG	ZG	MG	MG	J	J	ZO	MO	JO	ZW	ZW	MW	MW	JW	JW	ZCY	ZC	MC	MC	J	J		
	Y	N	Y	N	Y	N	N	N	N	Y	N	Y	N	Y	N		N	Y	N	Y	N		
TP1	0	3	0	4	1	2	3	4	3	2	1	2	2	0	3	1	2	1	3	0	3	40	
TP2	2	1	0	4	1	2	0	3	0	4	0	3	0	3	0	4	3	0	0	3	0	33	
CP2	2	1	1	3	2	1	3	4	3	0	3	1	3	1	2	0	3	1	3	2	1	40	
Active Margin	4	5	1	11	4	5	6	11	6	6	4	6	5	4	5	5	8	2	6	5	4	113	

Table 4.10: Correspondence analysis of assistive technology against problems experienced

(Refer to Addendum B, page 150-151 for meaning of codes)

Table 4.10 shows what technical and conceptual problems were experienced when using a specific assistive technology to complete the user test. As shown only two out of the three technical problems were experienced that is Links formulation and images without ‘ALT’ comment and from the three conceptual problems only one was experienced that is site organisation. From the table it can be deduced that Woolworths and Computicket websites contained most of the problems as four out of four visually impaired participants using Zoom text experienced TP2 (images without ‘ALT’ text). The same participants also found Computicket to be a problem as this website also did not contain ‘ALT’ text for the images

used. Participants assisted by technologies Zoom text and Screen magnifier encountered the most problems in both technical and conceptual categories (a total of six).

The research proposition (Is there a correlation between assistive technology used and accessibility problems experienced irrespective of task?) revealed that the three assistive technologies were not very effective in ensuring that blind and visually impaired individuals prevail over technical and conceptual problems. Therefore using a specific assistive technology did not help to eliminate an accessibility problem from being experienced. Each website was examined to determine which technical and conceptual problem was experienced and by how many individuals. These were the results:

Google: Two visually impaired individuals who used zoom text experienced images without “ALT” comment and site organisation problems. One visually impaired individual who used a screen magnifier experienced site organisation problem. One blind individual using JAWS experienced links formulation and images without “ALT” comment problems. Two blind individuals experienced site organisation problems.

Woolworths: Two visually impaired people using zoom text experienced links formulation problem and four experienced images without “ALT” comment. Two visually impaired individuals using a screen magnifier experienced links formulation problems, three experienced images without “ALT” comment and one experienced site organisation problem. Three blind individuals using JAWS experienced images without “ALT” comment and one experienced site organisation problem.

Computicket: One visually impaired individual using zoom text experienced links formulation problems and four experienced images without “ALT” comment. One visually impaired individual using a screen magnifier experienced links formulation problem and one experienced problems with the design of the Computicket website. Three blind individuals using JAWS experienced images without “ALT” comment and two with the layout and design of Computicket.

These numbers reveal that blind and visually impaired individuals still experienced technical and conceptual problems even though they used an assistive technology. Thus it can be deduced that

a specific assistive technology does not prevent a user from experiencing certain problems but rather assists them to interact with a website.

4.10.4 Is there a correlation between assistive technology used and accessibility problems experienced for individual web-based user task?

Summary

Dimension					Proportion of Inertia		Confidence Singular Value	
			Chi Square	Sig.	Accounted for	Cumulative	Standard Deviation	Correlation 2
	Singular Value	Inertia						
1	.564	.318			.762	.762	.062	-.222
2	.315	.099			.238	1.000	.077	
Total		.417	47.152	.203 ^a	1.000	1.000		

Table 4.11 summary of assistive technology against accessibility problems

The first axis accounts for 76.2% of the inertia and the second for 23.8%. Thus the data is completely represented in 2 dimensions. The first dimension will explain 76.2% of the total data variability and second dimension will explain 100% of the total variability.

Overview Row Points^a

Problems/Tasks	Mass	Score i n			Contribution				
		Dimension		Inertia	Of P oint t o Inertia of Dimension		Of D imension to Inertia of Point		Total
		1	2		1	2	1	2	
TP1	.354	.461	-.675	.093	.134	.512	.455	.545	1.000
TP2	.292	-1.169	.021	.225	.708	.000	1.000	.000	1.000
CP2	.354	.503	.658	.099	.159	.487	.511	.489	1.000
Active Total	1.000			.417	1.000	1.000			

Table 4.12 Row points of inertia against problems experienced

Overview Column Points^a

Assistive technology and tasks	Mass	Score i n			Contribution				
		Dimension		Inertia	Of P oint t o Inertia of Dimension		Of D imension to Inertia of Point		Total
		1	2		1	2	1	2	
ZGY	.035	-.590	1.078	.020	.022	.130	.349	.651	1.000
ZGN	.044	.255	-.855	.012	.005	.103	.137	.863	1.000
MGY	.009	.892	2.090	.016	.012	.123	.246	.754	1.000
MGN	.097	-.213	-.186	.004	.008	.011	.702	.298	1.000
JGY	.035	.132	.525	.003	.001	.031	.102	.898	1.000
JGN	.044	-.324	-.413	.005	.008	.024	.523	.477	1.000
ZON	.053	.855	-.027	.022	.069	.000	.999	.001	1.000
MON	.097	.057	-.002	.000	.001	.000	.999	.001	1.000

JON	.053	.855	-.027	.022	.069	.000	.999	.001	1.000
ZWY	.053	-1.109	-.671	.044	.116	.076	.830	.170	1.000
ZWN	.035	.874	1.032	.027	.048	.120	.562	.438	1.000
MWY	.053	-.615	-.334	.013	.036	.019	.859	.141	1.000
MWN	.044	.862	.397	.021	.058	.022	.894	.106	1.000
JWY	.035	-1.332	.571	.039	.111	.037	.907	.093	1.000
JWN	.044	.848	-.450	.021	.056	.028	.864	.136	1.000
ZCY	.044	-1.495	-.377	.058	.175	.020	.966	.034	1.000
ZCN	.071	-.238	.272	.004	.007	.017	.578	.422	1.000
MCY	.018	.855	-.027	.007	.023	.000	.999	.001	1.000
MCN	.053	.855	-.027	.022	.069	.000	.999	.001	1.000
JCY	.044	-.887	.875	.030	.062	.108	.648	.352	1.000
JCN	.035	.836	-1.085	.027	.044	.132	.515	.485	1.000
Active	1.000			.417	1.000	1.000			
Total									

a. Symmetrical normalization

Table 4.13 Column points against problems experienced

From the above tables, the variables that are important to the determination of the axes: Axis 1: TP2 (images without ‘‘ALT’’ comment) using Zoom text, Screen magnifier and Screen reader (JAWS) when using Woolworths website as well as Zoom text and JAWS whilst using Computicket were negative. Opposing this group (did not experience this problem) is Zoom text (OLS), JAWS (OLS), Screen magnifier (Woolworths), JAWS (Woolworths) and Screen magnifier (Computicket) were positive.

Axis 2: Visually impaired individuals who used zoom text and screen magnifier on Google and blind individuals who used JAWS on Computicket experienced site organisation problem and had a positive dimension. Visually impaired individuals who used zoom text on Google and blind individuals who used JAWS on Computicket did not experience links formulation problem

and had a negative dimension and thus were in opposition to CP2 (site organisation problem) which was on the positive dimension.

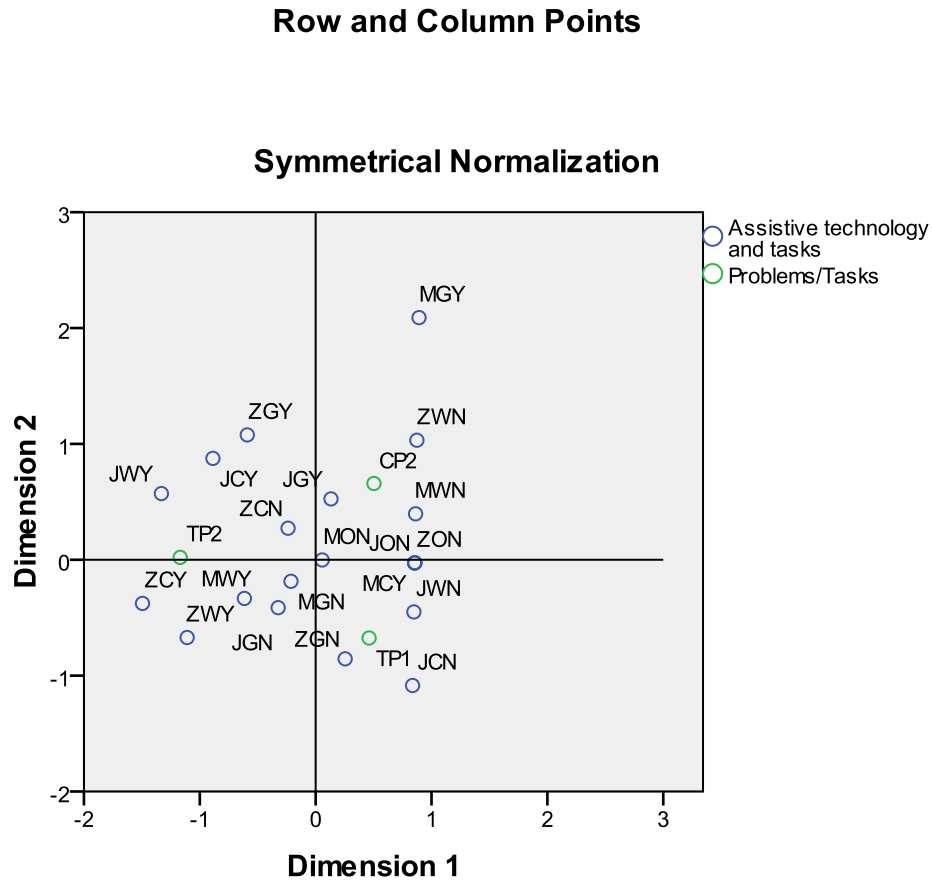


Figure 4.12: Relative distances of problems experienced against assistive technology used.

A row point or grouping of row points may point out a tendency of a column point that finds itself within the same area on the perceptual map. The perceptual map is the key product of correspondence analysis and it shows how row and column variables may be grouped.

The 3 problem areas, TP1 (links formulation); TP2 (images without ‘ALT’ text) and CP2 (site organisation) clearly occupy separate spaces. With each is a group of assistive technology/task variables. Links formulation seems to have been experienced the most when using a Screen magnifier on the Computicket website (MCY); Images without ‘ALT’ text was a problem when

using JAWS Computicket (JCY) and JAWS Google (JGY) and Zoom text Google (ZGY); Site organisation (TP2) was encountered when using Screen magnifier on Google (MGY).

Site or organisation is associated with zoom text (ZWN) and screen magnifier (MWN) in other words those who did not use zoom text and a screen magnifier with Woolworths did not experience site organisation problem.

Links formulation (TP1) is associated with those who did not use JAWS when interacting with Computicket (JCN) that is those who used JAWS did not have links problem. There was also an association between links formulation and when JAWS was not used with Woolworths (JWN) and Zoom text was not used with Google (ZGN). In other words participants that used JAWS with Woolworths did not experience links problem as well as participants that used Zoom text with Google.

4.10.5 Correspondence 3: Assistive technology vs. Problems (without tasks detailed)

Is there a correlation between assistive technology used and accessibility problems experienced irrespective of task?

Correspondence Table

Problems	Assistive technology						Active Margin
	ZTY	ZTN	SMY	SMN	JY	JN	
1	3	9	3	13	1	11	40
2	10	4	3	7	7	2	33
3	2	10	3	13	5	7	40
Active Margin	15	23	9	33	13	20	113

Table 4.14 Correspondence table of assistive technology against accessibility problems

Summary

Dimension					Proportion of Inertia		Confidence Singular Value	
							Correlation	
	Singular Value	Inertia	Chi Square	Sig.	Accounted for	Cumulative	Standard Deviation	2
1	.429	.184			.896	.896	.089	-.091
2	.146	.021			.104	1.000	.082	
Total		.206	23.238	.010 ^a	1.000	1.000		

a. 10 degrees of freedom

Table 4.15 Summary of inertia of assistive technology against accessibility problems

Overview Row Points^a

Problems	Mass	Score i n			Contribution				
		Dimension			Of P oint t o Inertia of Dimension		Of Dimension to Inertia of Point		
		1	2	Inertia	1	2	1	2	Total
1	.354	.556	-.402	.055	.255	.392	.849	.151	1.000
2	.292	-1.003	-.108	.127	.684	.023	.996	.004	1.000
3	.354	.272	.491	.024	.061	.585	.474	.526	1.000
Active Total	1.000			.206	1.000	1.000			

a. Symmetrical normalization

Table 4.16 Summary of row points of accessibility problem

Overview Column Points^a

Assistive technology	Score i Dimension	Contribution							
		Of P oint t o I nertia of Dimension			Of D imension t o I nertia of Point				
	Mass	1	2	Inertia	1	2	1	2	Total
ZTY	.133	-1.214	-.596	.091	.456	.323	.924	.076	1.000
ZTN	.204	.376	.257	.014	.067	.092	.863	.137	1.000
SMY	.080	-.136	-.043	.001	.003	.001	.967	.033	1.000
SMN	.292	.264	.084	.009	.047	.014	.967	.033	1.000
JY	.115	-.915	.682	.049	.224	.367	.841	.159	1.000
JN	.177	.700	-.410	.042	.202	.204	.895	.105	1.000
Active Total	1.000			.206	1.000	1.000			

a. Symmetrical normalization

Table 4.17 Summary of column points of accessibility problems

From Table 4.15 it can be deduced that the first axis accounts for 89.6% of the inertia and the 2nd the remaining 10.4%. This means they are uni-dimensional.

Variables that is important to the determination of the axes (Table 4.16):

Axis 1: positive, links formulation; JN (JAWS, No)

Negative, images without “ALT” text; JY (JAWS, Yes), ZTY (Zoom text, Yes)

Row and Column Points

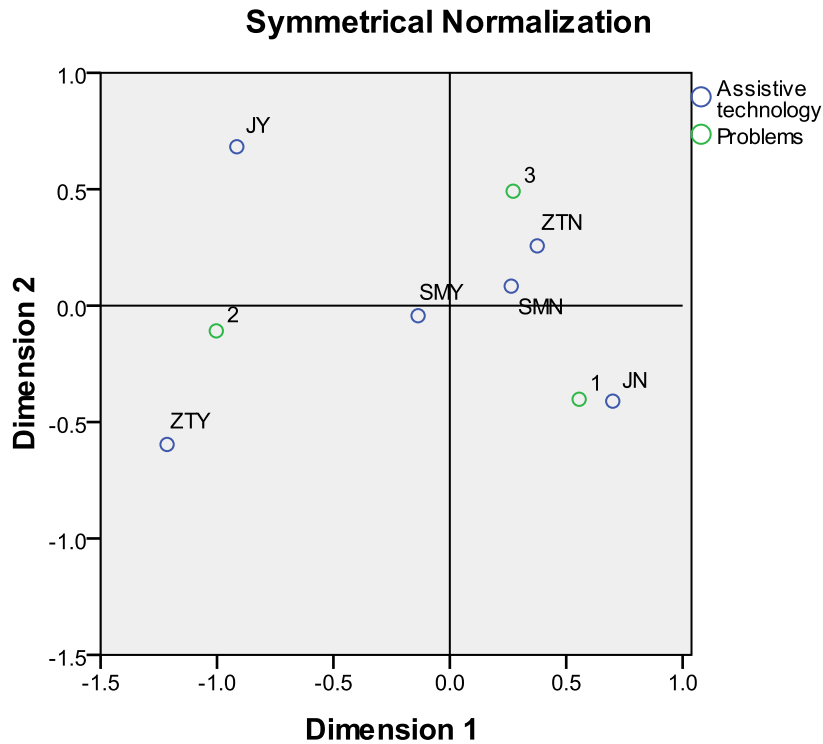


Figure 4.13: Relative distance of Assistive technology versus Problems (without tasks detailed)

Looking at Figure 4.13 above, Links formulation (TP1) is associated with those who did not use Jaws (In other words, those who used Jaws did not have a links problem); Images without “ALT” is associated with those who used jaws and zoom text. Screen magnifier (Y) and CP2 are not important to the orientation of these axes so do not really come into the picture that much. However, there is a slight association of CP2 with JY (on the second axis). It shows no association with SMY (Individuals that used a screen magnifier).

4.10.6 Correspondence analysis 4: Assistive technology vs. task satisfaction

Correspondence Table

Task	Satisfaction						Active Margin
	1	2	3	4	5	6	
Gag	1	2	1	3	3	0	10
OLS	3	0	1	1	2	1	8
WW	0	3	2	2	0	3	10
CT	2	1	1	3	1	2	10
Active Margin	6	6	5	9	6	6	38

Table 4.18: Correspondence table of assistive technology against task satisfaction

Summary

Dimension					Proportion of Inertia		Confidence Singular Value	
	Singular Value	Inertia	Chi Square	Sig.	Accounted for	Cumulative	Standard Deviation	Correlation
1	.511	.262			.662	.662	.106	-.195
2	.335	.112			.284	.947	.134	
3	.145	.021			.053	1.000		
Total		.395	15.010	.451 ^a	1.000	1.000		

3 15 degrees of freedom

Table 4.19 Summary of inertia against dimension of assistive technology and task satisfaction

Table 4.19 shows that Axis 1 accounts for 66.2% and axis 2 for 28.4% of the inertia.

Overview Row Points^a

Task	Score i Dimension	Contribution							
		Of P oint to Inertia o f			Of D imension t o				
	Mass	1	2	Inertia	1	2	1	2	Total
Gag	.263	.313	-.934	.090	.050	.686	.146	.854	1.000
OLS	.211	.921	.583	.120	.349	.214	.760	.200	.960
WW	.263	-1.080	.137	.161	.600	.015	.974	.010	.984
CT	.263	.031	.331	.024	.001	.086	.006	.411	.416
Active									
Total	1.000			.395	1.000	1.000			

a. Symmetrical normalization

Table 4.20: Summary of row points of task against inertia

Is there a correlation between assistive technology used and task satisfaction?

Task satisfaction was determined by examining each website and whether the users were satisfied or not with the tasks involved in each website. The results revealed from Google that one out of three using zoom text was satisfied with Google, one out of four visually impaired using a screen magnifier was satisfied and three out of three blind individuals using JAWS was satisfied. With OLS the following individuals were satisfied: three visually impaired using zoom text, one visually impaired person using a screen magnifier and two blind individuals who used JAWS. The Woolworths website revealed satisfaction from one visually impaired individual using zoom text and two blind users with JAWS. While Computicket revealed that two visually impaired individuals using zoom text were satisfied as well as one visually impaired user with a screen magnifier and one blind individual who used JAWS.

These results show that an assistive technology does not satisfy blind and visually impaired individuals as many of these individuals experienced an enjoyable Internet experience whilst performing the different tasks using their assistive technology.

Variables that is important to the determination of the axes (Table 4.20):

Axis 1: positive, OLS; ZTY (Zoom text Yes), JY (JAWS Yes)

Negative, Woolworths; ZTN (Zoom text No), JN (JAWS No)

Axis 2: positive ZTY (Zoom text Yes), JN (JAWS No)

Positive, Google; ZTN (Zoom Text No), JY (JAWS Yes)

OLS is contrasted with Woolworths; satisfaction with Zoom text and JAWS is contrasted with dissatisfaction of the same technologies that is users were satisfied when using Zoom text with Woolworths but not with Google and JAWS with Google but not with Woolworths. This dissatisfaction had nothing to do with the use of the assistive technology but rather with the task involved in the websites. Participants just experienced more problems and difficulties when completing the tasks. Therefore it can be noted that the problem in this analysis was with the website and not with the use of a specific assistive technology.

Row and Column Points

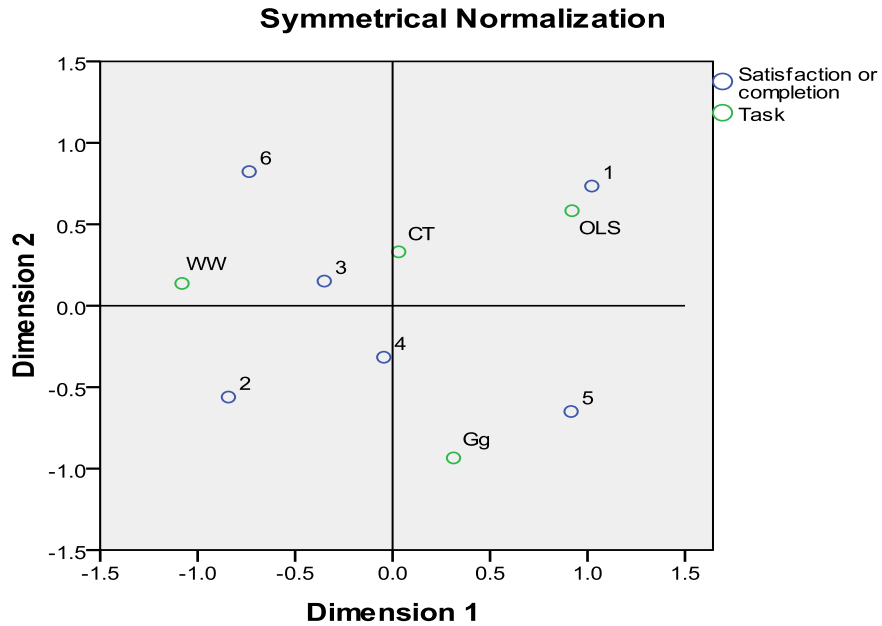


Figure 4.14: Relation distance between assistive technology and task satisfaction

JAWS is associated with Google, those who used JAWS with Google experienced task satisfaction. OLS is associated with zoom text, those who used zoom text with OLS experienced task satisfaction. Woolworths is associated with screen magnifier and JAWS, those who used screen magnifier and JAWS with Woolworths experienced task satisfaction.

4.10.7 Correspondence analysis 5: Assistive technology vs. task completion

Correspondence Table

Task	Task completion						Active Margin
	1	2	3	4	5	6	
Gag	3	0	4	0	3	0	10
OLS	3	0	1	1	2	1	8
WW	2	1	3	1	1	2	10
CT	2	1	1	3	1	2	10
Active Margin	10	2	9	5	7	5	38

Table 4.21: Correspondence table of assistive technology against task completion

Is there a correlation between assistive technology used and successful task completion?

The results revealed the following about each website task completion:

Google revealed that all the participants completed this task. All three visually impaired individuals using zoom text completed the Google task as well as all four visually impaired and all three blind users. OLS was completed by three visually impaired individuals using zoom text, one visually impaired using a screen magnifier and two blind individuals using JAWS. The Woolworths task was completed by two visually impaired individuals using zoom text, one visually impaired screen magnifier individual and one blind user with JAWS. Thus the results indicate that a specific assistive technology does help an individual to complete a task better (zoom text) than compared to another assistive technology. Therefore it can be understood that a specific assistive technology does impact on the completion of a task as revealed by the results.

Summary

Dimension					Proportion of Inertia		Confidence Singular Value	
							Correlation	
	Singular Value	Inertia	Chi Square	Sig.	Accounted for	Cumulative	Standard Deviation	2
1	.495	.245			.758	.758	.108	-.080
2	.256	.065			.202	.960	.145	
3	.114	.013			.040	1.000		
Total		.324	12.306	.656 ^a	1.000	1.000		

Table 4.22: Summary of task against inertia

Overview Row Points^a

Task	Mass	Score i n			Contribution				
		Dimension		Inertia	Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		
		1	2		1	2	1	2	Total
Gag	.263	-.999	-.087	.133	.530	.008	.977	.004	.981
OLS	.211	-.154	.757	.037	.010	.471	.066	.827	.893
WW	.263	.217	-.691	.041	.025	.490	.150	.781	.931
CT	.263	.905	.173	.112	.435	.031	.951	.018	.969
Active Total	1.000			.324	1.000	1.000			

Table 4.23: Summary of row points of task and accessibility problem

Overview Column Points^a

completion	Score i	Dimension		Inertia	Contribution				
		1	2		Of Point to Inertia of Dimension		Of Dimension to Inertia of Point		
	Mass	1	2	Inertia	1	2	1	2	Total
1	.263	-.245	.380	.019	.032	.148	.405	.502	.907
2	.053	1.132	-1.012	.047	.136	.211	.706	.291	.997
3	.237	-.581	-.648	.066	.162	.388	.602	.386	.987
4	.132	1.121	.456	.093	.334	.107	.877	.075	.952
5	.184	-.629	.409	.044	.147	.121	.815	.178	.993
6	.132	.844	-.218	.053	.189	.025	.869	.030	.899
Active Total	1.000			.324	1.000	1.000			

a. Symmetrical normalization

Table 4.24: column points of inertia against task completion

First axis accounts for 75.8% of inertia and 2nd for 20.2%.

Variables that is important to the determination of the axes:

Axis 1: positive; CT (Computicket); ZTN (Zoom text No), SMN (Screen magnifier No), JN (JAWS No)

Negative; Gag (Google); SMY (Screen magnifier Yes), JY (JAWS Yes). This means that Computicket opposes Google; Incompletion of zoom text, screen magnifier and JAWS opposes completion of screen magnifier and JAWS

Axis 2: positive; OLS, ZTY (Zoom text Yes)

Negative; WW (Woolworths); ZTN (Zoom text No), SMY (Screen magnifier Yes). In other words, OLS and Woolworths are opposed as are ZTY (Zoom text Yes) with ZTN (Zoom text No) and SMY (Screen magnifier Yes).

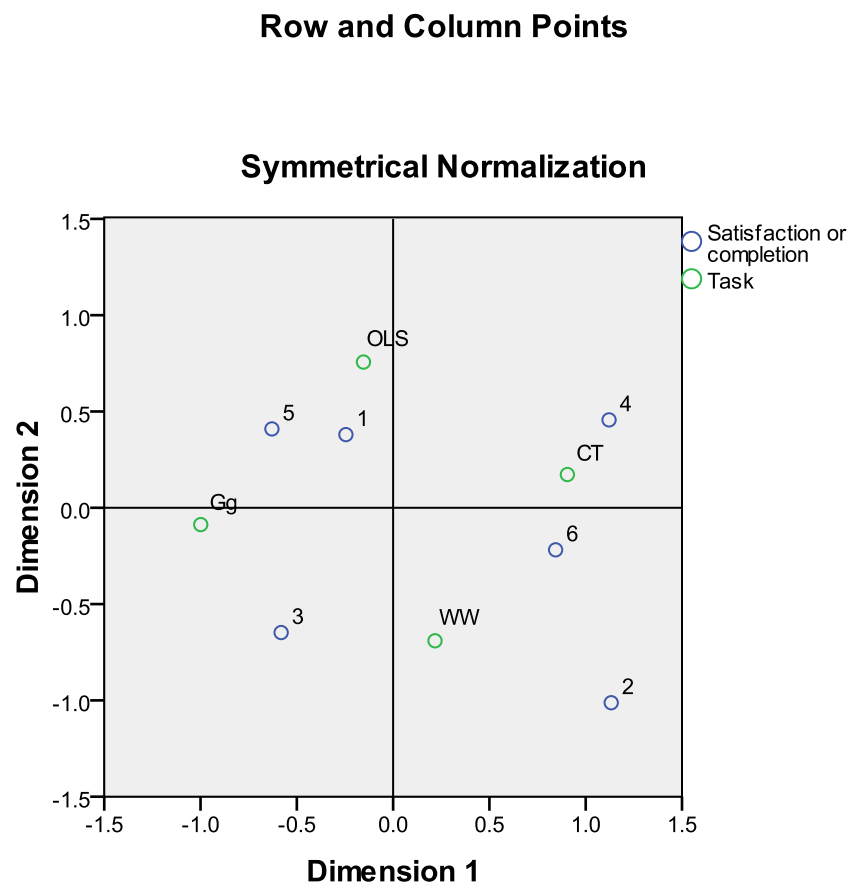


Figure 4.15: Relative distance between assistive technology and task completion

OLS task was completed by participants using Zoom text as well as with JAWS; Google task was completed by participants using a Screen magnifier; the Computicket and the Woolworths task were not completed by the participants who used all three assistive technologies. Thus assistive technologies are effective with regards to task completion. However, this depends on the design of the website. If a website follows accessibility guidelines then participants would be able to complete web-based task. As the previous results showed, an assistive technology can

influence the satisfaction of a task. Therefore if these guidelines are followed, an individual will spend less time trying to figure out what is displayed on the website.

4.10.8 Correspondence analysis 6: Sight vs. Task completion

Is there a correlation between the type of visual disability and successful task completion?

Correspondence Table

Task (sight)	Sight completion				
	BC	BNC	VIC	VINC	Active Margin
1	3	0	7	0	10
2	2	1	4	1	8
3	1	2	5	2	10
4	1	2	3	4	10
Active Margin	7	5	19	7	38

Table 4.25: Correspondence table of degree of visual disability against task completion

The type of disability was investigated against each task to determine if a certain type of disability impacts on the completion of a task. The results revealed the following:

Google: All three blind users completed as well as all seven visually impaired individuals.

OLS: Two blind users and only four visually impaired individuals completed this task.

Woolworths: This task was completed by only one blind user and five visually impaired individuals.

Computicket: One blind user and three individuals completed this task.

These results depict that a fair number of both blind and visually impaired individuals completed each task. There was no significant difference between the two disabilities to indicate that those with one disability completed the tasks better than the other. Thus it can be revealed that a specific disability does not impact on a task completion. An individual with a certain disability does not have a certain advantage over another individual with a different type or degree of disability.

Summary

Dimension					Proportion of Inertia		Confidence Singular Value	
							Correlation	
	Singular Value	Inertia	Chi Square	Sig.	Accounted for	Cumulative	Standard Deviation	²
1	.489	.240			.924	.924	.111	.103
2	.125	.016			.060	.984	.167	
3	.064	.004			.016	1.000		
Total		.259	9.851	.363^a	1.000	1.000		

a. 9 degrees of freedom

Table 4.26: Summary of inertia of task against degree of visual disability

Overview Row Points^a

Task (sight)	Score in Dimension			Contribution					
				Of Point to Inertia of Dimension			Of Dimension to Inertia of Point		
	Mass	1	2	Inertia	1	2	1	2	Total
1	.263	-.972	.152	.123	.508	.049	.988	.006	.994

2	.211	-.236	.079	.009	.024	.011	.634	.018	.652
3	.263	.268	-.567	.020	.038	.679	.464	.532	.996
4	.263	.893	.352	.107	.429	.261	.960	.038	.998
Active									
Total	1.000			.259	1.000	1.000			

a. Symmetrical normalization

Table 4.27: Summary of inertia of task and degree of visual disability

Overview Column Points^a

Sight completion	Mass	Score i n Dimension			Contribution				
		1	2	Inertia	Of P oint t o Inertia of Dimension		Of D imension to Inertia of Point		
					1	2	1	2	Total
BC	.184	-.650	.457	.044	.159	.309	.859	.108	.967
BNC	.132	.853	-.564	.053	.195	.336	.876	.098	.974
VIC	.500	-.401	-.169	.042	.165	.114	.936	.042	.978
VINC	.184	1.130	.404	.119	.481	.241	.965	.031	.997
Active									
Total	1.000			.259	1.000	1.000			

Table 4.28: Column points of inertia of degree of visual disability against task completion

First axis accounts for 92.4% of inertia therefore it is Uni-dimensional.

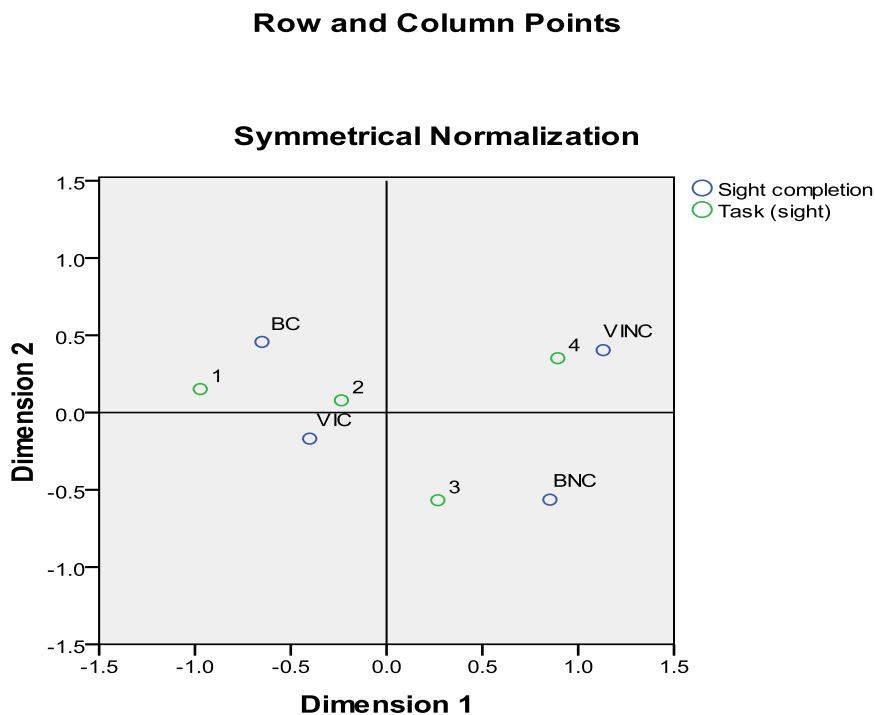
Variables that is important to the determination of the axes:

Axis 1 : positive ; Computicket; V INC (Visually impa ired not completed), B NC (Blind not completed)

Negative; Google; VIC (visually impaired completed), BC (Blind completed)

Computicket opposes Google; Incompletion by blind and impaired sighted opposes completion by blind and impaired sighted.

1=Google; 2=OLS; 3=Woolworths; 4=Computicket.



1=Google; 2=OLS; 3=Woolworths; 4=Computicket.

Figure 4.16: Relative distance between type of visual disability and task completion

Google task and OLS were completed by blind and visually impaired participants; Woolworths and Computicket tasks were not completed by both blind and visually impaired users. The reason for this was that the participants could not find the link to perform online shopping as well as the link to purchase a bus ticket. Google and OLS tasks were fairly easier than Woolworths and Computicket and therefore most of the participants did not experience many problems and were able to complete the tasks.

4.10.9 Correspondence analysis 7: Sight vs. Task satisfaction

Is there a correlation between the type of visual disability and task satisfaction?

Correspondence Table

Task (sight)	Sight satisfaction				
	BS	BNS	VIS	VINS	Active Margin
1(Google)	3	0	2	5	10
2 (OLS)	2	1	4	1	8
3 (Woolworths)	0	3	2	5	10
4 (Compticket)	1	2	3	4	10
Active Margin	6	6	11	15	38

Table 4.29: Correspondence table of degree of visual disability against task satisfaction

Summary

Dimension					Proportion of Inertia		Confidence Singular Value	
	Singular Value	Inertia	Chi Square	Sig.	Accounted for	Cumulative	Standard Deviation	Correlation
1	.423	.179			.657	.657	.119	-.200
2	.305	.093			.342	.998	.141	
3	.020	.000			.002	1.000		
Total		.272	10.343	.323 ^a	1.000	1.000		

a. 9 degrees of freedom

Table 4.30: Summary of inertia of degree of visual disability against task satisfaction

Overview Row Points^a

Task (sight)	Mass	Score i Dimension		Inertia	Contribution				
		1	2		Of P oint to Inertia of Dimension		Of D imension to Inertia of Point		Total
					1	2	1	2	
1	.263	-.647	.734	.090	.261	.465	.519	.481	1.000
2	.211	-.632	-.867	.084	.199	.519	.424	.576	1.000
3	.263	.896	.074	.090	.500	.005	.994	.005	.999
4	.263	.256	-.115	.009	.041	.011	.845	.122	.968
Active Total	1.000			.272	1.000	1.000			

a. Symmetrical normalization

Table 4.31: Row points of inertia of task against degree of visual disability

Overview Column Points^a

Sight satisfaction	Mass	Score i Dimension		Inertia	Contribution				
		1	2		Of P oint t o Inertia of Dimension		Of D imension to Inertia of Point		Total
					1	2	1	2	
BS	.158	-1.162	.193	.092	.504	.019	.979	.020	.999
BNS	.158	1.013	-.478	.080	.383	.118	.860	.138	.998
VIS	.289	-.271	-.654	.047	.050	.407	.191	.806	.998
VINS	.395	.258	.594	.054	.062	.456	.208	.792	.999
Active Total	1.000			.272	1.000	1.000			

Overview Column Points^a

Sight satisfaction	Score i Dimension	Contribution							
		Of P oint t o Inertia of Dimension			Of D imension to Inertia of Point				
	Mass	1	2	Inertia	1	2	1	2	Total
BS	.158	-1.162	.193	.092	.504	.019	.979	.020	.999
BNS	.158	1.013	-.478	.080	.383	.118	.860	.138	.998
VIS	.289	-.271	-.654	.047	.050	.407	.191	.806	.998
VINS	.395	.258	.594	.054	.062	.456	.208	.792	.999
Active Total	1.000			.272	1.000	1.000			

Table 4.32: Column points of inertia of degree of visual disability against task satisfaction

First axis accounts for 65.7% of inertia and the second for 34.2%.

Variables that is important to the determination of the axes:

Axis 1: positive; Woolworths; BNS (Blind not satisfied)

Negative; Google; OLS; BS (Blind satisfied)

Axis 2: positive ; Google; VINS (Visually impaired not satisfied)

Negative; OLS; VIS (Visually impaired satisfied)

Woolworths is associated with blind dissatisfaction and this grouping opposes Google and OLS which is associated with blind satisfaction. Google, a associated with dissatisfaction of visually impaired, opposes OLS which is associated with satisfied visually impaired.

Row and Column Points

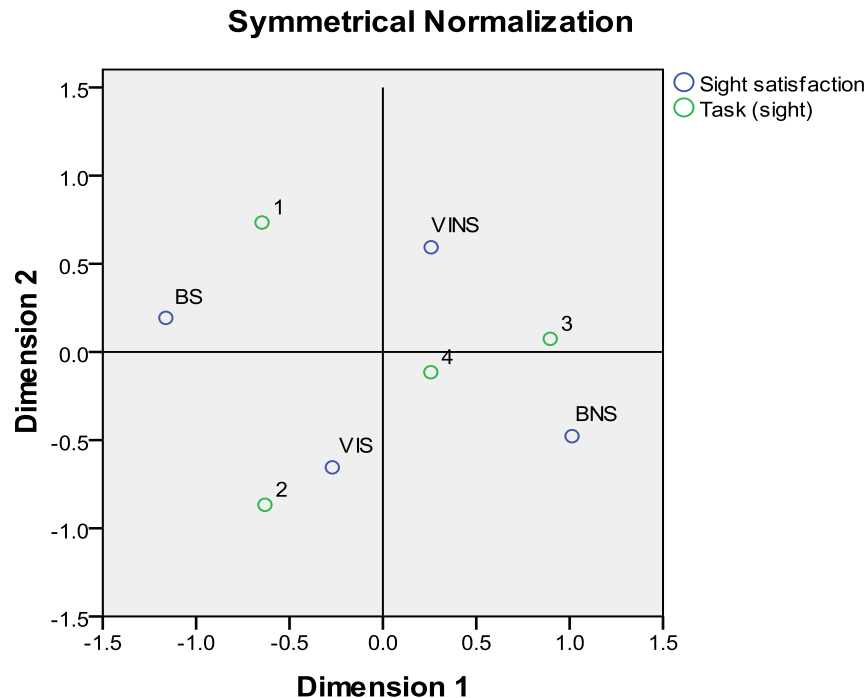


Figure 4.17: Relative distance between type of visual disability and task satisfaction

Blind users were satisfied with Google task; OLS task left visually impaired users satisfied and both blind and visually impaired were not satisfied with Woolworths and Computicket tasks.

From the correspondence analysis, it can be noted that there were many problems that blind and visually impaired users experienced when performing the user test. There were a number of variables that contributed to this such as assistive technology used, type and acuteness of visual disability. As depicted in the analysis above some participants were able to perform a task better than others as a result of the assistive technology used. This in turn impacted on the time of completion of a task for example blind participants were disadvantaged when it came to an image on the Woolworths website as it did not have an “ALT” text for the image. This caused confusion in the participant thereby making it difficult to purchase a product on the Woolworths website or even complete the task. Also, JAWS took a longer time to manoeuvre around a web page which resulted in blind participants taking a longer time to complete a task. The same goes

for participants using zoom text or a screen magnifier. Thus one can conclude that there are many factors that play a role in determining the accessibility of websites for blind and visually impaired users. The design of a website does play a crucial role but other aspects need to be taken into consideration like the type of assistive technology used and the extent of the disability.

4.11 Automated web evaluation

Automated web evaluation is a tool used to highlight any problems/errors that a website may contain. The role of automated web evaluation tool is important for helping web designers to learn about effective design practices, to apply evaluation criteria consistently and broadly across entire website, and to reduce the cost of non-automated evaluation methods like usability testing (Ivory, 2003).

An expert evaluation was carried out 05 August 2010 by an online accessibility expert, webrichtlijnen (<http://www.webrichtlijnen.nl/english/>). The detailed results can be found under the Addendum D.

Google scored 35 out of 47 when the web guideline QuickScan was conducted. This means that Google has only 35 accessibility guidelines in accordance with the web design guidelines rules, 12 of the designs needs improvement and 78 accessibility guidelines needed manual testing and therefore were not testable (automatic).

How is the score calculated?

According to the webrichtlijnen website (2010), the scores are calculated in the following way: Compliance with each guideline is 1 point per guideline. When there is no compliance, a score of 0 (zero) points is added to the total score. It is not possible to automatically test many of the guidelines. Those guidelines are not included in the final score.

The score of 35 points was calculated by taking into account all 125 requirements of the Web Guidelines. However, using only the automatic tests, 47 requirements can be properly tested. Therefore the test was out of 47 and not 125. To get a more detailed result of the website a manual test is required. It must be noted that the score from the Web Guidelines QuickScan

offers a fair indication of compliance for those pages tested, but does *not* represent the whole website.

4.11.1 Website 1: Google

The Web Guidelines QuickScan revealed that Google:

- Used font tags which should have been separate from the structure and design
- A submit button was absent in a form (this functionality must not be dependent on a script)
- The DOCTYPE was invalid. HTML 4.01 or XHTML 1.0 according to W3C specifications for marking up websites should have been used (Chapter 2, section 2.6.1)
- Cascading Style Sheets was absent and should have been used on Google website
- No headers were found in the document. At least one header tag is needed to communicate document hierarchy. When listing the results, no lists using ol or ul tags were found (Chapter 2, section 2.6.1). Directory structure was missing from the URL
- A readable, expandable directory structure should be present
- No links have been found that contain image tags. This is one of the problems some of the participants complained regarding the kite link. The kite image placed in the link should have contained an alternative text to enable blind and visually impaired individuals who do not see the image to follow the link. Also the links on Google seemed to open without warning new windows. Links should not automatically open new windows without warning the user.

4.11.2 Website 2: OLS

Moodle is the new educational web based system that is being used at all UKZN campuses as of July 2010 and not OLS. As a result the researcher could not do a QuickScan with OLS.

4.11.3 Website 3: Woolworths

Woolworths scored 32 out of 47. From the 125 design guidelines: 32 were in accordance, 15 needs improvement and 78 were not testable (automatic). The QuickScan confirmed similar results of the problems expressed by the participants in the user test. Blind and visually impaired individuals were dissatisfied with the site organisation of Woolworths, for example they could

not find the link to perform online shopping as the information on the homepage was not clear. The QuickScan was in a greement with this as the scan picked up that the links on the Woolworths page contained javascript. Some users will be unable to use these links (See Addendum D). Some users may have a problem reading the text with their assistive technology as some assistive technologies are programmed to read standard formatting text in HTML and not javascript. One of the design guidelines states that technology should be used to complement the information and should never be used to limit the accessibility to the page content, were the optional technology to be unavailable. Thus some blind users with a screen reader may experience problems reading the links on Woolworths. This could have also been a reason why the two blind participants in the study could not complete the Woolworths task. Furthermore Woolworths contains links which will not work if javascript is unavailable or switched off thus posing a problem with an assistive technology that works only with HTML.

The scan also picked up that no lists using ol or ul tags have been found for any of the lists. This is another factor that affected the participants from accurately and swiftly completing the online shopping task. The items that a participant had to choose from when purchasing would not have been listed correctly with regards to the correct use of ordered and unordered tags.

Images without 'ALT' comment/text were another accessibility problem that both the scan and participants in the user test picked up. Blind users with a screen reader had problems with the images on Woolworths as they did not contain a text alternative for the images. According to accessibility guidelines (W3C, 2000), the 'ALT' attribute should be used on every image and area element and should be provided with an effective alternative text.

4.11.4 Website 4: Computicket

Computicket scored 26 out of 47. From the 125 guidelines: 26 were in accordance; 21 needs improvement and 78 not testable (automatic).

Computicket just like Woolworths contained links with javascript. Many blind and visually disabled individuals complained about the layout of the links as well as the homepage containing too much of information in the form of links. Blind users did experience problems reading the information on Computicket which could have been as a result of the links being in javascript and not HTML.

‘ALT’ texts were also absent which would have had a negative impact on the participant’s task completion and satisfaction. Many of the participants did complain about the images not containing an ‘ALT’ comment/text. The absence of this text frustrated the participants when completing the user test task.

4.12 Etre automated web evaluation

A second independent expert evaluation was carried out by a company called Etre. Etre's Accessibility Check evaluates a web page against subset of the WAI guidelines. These guidelines form the basis of most global legislation relating to accessibility. The findings of this analysis are presented below:

Task 1: Google

There were 16 problems identified with Google. This is shown in the table below:

Accessibility issues for <i>Google</i> by WAI Priority	
WAI Priority	No. of accessibility problems
Priority 1 - "must fix"	0 problems
Priority 2 - "should fix"	14 problems
Priority 3 - "may fix"	2 problems

Table 4.33: Accessibility issues for Google by Etre

The scan showed that Google contained 14 problems that should be fixed and 2 problems that may be fixed. A significant problem outlined was the size of the text, exact size of a font using an absolute measurement (for example pixels or points) prevents visually impaired users from resizing them when they use the Internet. A detailed description of the problems identified with all four websites can be found in the Addendum E.

Task 2: Moodle

The researcher could not run the scan with OLS as OLS is no longer available for use as the University has changed to a new educational web based system called Moodle as of July 2010. Therefore the researcher could not perform a scan on OLS.

Task 3: Computicket

Computicket was tested and it was found that it does not adhere to the WAI accessibility guidelines. There were 15 problems identified. These issues are broken out by WAI priority in the table below.

Accessibility issues for <i>Computicket</i> by WAI Priority	
WAI Priority	No. of accessibility problems
Priority 1 - "must fix"	3 problems
Priority 2 - "should fix"	9 problems
Priority 3 - "may fix"	3 problems

Table 4.34: Accessibility issues for Computicket by Etre

The main problem identified was that ‘ALT’ texts were omitted. Speech and Braille software use ‘ALT’ text to describe an image to blind users. Failing to provide these tags can therefore make important content inaccessible for blind individuals.

Task 4: Woolworths

There were 22 problems identified with Woolworths. This is broken up in the table below:

Accessibility issues for <i>Woolworths</i> by WAI Priority	
WAI Priority	No. of accessibility problems
Priority 1 - "must fix"	0 problems
Priority 2 - "should fix"	20 problems
Priority 3 - "may fix"	2 problems

Table 4.35: Accessibility issues for Woolworths by Etre

The scan showed that Woolworths contained 20 problems that should be fixed and 2 problems that may be fixed. This included problems such as nested tables. Nested tables pose a problem for blind individuals because the table is read aloud by a screen reader cell-by-cell, one after the other, from left-to-right, top-to-bottom which confuses a blind user when interpreting the data in a table. Links were also a problem. Adjacent links are separated by white space. The problem is that older assistive technologies read adjacent links as a single link and as a result blind and visually impaired individuals do not understand the link. Although the number and types of accessibility problems differed from that of the automated web evaluation conducted by

QuickScan, the Etre scan did highlight certain problems not identified by QuickScan. This included the size of the text for Google and Woolworths as well as links formulation problem in Woolworths and the absence of an ‘ALT’ text in Computicket. The similarities between QuickScan and Etre scan were that links in the Woolworths website were identified by both automated web evaluations. QuickScan and Etre scan also recognised that ‘ALT’ text was missing on Computicket.

The type of assistive technology also played an important role with regards to accessibility and whether a participant could complete the task successfully or not. This was depicted in the correspondence analysis and also confirmed by the Quickscan and supported by the findings of the NoVA report. Observations of the NoVA usability testing showed that performance varied between assistive technologies.

Blind and visually impaired individuals who did not have the latest technology or the most up-to-date versions of an assistive technology can have a negative impact when interacting with a website. General reasons for not having the latest assistive technology could be because an individual cannot afford to keep upgrading their software or because they feel comfortable using a particular version. Another reason may be that they are using a public access terminal where the assistive technology has been chosen for them which are the case for the participants at UKZN. The participants at UKZN used a particular version of assistive technology (not the latest) because the assistive technology they use is provided to them by the University so they make use of whatever is available.

Problems that were encountered when performing the user test that were similar to the NoVA report was when students were unable to perform the Woolworths task because they felt it was not clear to the user where to click in order to purchase an item which was similar to the NoVA report. The UKZN students also had problems with the links. Links were not clear on the Home Page for example Computicket. This was similar to the findings in the NoVA report where blind users in the NoVA report mentioned that the screen reader did not read out graphical links.

The Google task, users experienced problems when it came to the way the results were displayed for example students commented that the results page was confusing as there were too many results on a page to go through. The same problem was experienced by the participants in the NoVA report.

4.13 Comparison between Findings of User Testing and Automated Web Evaluation

After looking at all four tests (UKZN user test, QuickScan and Etre scan) it can be noted that if not the same but similar problems were experienced by all the participants in the four tests. Problems with the assistive technology, time to complete a task and user satisfaction was the same for all three tests. However since the independent expert evaluation conducted by QuickScan did an extensive and a more in depth analysis it identified more design problems as compared to Etre scan and the user test. After taking the web evaluations and user into account, one can conclude that certain web design guidelines are not being followed and the use of assistive technologies is not being considered when designing websites. Thus blind and visually impaired individual's needs were not taken into account when designing the websites in the user test tasks. The QuickScan, Etre scan and UKZN user test confirms that accessibility guidelines were not followed when designing these websites and the use of an assistive technology was not tested to check how well it would work with the websites. The researcher would like to stress the importance of using both techniques (automated web evaluation and user testing) as they are complementary and ultimately would provide a more complete representation of the accessibility problems associated with the four website cases.

4.14 User's perceptions on website accessibility

This section discusses information relating to content category B. This category is made up of three themes:

B1: Participants felt that if websites are accessible to blind and visually impaired individuals, they would use the Internet more often. They would also rely less on other people to assist them like purchasing groceries. They would be able to do a lot more online that they previously could not.

B2: Participants were not satisfied with the design and layout of Computicket. They felt Computicket did not cater to their needs as blind and visually impaired individuals as they experienced difficulties using the website. The main problem they experienced was with the layout of the website as it contained too much of information and links on the Home page which frustrated and confused the individuals.

B3: To improve website accessibility, blind and visually impaired individuals felt if web designers should test a website with blind and visually impaired individuals before launching the website they would be able to determine if the website contains any problems and if it is accessible to blind and visually impaired individuals. 'ALT' text should be available for all images and links should be kept to a minimum and an 'ALT' text should also be available for links. With regards to the layout of a website, information on the Homepage should be kept to minimum and links on the Homepage should be easily accessible to blind and visually impaired individuals. The table below shows users' perceptions of designing for/improving website accessibility and associated benefits:

	Themes/Concept	Theme code	Total
	Users' perceptions of designing for/improving website accessibility and associated benefits		
1	Perceived benefits of accessible websites	B1	10
2	Perceptions about achieving user goal on Computicket website	B2	4
3	User recommendations for improving website accessibility	B3	8
	<i>Totals</i>		22

Table 4.36: Content analysis showing relative frequencies of designing for website accessibility

4.15 Methodological Limitations

It is always advisable to know what the limitations inherent in one's research design are, in order to minimise their impact, if possible, and to know how they may shape the extent and quality of the data gathered (Gerber, 2002).

The limitation that the researcher faced was the small number of participants that is sample size that was involved in the user testing, observation and interviews. Due to the voluntary nature of the research, students were not willing to participate although it was mentioned to them that their identity will be kept confidential. However the researcher felt that 10 was an acceptable sample size as Nielsen (2003) outlined that five users is a sufficient sample size to determine 80% of the site level usability.

Another limitation would be the web-based tasks that participants were required to perform as the researcher could not test for occurrences of accessibility problems such as 'tables and multi-column texts' as well as multiple framesets because the websites chosen for testing did not contain tables and multiple framesets. Therefore the researcher could not test whether this was a problem experienced by blind and visually impaired participants as the study was limited to four websites.

The researcher could not collect data on the experience that participants had with the assistive technologies which would be a limitation to the study. This could have had a moderating effect.

Also the version of assistive technology software that was used for user testing could have impacted on the tasks being performed as an earlier version of the software would be a limitation for the participants successfully completing a task.

4.16 Conclusion

This chapter highlighted the findings derived from the user tests, interviews and observations. The data was presented graphically and interpreted, using statistical procedures such as content and correspondence analysis. The findings indicate that some websites are still inaccessible for blind and visually impaired individuals although accessibility guidelines have been legislated to

ensure accessible websites are available for all individuals whether they have a disability or not. As a result the next chapter will reveal recommendations for future study and ways to manage the effects of inaccessible websites.

Conclusions and Recommendations

5.1 Introduction

This dissertation addresses the topic of web accessibility for blind and visually impaired individuals and the impact it has on these individuals. The problems presented in section 2.5 of Chapter 2 highlighted the one-sided approach of literature with regard to web design guidelines and specifically the lack of guidelines followed by web designers. In other words, the literature deals mainly with web accessibility design guidelines and common types of accessibility problems and there is a dearth of literature on empirical studies testing the accessibility of websites. The literature study conducted demonstrated the need for empirical studies investigating the accessibility of websites. It was with this goal in mind that qualitative and quantitative approaches were used to evaluate web accessibility problems experienced by blind and visually impaired people and to test the impact of inaccessible websites.

The research strategy deemed appropriate and chosen for this study was the case study method. Different websites were selected as cases to be investigated and the unit of analysis for this study was a website's accessibility. Data was collected using three methods; by means of a user test, observation using the 'Think aloud' protocol and an interview.

Content analysis and correspondence analysis techniques were used to analyse the data. Discussion on the findings and analysis are presented in Chapter 4.

In the following sections the answers to the research questions are summarised and some recommendations are made.

5.2 The study's Research Questions:

1. What are the accessibility problems experienced by blind and visually impaired people interacting with selected websites?
2. How does website design correlate to accessibility problems experienced by blind and visually impaired individuals?
3. How does assistive technology used by blind and visually impaired individuals relate to website accessibility and the performance of web-based tasks?
4. How does the degree of visual impairment relate to the performance of web-based tasks?

5.3 Answers to research questions

In Chapter 3, six research propositions were put forward:

- There is a correlation between website design and accessibility problems experienced
- There is a correlation between assistive technology used and accessibility problems experienced for individual web-based user tasks
- There is a correlation between assistive technology used and accessibility problems experienced irrespective of task

The first proposition reflects research question 2 (How does website design correlate to accessibility problems experienced by blind and visually impaired individuals). The more accessible the design of a website (fewer design problems), the more accessible it will be for blind and visually impaired individuals.

- There is a correlation between assistive technology used and user satisfaction with website
- There is correlation between assistive technology used and successful task completion

The four propositions listed above reflect research question 3 (How does assistive technology used by blind and visually impaired individuals relate to website accessibility and the performance of web-based tasks)

- There is a correlation between the type of visual disability and successful task completion
- There is a correlation between the type of visual disability and user satisfaction with website

These two propositions relate to research question 4 (How does the degree of visual impairment relate to the performance of web-based tasks).

In order to understand the detailed results and interpretations presented in this research, the reader should refer to Chapter 4. However, a summary of the conclusions of this research are discussed below. The summary is a representation of results from data collected with user testing and accompanying data collection techniques by means of observation using ‘think aloud protocol’, structured interviews as well as results from the automated web evaluation of websites. As web-based tasks selected for user testing were restrictive and could not test for other types of accessibility problems, the expert evaluation technique was used to uncover other types of accessibility problems associated with the website cases chosen for this study.

5.3.1 Is there a correlation between website design and accessibility problems experienced?

The results revealed that there is a correlation between website design and accessibility problems experienced. The blind and visually impaired individuals in this study experienced technical and conceptual problems with website design. These individuals experienced problems such as links formulation, images without ‘ALT’ comment and site organisation problems (Chapter 4, subsection 4.10.1).

The Web Guidelines QuickScan also revealed that the links on Google were a problem. The QuickScan also found ‘ALT’ text to be absent from Computicket and Woolworths website. Thus it can be deduced that website design does have an impact on website accessibility in view of the type and extent of accessibility problems experienced.

5.3.2 Is there a correlation between assistive technology used and accessibility problems experienced for individual web-based user tasks?

The results revealed that links formulation problem was experienced the most when using a screen magnifier on Computicket website; images without ‘‘ALT’’ text were a problem when using JAWS with Computicket and Google websites and when the participants used Zoom text, they experienced problems with Google website. The one conceptual problem namely site organisation was encountered when using Screen magnifier with Google. The evidence from the individual web-based tasks performed on three of the four websites investigated supports the proposition that there is a correlation between assistive technology used and accessibility problems experienced for individual web-based user tasks.

The QuickScan revealed that Woolworths contained links in javascript. Some users may have a problem reading the text with their assistive technology as some assistive technologies are programmed to read standard formatting text in HTML and not javascript. One of the design guidelines states that technology should be used to complement the information and should never be used to limit the accessibility to the page content, where the optional technology to be unavailable. Thus some blind users with a screen reader may experience problems reading the links on Woolworths.

5.3.3 Is there a correlation between assistive technology used and accessibility problems experienced irrespective of task?

The results indicate that there is a correlation between assistive technology and accessibility problems experienced irrespective of the task performed. The participants experienced technical and conceptual problems when using a specific assistive technology to complete the web-based tasks during user testing. However most of the participants experienced both technical and conceptual problems with Woolworths and Computicket website. The results revealed that the three assistive technologies namely a Screen reader, Screen magnifier and Zoom text were not very effective in ensuring that blind and visually impaired individuals overcame technical and

conceptual accessibility problems (Chapter 4, subsection 4.10.3). Therefore using a specific assistive technology did not help to prevent the occurrence of accessibility problems (Chapter 4, subsection 4.10.3).

5.3.4 Is there a correlation between assistive technology used and task satisfaction?

The results obtained from the user testing of the Google website showed that one out of three participants using zoom text was satisfied with Google, one out of four visually impaired participants using a screen magnifier was satisfied and three out of three blind participants using JAWS were satisfied. With OLS participants reported task satisfaction with specific assistive technology as follows: three visually impaired using zoom text, one visually impaired person using a screen magnifier and two blind individuals who used JAWS. One visually impaired participant using zoom text and two blind participants using JAWS expressed satisfaction with the Woolworths website. Two visually impaired participants using zoom text, one visually impaired participant using a screen magnifier and one blind participant using JAWS expressed satisfaction with Computicket website. Thus it can be revealed that there is a correlation between assistive technology and task satisfaction (Chapter 4, subsection 4.10.6).

5.3.5 Is there a correlation between assistive technology used and successful task completion?

The results showed that when the participants used a specific assistive technology they were more successful in completing the task. Therefore it can be understood that a specific assistive technology does impact on the completion of a task as revealed by the results in Chapter 4, subsection 4.14.7.

5.3.6 Is there a correlation between the type of visual disability and successful task completion?

The type of disability was investigated against each task to determine if a certain type of disability impacts on the completion of a task. The results revealed all the participants completed the Google task (blind and visually impaired). With regards to Woolworths, Computicket and OLS tasks there was a slight difference in the number of participants from both groups that completed the tasks successfully. These results showed that a fair number of both blind and visually impaired individuals completed each task. There was no drastic difference between the two disabilities to indicate that participants with one disability completed the tasks better than the other. Thus it can be revealed that a specific disability does not have an impact on a task completion. An individual with a certain disability does not have a certain advantage over another individual with a different type or degree of disability. Therefore there is no correlation between the type of visual disability and successful task completion.

5.3.7 Is there a correlation between the type of visual disability and task satisfaction?

The results revealed that blind and visually impaired participants were satisfied with Google task. Visually impaired participants expressed satisfaction with OLS task. However, both blind and visually impaired expressed dissatisfaction with Woolworths and Computicket tasks. It would appear from the cases investigated that there is no correlation between visual disability and task satisfaction since both these individuals were satisfied and dissatisfied with certain tasks.

5.4 Web page design

The design of web pages critically affects blind and visually impaired individual's accessibility. Even those websites which pass all the standard automatic checking services and adhere to the Web Accessibility Initiative Guidelines may still be difficult to access by those with visual impairments (NoVA final report, 2005). This may be attributed to the assistive technology being

used. Thus web designers need to consider the layout and content of websites and how this affects accessibility.

Participants felt that web designers should conduct user test amongst blind and visually impaired individuals before a website is made available to the public. They also would prefer if a different version of a website is designed just for blind and visually impaired individuals.

5.5 Limitations

In this section the researcher discusses certain factors that prevented blind and visually impaired participants from experiencing accessibility in the user test tasks.

- **Choice and number of websites chosen for study**

Four websites were chosen for the user test. The researcher chose four as this number allowed the researcher to take notes and observe easily the tasks that the participants had to perform. Also time was an issue, if the researcher used more than four websites it would have been time consuming to observe the participants performing the user tasks and the interview would have taken a long time to complete.

- **Web-based tasks chosen to test for accessibility**

The researcher wanted the tasks to be performed with websites that the participants used most often. Due to the fact that the researcher did not use a wide variety of websites could pose as a limitation as the results would have been focused on only certain tasks and accessibility problems.

- **Content analysis**

Content analysis was a limitation because the researcher could not measure the results according to the number of occurrences of an accessibility problem because the participants were only asked to state if they experienced an accessibility problem and not on the number of occurrences of a specific problem. Therefore the researcher had to focus on an accessibility problem experienced rather than on the number of times a participant experienced a specific problem.

- **Small number of participants**

The sample size consisted of 10 participants which precluded quantitative analysis. The small number of participants was a limitation. In addition there was not an even number of blind and visually impaired individuals and as a result there were more visually impaired individuals than blind students that participated in the study.

- **Assistive technology**

Access to the most up-to-date software enables greater control therefore the University should invest in up-to-date technology to enable blind and visually impaired individuals to gain access to the same information as sighted users. However some individuals may be using older versions, like some of the participants in the study and therefore web designers must also be aware of these issues and must not assume that everyone has the latest version of software available.

- **Universal design**

Some of the similarities between the two groups (blind and visually impaired) confirm the need for universal design rather than separate systems for each category of users. Some blind and visually impaired users in this study felt that text only options tend to be out of date and that all developers should adopt universal design when creating websites.

- **Baseline Test**

A baseline test could not be performed because the researcher did not conduct the user test with sighted individuals.

- **OLS test site**

The two blind participants that did not use OLS were unable to perform the task because the lecture material was emailed to them by their lecturers. The researcher was unaware of this situation and as a result a test OLS site was not pre-planned for or accommodated in this study.

- **Analysis of Demographic data**

Demographic data was not analysed against the phenomenon being investigated which might have yielded further insights.

5.6 Recommendations and future research

5.6.1 What can South Africa do to encourage accessibility of website for visually impaired?

The EEA and ECT Acts need to develop a policy on web accessibility for South Africa. The government must play a vital role in this process in order to implement this policy on its own sites. They can also promote accessibility in the education, private sector as well as in libraries. The government needs to make people more alert of the barriers which exclude a large part of the South African population and provide support for individuals and groups such as blind and the visually impaired who suffer from online discrimination (Venter and Lotriet, 2005).

South Africa needs to re-evaluate their current ICT status as limited bandwidth poses a problem. Because many disadvantaged people are still using old computers and software; they have limited knowledge about computers and they have a low-literacy level. According to Vosloo (2002), web accessibility can be a major catalyst in helping these people to get online, to help foster a knowledge society and an IT skilled nation. In order to bridge the gap of the current digital divide in South Africa and around the world we need to implement and make web designers as well as people aware of the importance of web accessibility. This will provide barrier-free information to maintain an equal user experience for all by adapting with international trends to support democracy in the digital playing field (Vosloo, 2002). With

regards to educational institutions and businesses, accessibility will help to promote a competitive edge that will attract international businesses and academic institutions.

5.7 User testing and expert evaluation results

After conducting the user testing, expert evaluation and post-test interviews the researcher is now able to draw a conclusion on the accessibility of certain websites. The results showed that Woolworths and Computicket websites were extremely inaccessible for blind and visually impaired individuals. These two websites presented a fair number of problems to the visually disabled and because of this they are unlikely to visit these websites to perform online shopping and to purchase a bus ticket. Although some of them did not like the layout of Google (links of the search results) they found Google to be easy to use. The results indicate that layout was a major barrier of Woolworths and especially Computicket website. These websites contained too much of information which the participants did not find useful. The home page of a website is supposed to contain concise information, giving the user a brief description of the website and what to look forward to or what can be found in the other pages of the website. The participants felt this was not the case with Woolworths and Computicket and therefore web designers should make sure that they consider the layout of a website very carefully.

Blind and visually impaired individuals rely on online shopping website to help them to purchase food. The Woolworths website was difficult to use hence they found it easier to get someone to help them to go to a physical store or to get someone to buy the products for them rather than performing online shopping. Computicket on the other hand had too many links on the Home page and there were too many advertisements for shows which confused the participants. Also the participants felt that there was no indication on the Home page as to where to click on to get to the web page that contained the information to purchase a bus ticket. This in turn frustrated the participants and that is why some of them terminated the task without completing it. As a result it can be deduced that links should be clearly labelled and should be placed on the web page where the user can easily access it.

The Etre scan showed that Computicket website contained images without an ‘ALT’ text and as a result this confused the blind participants.

5.8 Conclusion

The two South African websites (Woolworths and Computicket) demonstrates that some websites are inaccessible for blind and visually impaired users and accessibility guidelines (section 4.16, of Chapter 4) have not been applied to the design of these websites. This is evident by the accessibility check run by the Etre and QuickScan (expert software). The evidence from these tests help to answer the research questions and fill the gaps with respect to compliance with accessibility guidelines that could not be tested with user testing because of the scope and nature of tasks performed. Web designers must also take into consideration that these individuals make use of assistive technologies to help them retrieve information from the Internet in a meaningful way thus they must create websites that will work well with all types of assistive technologies.

Therefore it is very important that web designers take into account every aspect of a website, from the layout to the coding and colour. They need to make sure they follow accessibility design guidelines and perform user tests on these websites. Web designers should test these websites with blind and visually impaired individuals to ensure that they can access the same information as a sighted user. Blind and visually impaired individuals should not be disadvantaged and discriminated against when it comes to accessibility and therefore they should be given the same information or benefits that a sighted user would gain from a website.

Addendum A

Interview Schedule

	Interview Question	Purpose of the Question
1	What is your race?	This question is asked for demographic purposes.
2	What is your gender?	This question is asked for demographic purposes.
3	How old are you?	This question is asked for demographic purposes.
4	What degree are you registered for?	The aim of this question is to get an understanding of any similarities among the participants and their choice of degree.
5	What year of study are you in?	This question is asked to determine how far the participant is gone in their tertiary education.
6	How often do you use the Internet?	This question involves understanding whether the participant uses the Internet often and the reason for the frequency of use.
7	What do you use the Internet for?	This question is used to identify the participant's online activities. The data to see if they match given tasks or whether these tasks are predominately simple in nature etc.
8	What type of assistive technology do	This question is used to identify the different

	you use when using websites?	types of assistive technologies used.
9	Which technical and/or conceptual problems did you experience whilst performing the given tasks?	This question aims to give feedback on different problems blind and visually impaired individuals experience whilst using the Internet. The researcher listed a few technical and conceptual problems and asked the participants to point out which of the problems they had experienced.
10	What benefit would accessible websites have for you when accessing information?	This question helps the researcher understand what positive outcome accessible and usable websites would offer a blind or visually impaired individual.
11	After visiting Computicket (A South African Website), do you feel your needs as a blind or visually impaired individual was fulfilled with regards to accessibility?	This question helps to determine if a South African website is accessible or not to a blind or visually impaired individual.
12	What suggestions/ recommendations would you make for designing more accessible websites?	This question aims to provide possible suggestions to web designers when creating websites.
13	How long have you been using the Internet (months, years)?	This question is to identify how long the participant has been using the Internet.
14	From the time you have used the Internet do you feel there has been an	This question aims to inform the researcher if there have been any accessibility problems in

	improvement with the design of websites for blind and visually impaired individuals?	the past and if there have been any improvements thus far.
15	Do you enjoy using the Internet and why?	This question will help the researcher understand a participant's Internet experience, whether they are satisfied/enjoyed a website that they will visit it again.

Addendum B

Correspondence Analysis codes

4.14 Correspondence Analysis

Accessibility problem	
Technical problem 1 (TP1)	Links formulation
Technical problem 2 (TP2)	Images without the “ALT” comment
Technical problem 3 (TP3)	Tables and multi-column tables
Conceptual problem 1 (CP1)	Multiple frameset
Conceptual problem 2 (CP2)	Site organisation
Conceptual problem 3 (CP3)	Sites dedicated to one specific browser

Table 1: Accessibility problem codes

4.14.1

Theme (Blue)	Accessibility problem	Website (Green)
1	T1 (links formulation)	1=Google
2	T2 (Images without “ALT” comment)	3=Woolworths
5	C2 (Site organisation)	4=Computicket

Table 2 : Theme displaying accessibility problem against website

4.10 and 4.14.3

<i>Code</i>	<i>Assistive technology</i>	<i>Website</i>	<i>Problem experienced</i>
ZGY	Zoom text	Google	Yes
ZGN	Zoom text	Google	No
MGY	Screen magnifier	Google	Yes
JGY	JAWS	Google	Yes
JGN	JAWS	Google	No
ZON	Zoom text	OLS	No
MON	Screen magnifier	OLS	No
JON	JAWS	OLS	No

ZWY	Zoom text	Woolworths	Yes
ZWN	Zoom text	Woolworths	No
MWY	Screen magnifier	Woolworths	Yes
MWN	Screen magnifier	Woolworths	No
JWY	JAWS	Woolworths	Yes
JWN	JAWS	Woolworths	No
ZCY	Zoom text	Computicket	Yes
ZCN	Zoom text	Computicket	No
MCY	Screen magnifier	Computicket	Yes
MCN	Screen magnifier	Computicket	No
JCY	JAWS	Computicket	Yes
JCN	JAWS	Computicket	No

Table 3: Accessibility problems against website and assistive technology used

<i>Code</i>	<i>Accessibility problem</i>
TP1	Links formulation
TP2	Images without “ALT” comment
TP3	Tables and multi-column text
CP1	Multiple frameset
CP2	Site organisation
CP3	Sites dedicated to one specific browser

Table 4: Accessibility problems code

4.14.5

Code	Problem
1=TP1 (Technical problem)	Links formulation
2=TP2 (Technical problem)	Images without “ALT” text
3=CP2 (Conceptual problem)	Site organisation

Table 5: Correspondence analysis 3: Assistive technology vs. Problems (no Tasks detailed)

4.14.6 Do assistive technologies contribute to user satisfaction of websites visited?

Code:

Code	Assistive technology	Task completion
1	Zoom text	Yes
2	Zoom text	No
3	Screen magnifier	Yes
4	Screen magnifier	No
5	JAWS	Yes
6	JAWS	No

Table 6: Assistive technologies against user satisfaction of websites visited

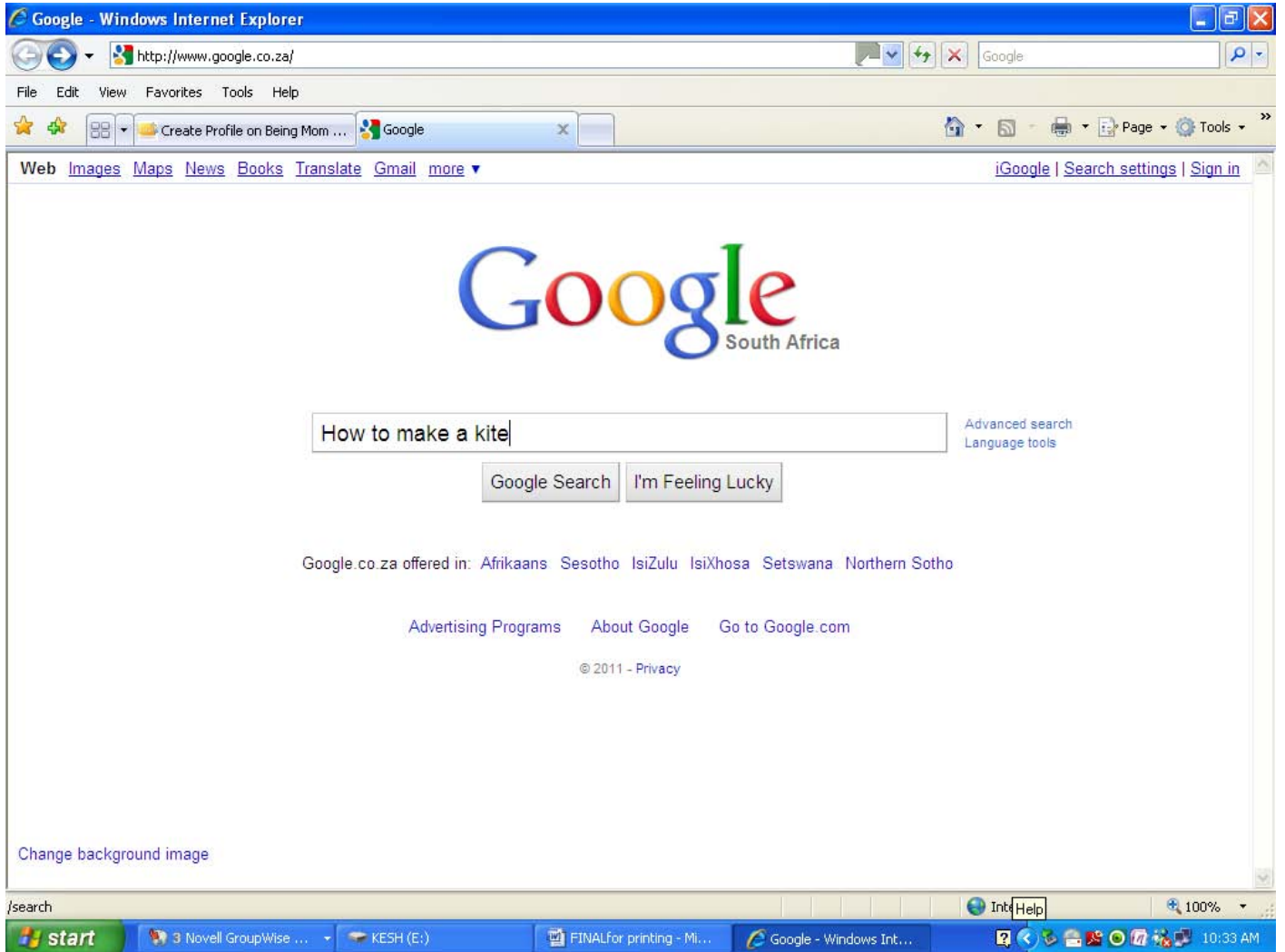
4.14.9 Correspondence analysis 7: Sight vs. Task satisfaction

Code	Website
1	Google
2	OLS
3	Woolworths
4	Computicket

Table 7: Degree of Sight against against task satisfaction

Addendum C

Screenshots of Websites in the User Test





CALL US ON 083 915 8000
CALLS CHARGED FROM R2.85 PER MIN
CHECK WITH YOUR SERVICE PROVIDER
TECHNICAL SUPPORT ON 011 340 8000
STANDARD LANDLINE RATES APPLY

- ALL
- ON STAGE
- MUSIC
- LIFESTYLE
- FESTIVALS
- SPORT
- TRAVEL

SA vs Egypt

Sport | Soccer
26 Mar 11
2012 AFCON Qualifier

[FIND OUT MORE? CLICK HERE!](#) | [BOOK](#)

EVENT CALENDAR

All Events | Mar 2011 | GO

SUN	MON	TUE	WED	THU	FRI	SAT
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

FIND WHAT ALL EVENTS WHERE ALL REGIONS WHEN ANYTIME [RESET](#) **SEARCH** Enter keyword

ALL EVENTS • ALL REGIONS • ANYTIME

Search within results

View: [Grid] [List] Select Sort Order Showing 1 to 18 of 794 Events - Page 1 of 45

<p>Arthur Miller's Broken Glass 24 Mar 11 - 16 Apr 11 The Fugard Theatre is excited to we...</p> <p>On Stage Drama BOOK</p>	<p>Bizet's Carmen 24 Mar 11 - 26 Mar 11 Fiery, beautiful and irresistible, ...</p> <p>Music Opera BOOK</p>	<p>Cape Town International Jazz Fest. 25 Mar 11 - 26 Mar 11 CTIJF 2011 is sold out ? Tickets st...</p> <p>F Not available BOOK</p>
<p>Earth Wind and Fire 40th Anniversary 27 Mar 11 Earth Wind and Fire 40th Anniversar...</p> <p>Music Jazz BOOK</p>	<p>EVITA The Musical 24 Mar 11 - 10 Apr 11 'Sheer magnificence.' 'Run, don't ...</p> <p>On Stage Musicals BOOK</p>	<p>Kings of Leon 26 Oct 11 - 29 Oct 11 Brought to you by Nokia and 5fm the...</p> <p>Music Rock And P... BOOK</p>

MY COMPUTICKET

[LOGIN](#) [REGISTER](#)

MY BASKET

[TRANSACTIONS](#)

Your basket is currently empty.

[TRAVEL PACKAGES ONLINE](#)

[BOOK CARS ONLINE](#)

Computicket - the Ticket you can Trust - Home - Windows Internet Explorer

http://www.computicket.com/web/

File Edit View Favorites Tools Help

Course: ISTN100 - End User ... Jobs in KwaZulu-Natal in the ... Computicket - the Ticket ...



Computicket
the Ticket you can Trust

CALL US ON 083 915 8000
CALLS CHARGED FROM R2.85 PER MIN
CHECK WITH YOUR SERVICE PROVIDER

TECHNICAL SUPPORT ON 011 340 8000
STANDARD LANDLINE RATES APPLY

ALL
ON STAGE
MUSIC
LIFESTYLE
FESTIVALS
SPORT
TRAVEL

EVENT CALENDAR

Events | Mar 2011 | GO

SUN	MON	TUE	WED	THU	FRI	SAT
		1	2	3	4	5
	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Smokie
Music | Rock And Pop
02 Apr 11 - 10 Apr 11

The internationally successful British pop group Smokie returns to South Africa in April 2011 after their sold-out tour in 2008. W...

[FIND OUT MORE? CLICK HERE!](#) | [BOOK](#)





Flight Bookings

Hotels

Bus Tickets

Travel packages

FIND WHAT ALL EVENTS WHERE ALL REGIONS WHEN ANYTIME [RESET](#) **SEARCH**

ALL EVENTS • ALL REGIONS • ANYTIME

View: Select Sort Order Showing 1 to 18 of 794 Events - Page 1 of 45

Arthur Miller's Broken Glass
24 Mar 11 - 16 Apr 11
The Fugard Theatre is excited to we...

On Stage | Drama | [BOOK](#)

Bizet's Carmen
24 Mar 11 - 26 Mar 11
Fiery, beautiful and irresistible, ...

Music | Opera | [BOOK](#)

Cape Town International Jazz Fest.
25 Mar 11 - 26 Mar 11
CTIJF 2011 is sold out ?
Tickets at...

Not available | [BOOK](#)

Earth Wind and Fire 40th Anniversary
27 Mar 11
Earth Wind and Fire 40th Anniversar...

Music | Jazz | [BOOK](#)

EVITA The Musical
24 Mar 11 - 10 Apr 11
'Sheer magnificence.'
'Run, don't ...

On Stage | Musicals | [BOOK](#)

Kings of Leon
26 Oct 11 - 29 Oct 11
Brought to you by Nokia and 5fm the...

Music | Rock And P... | [BOOK](#)

MY COMPUTICKET [?](#)

[LOGIN](#) [REGISTER](#)

MY BASKET [TRANSACTIONS](#)

Your basket is currently empty.

TRAVEL PACKAGES
ONLINE [▶](#)

BOOK CARS
ONLINE [▶](#)

http://www.computicket.com/web/bus_tickets/

Internet 100%

start Novell GroupWise... seat numbers for... Computicket - the... masters correctio... Document2 - Micr... 11:18 AM

Computicket - the Ticket you can Trust - Bus Tickets - Windows Internet Explorer

http://www.computicket.com/web/bus_tickets/

File Edit View Favorites Tools Help


Course: ISTN100 - End User ... Jobs in KwaZulu-Natal in the ... Computicket - the Ticket ...



CALL US ON 083 915 8000
CALLS CHARGED FROM R2.85 PER MIN
 CHECK WITH YOUR SERVICE PROVIDER

TECHNICAL SUPPORT ON 011 340 8000
STANDARD LANDLINE RATES APPLY

ALL ON STAGE MUSIC LIFESTYLE FESTIVALS SPORT TRAVEL



Cirque du Soleil Saltimbanco
 On Stage | Cabaret
 24 Mar 11 - 03 Apr 11

The critically-celebrate, international entertainment group Cirque du Soleil will perform for the first time ever in South Africa ...

[FIND OUT MORE? CLICK HERE!](#) | [BOOK](#)



SUPER DEALS MAKE FLYING FUN & EASY

EVENT CALENDAR

All Events | Mar 2011 | [GO](#)

SUN	MON	TUE	WED	THU	FRI	SAT
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

FIND WHAT **ALL EVENTS** WHERE **ALL REGIONS** WHEN **AT ANYTIME** [RESET](#) **SEARCH**

BUS TICKETS

Are you travelling one way or returning?
 One Way Return Trip

Depart from:

Arrive at:

Departure date:

[CONTINUE](#)


MY COMPUTICKET [?](#)

[LOGIN](#) [REGISTER](#)

MY BASKET [TRANSACTIONS](#)

Your basket is currently empty.

 **TRAVEL PACKAGES ONLINE**

 **BOOK CARS ONLINE**

Page: 2 of 3 Words: 0

start Novell GroupWise... seat numbers for... Computicket - the... masters correctio... Document2 - Micr... 11:18 AM

Woolworths - Windows Internet Explorer

http://www.woolworths.co.za/caissa.asp?Page=ITB4_RHContext&Post=Home

File Edit View Favorites Tools Help

@ Course: ISTN100 - End User ... Jobs in KwaZulu-Natal in the ... Woolworths


home login register gift lists store locator MySchool events win contact us help

W
WOOLWORTHS

OUR COMPANY WHAT WE OFFER ONLINE SHOP FINANCIAL SERVICES REWARD YOURSELF

shopping bag: 0 items
→ view → checkout

we are
for love of water
NATIONAL WATER WEEK
21-27 MARCH


CLICK HERE NOW


gift hampers

online shop

We've made it easy for you to indulge in the best. Shop for food, fashion and homeware - It's so easy and convenient! Plus get R50 off your first shop! [Click here](#)



BOWL US OVER
YOUR HOME-MADE SOUP RECIPE COULD WIN R50 000



60+
EARTH HOUR

quick links

Join W Rewards W café, foodbar, winebar & to-go Good Business Journey

Internet 100%

start Novell GroupWise... seat numbers for... Woolworths - Win... masters correctio... Document2 - Mic... 11:19 AM

Woolworths : online shop - Windows Internet Explorer

http://www.woolworths.co.za/caissa.asp?Page=ITB4_RHContext&Post=SHOP_home

File Edit View Favorites Tools Help

Woolworths : online shop

home login register gift lists store locator MySchool events win contact us help

Woolworths

OUR COMPANY WHAT WE OFFER ONLINE SHOP FINANCIAL SERVICES REWARD YOURSELF

shopping bag: 0 items → view → checkout

food & wine beauty gifts baby & kids home clothing & accessories connect taste

shop online

online shop CALL US 0860 100 987

login

→ forgot password?
→ not yet registered?

shop for delivery

Cape Town

→ check for your suburb

product search

search

search all
product or category

Fast Shop
Your Details

R50 OFF YOUR FIRST SHOP REGISTER HERE

shop for food & wine

We've made it easy for you to indulge in the best. From fresh salads to delicious prepared meals, desserts, special treats and wine. Shop online and you'll have more time to enjoy it!

shop for homeware

Shop online for homeware. Click here to browse through our gorgeous collection of homeware and accessories, as well as our great value products.

EAT IN FOR 4 UNDER R100

Done

start Novell GroupWise... seat numbers for... Woolworths : onli... masters correctio... Document2 - Micr... 11:19 AM

Woolworths - Windows Internet Explorer

http://www.woolworths.co.za/caissa.asp?Page=ITB4_RHRegStep1

File Edit View Favorites Tools Help

Course: ISTN100 - End User ... Jobs in KwaZulu-Natal in the ... Woolworths

home login register gift lists store locator MySchool events win contact us help

W
WOOLWORTHS

OUR COMPANY WHAT WE OFFER ONLINE SHOP FINANCIAL SERVICES REWARD YOURSELF

shopping bag: 0 items
→ view → checkout

→ food & wine beauty gifts baby & kids home clothing & accessories connect taste

shop online register CALL US 0860 100 987

login

→ forgot password?
→ not yet registered?

shop for delivery
Cape Town

→ check for your suburb

product search

search

search all
 product or category

Fast Shop
Your Details

Registration (Step 1 of 2)

Please note : Woolworths currently delivers to selected suburbs in major metropolitan areas.

To ensure that we can deliver to you please select your suburb.

Please select your region & suburb.

Select your region Johannesburg

Select your suburb

- (Not in delivery area JHB), 9999
- Abbotsford, 2192
- Activia Park, 1429
- Aeroton, 2013
- Airdlin, 2157
- Airport Park, 1401
- Alan Manor, 2091
- Albemarle, 1401
- Albemarle Ext 2, 1401
- Alberante, 1449

If you cannot find your suburb please check the adjoining region by changing the region listed above (eg Kempton Park is listed under East and West Rand region).

If you wish to register but you live in an area not listed for home delivery - please select (Not in Delivery Area) from the region which is nearest to your address

Done Internet 100%

start Novell GroupWise... seat numbers for... Woolworths - Win... masters correctio... Document2 - Micr... 11:20 AM



WOOLWORTHS

home login register gift lists store locator MySchool events win contact us help

OUR COMPANY

WHAT WE OFFER

ONLINE SHOP

FINANCIAL SERVICES

REWARD YOURSELF



shopping bag:
0 items
→ view → checkout

→ food & wine beauty gifts baby & kids home clothing & accessories connect taste

NEW GROCERIES ONLINE

- baby
- bakery, cakes & desserts
- beverages & juices (cold)
- beverages (hot)
- cooks & baking essentials range
- dairy, eggs & milk
- delicatessen
- earth friendly
- essentials range
- flowers & plants
- frozen foods
- fruit & vegetables
- grocery cupboard
- Halaal
- Kosher
- low fat
- magazines & books
- non-foods & pets
- organic products
- prepared foods
- protein - beef, lamb, pork
- protein - fish
- snacks & sweets
- toiletries & health

- biscuits
- bread
- cakes
- desserts
- muffins, scones & buns
- pastries
- rolls

- all biscuits
- baking essentials
- crunchies
- rice cakes
- rusks
- savoury biscuits
- sweet biscuits

CALL US 0860 100 987

OUTDOORS



healthy eating

food 2 go

Woolies has brought back its Slimmer's Choice range, and it's bigger and better to help you get smaller faster! They're all low-fat and kilojoule-controlled. [Click here to view ...](#)



Don't miss out on the absolute freshness and complete convenience of our 2 Go range. From wraps and sandwiches to warm meals and fruit tubs. [Click here to view ..](#)



SPECIALITY CHEESE SHOP
[>> CLICK HERE](#)

Woolworths - Windows Internet Explorer

http://www.woolworths.co.za/caissa.asp?Page=ITB4_RHDepartment&Search=No&FullText=&Dept=2646&Prods=8Shc

File Edit View Favorites Tools Help

home login register gift lists store locator MySchool events win contact us help

W
WOOLWORTHS

OUR COMPANY WHAT WE OFFER **ONLINE SHOP** FINANCIAL SERVICES REWARD YOURSELF

shopping bag: 0 items
→ view → checkout

→ food & wine beauty gifts baby & kids home clothing & accessories connect taste

shop online **seed & rye bread** CALL US 0860 100 987




login
→ forgot password?
→ not yet registered?

shop for delivery
Cape Town
→ check for your suburb

product search
search
search all
product or category

Fast Shop
Your Details

→ don't show the product picture

	Berliner Landbrot Bread 400g → view details	unit price: R18.95 quantity: <input type="text"/> add to shopping bag
	Soft Rye Bread 400g → view details	unit price: R18.95 quantity: <input type="text"/> add to shopping bag
	Pumpkin Seed Rye Bread 300g → view details	unit price: R18.95 quantity: <input type="text"/> add to shopping bag

Done

start Novell GroupWise... seat numbers for... Woolworths - Win... masters correctio... Document2 - Micr... 11:21 AM

Addendum D

QuickScan performed on the four websites

4.15.1 Website 1: Google

Summary of Web Guidelines QuickScan for Google:

Keep structure and design as separate as possible: use HTML of XHTML for the structure and CSS for the design.	The use of the font tag is not allowed. Fonts should be defined using CSS.
Do not let the functionality of the website depend on optional technology such as CSS or client-side script: Optional technology should be used to compliment the information and should never be used to limit the accessibility to the page content, were the optional technology to be unavailable.	A form without a submit button has been found. This functionality must not be dependent on a script.
Use the HTML 4.01 of XHTML 1.0 according to W3C specifications for marking up websites.	The DOCTYPE of this page seems to be invalid.
Use CSS Level-2.1 of the W3C specification when designing websites.	CSS does not seem to have been used on this page.

<p>Use heading elements to define the hierarchy of the page.</p>	<p>No headers have been found in the document. The use of at least one header tag is needed to communicate document hierarchy.</p>
<p>Do not skip any heading elements in the document hierarchy.</p>	<p>No headers have been found in the document. The use of at least one header tag is needed to communicate document hierarchy.</p>
<p>Use the ol (ordered list) and ul (unordered list) elements for lists.</p>	<p>No lists using ol or ul tags have been found.</p>
<p>Set up a readable, expandable directory structure.</p>	<p>Unable to make out a directory structure from the URL. This could possibly be the home page.</p>
<p>Images placed in a link should have a non-empty alternative text to enable visitors who do not see the image to follow the link.</p>	<p>No links have been found that contain image tags.</p>

Links on websites should not automatically open new windows without warning.	Links on this page seem to open without warning new windows.
Use the label element to explicitly associate text with an input field in a form.	An input field has been found with no label association.

4.15.3 Website 3: Woolworths

Keep structure and design as separate as possible: use HTML or XHTML for the structure and CSS for the design.	The use of the bgcolor attribute is not allowed.
Do not let the functionality of the website depend on optional technologies such as CSS or client-side script: Optional technology should be used to compliment the information and should never be used to limit the accessibility to the page content, were the optional technology to be unavailable.	Links have been found on this page which contain javascript. Some users will be unable to use these links.
When adapting/transforming a website: use only HTML 4.01 or XHTML 1.0 Transitional doctype only when the use of the strict doctype is impossible or undesirable.	The DOCTYPE of this page seems to be XHTML 1.0 Transitional. Please use a strict DOCTYPE.

<p>Use CSS L evel-2.1 of t he W 3C s pecification w hen de signing websites.</p>	<p>The C SS ha s va lida tion errors.</p>
<p>Write both grammatically correct and descriptive mark up.</p>	<p>This pa ge seems to c ontain grammatically cor rect mark up, but contains b or i tags. These t ags de scribe vi sual aspects of text, it is better to use CSS for this purpose.</p>
<p>Use heading elements to define the hierarchy of the page.</p>	<p>No headers have been found in the document. The use of at l east one h eader t ag is needed t o communicate document hierarchy.</p>
<p>Use the em (emphasis) and strong elements to emphasize text.</p>	<p>This pa ge c ontains b or i tags. These t ags de scribe visual a spects of te xt, i t is better t o us e C SS f or this purpose.</p>
<p>Use the ol (ordered list) and ul (unordered list) elements for lists.</p>	<p>No lists us ing ol or ul ta gs</p>

	have been found.
Use friendly URL's that are readable and recognisable.	Query strings have been found in the URL. This makes the URL difficult to read.
Every HTML or XHTML document should start with a valid doctype declaration.	The document contains a valid DOCTYPE.
The 'ALT' (alternative) attribute should be used on every image (img) and area element and should be provided with an effective alternative text.	At least one img element has been found without an 'ALT' attribute.
When using client-side script in combination with a link: if the link does not lead to anything, do not confront the visitor without support for client-side script with a non-working link.	Contains links which will not work if javascript is unavailable or switched off.
Use the label element to explicitly associate text with an input field in a form.	No input element has been found in which to associate a label with.

4.15.5 Website 4: Computicket

<p>Do not let the functionality of the website dependant on optional technology such as CSS or client-side script: Optional technology should be used to compliment the information and should never be used to limit the accessibility to the page content, were the optional technology to be unavailable.</p>	<p>Links have been found on this page which contain javascript. Some users will be unable to use these links.</p>
<p>Use the HTML 4.01 or XHTML 1.0 according to W3C specifications for marking up websites.</p>	<p>Valid HTML found, but without a strict DOCTYPE</p>
<p>Write both grammatically correct and descriptive mark up.</p>	<p>This page seems to contain grammatically correct mark up, but contains an invalid hierarchy. This might mean that headings have been used for their size instead of their place within the document structure.</p>
<p>Use heading elements to define the hierarchy of the page.</p>	<p>It looks like the header hierarchy seems to have been skipped somewhere in the document (e.g.: skips from h1 to h3 without an h2 header. This might mean that headings have been used for their size instead of their</p>

	place within the document structure.
Use the ol (ordered list) and ul (unordered list) elements for lists.	No lists using ol or ul tags have been found.
Use friendly URL's that are readable and recognisable.	No query strings have been found in the URL.
The 'ALT' (alternative) attribute should be used on every img (image) and area element and should be provided with an effective alternative text.	At least one img element has been found without an 'ALT' attribute.
When using client-side script in combination with a link: if the link does not lead to anything, do not confront the visitor without support for client-side script with a non-working link.	Contains links which will not work if javascript is unavailable or switched off.
Do not automatically open links to downloadable files in a new window.	There are links on this page that use the target attribute, this implies the opening of new windows. The target attribute has also been deprecated.

Use the th (table header) to describe a column or row in a table with relational information.	At least one table has been found that uses no th element.
Do not use frames on websites. You are not allowed to use either frames or iframes.	The use of iframes is not allowed.
Avoid automatic redirection during interaction with forms.	At least one form does not have a submit button.
Specify the base language of a page in the markup.	Language has not been specified on this page.
Specify the UTF-8 character set.	The UTF-8 character set has not been specified.
Also specify the character set by means of HTTP headers, if possible.	No character set in the HTTP header has been found.
Use (at least) the meta element to specify the character set markup.	The meta tag that specifies the character set should be placed above all other meta

Addendum E




Etre Evaluation

Google (South Africa)

The page you tested does not adhere to the WAI accessibility guidelines we evaluated it against.

There were 16 problems identified on the page you submitted. These issues are broken out by WAI priority in the table below.

Accessibility issues for Google by WAI Priority

WAI Priority	No. of accessibility problems
Priority 1 - "must fix"	 0 problems
Priority 2 - "should fix"	 14 problems
Priority 3 - "may fix"	 2 problems

- Priority 1 issues *must* be fixed to provide the most basic level of accessibility.
- Priority 2 issues *should* be fixed to provide the minimum level of accessibility recommended by the EU.
- Priority 3 issues *may* be fixed to maximise accessibility.

So what's wrong?

Here's a taster of the problems we found:

a tags need to be correctly nested and closed

When tags aren't constructed in this manner, pages are interpreted inconsistently by different browsers. This can render content inaccessible on many platforms.

Inline style tags are favoured over an external stylesheet

Content should be styled via external CSS file wherever possible. This is because inline styles can prevent users from applying their own stylesheet to the page. Why would anyone want to use their own stylesheet? Well, someone with poor eyesight might apply a stylesheet that boosts font sizes by 200% to increase legibility, for example.

DOCTYPE is not the first line of code

When DOCTYPE doesn't feature as the first line it is ignored by browsers. So instead of ensuring that the page adheres to the desired W3C standard, it assumes that it's old, buggy HTML and needs to be displayed as an old, buggy browser would have displayed it.

Woolworths

The page you tested does not adhere to the WAI accessibility guidelines we evaluated it against.

There were 19 problems identified on the page you submitted. These issues are broken out by WAI priority in the table below.

Accessibility issues for Woolworths by WAI Priority

WAI Priority	No. of accessibility problems
Priority 1 - "must fix"	0 problems
Priority 2 - "should fix"	20 problems
Priority 3 - "may fix"	2 problems

- Priority 1 issues *must* be fixed to provide the most basic level of accessibility.
- Priority 2 issues *should* be fixed to provide the minimum level of accessibility recommended by the EU.
- Priority 3 issues *may* be fixed to maximise accessibility.

So what's wrong?

Here's a taster of the problems we found:

Deprecated bgcolor attribute(s) found

A deprecated attribute is a tag that is no longer supported as part of W3C's latest HTML standard. This means that browsers and assistive technologies are under no obligation to support it in future versions, thus potentially rendering its contents inaccessible. It's worth noting that many elements and attributes are deprecated solely on the grounds that they cause accessibility problems.

Adjacent links are separated by white space

Older assistive technologies read adjacent links as a single link when they are separated only by spaces (even if they appear on different lines!).

Nested tables are used




Nested tables usually linearise poorly. Linearisation is the process by which a table is read aloud by a screen reader or speech browser - i.e. cell-by-cell, one after the other, from left-to-right, top-to-bottom. This is the perfect sequence for tabular data - but it doesn't work as well for nested tables.

Computicket

The page you tested does not adhere to the WAI accessibility guidelines we evaluated it against.

There were 13 problems identified on the page you submitted. These issues are broken out by WAI priority in the table below.

Accessibility issues for Computicket - the Ticket you can Trust - Home by WAI Priority

WAI Priority	No. of accessibility problems
Priority 1 - "must fix"	 3 problems
Priority 2 - "should fix"	 9 problems
Priority 3 - "may fix"	 3 problems

- Priority 1 issues *must* be fixed to provide the most basic level of accessibility.
- Priority 2 issues *should* be fixed to provide the minimum level of accessibility recommended by the EU.
- Priority 3 issues *may* be fixed to maximise accessibility.

So what's wrong?

Here's a taster of the problems we found:

<iframe> elements don't have titles

Blind users rely upon titles to decide whether it is worth accessing the content within an <iframe>. When titles are omitted screen readers try to guess what's in the <iframe> from its src attribute - this usually results in an incoherent stream of gobbledegook.

The "what_recent" form element doesn't feature a <label>

The <label> tag allows you to associate a form label with any kind of form <input> element: e.g. text boxes, multi-line text areas, checkboxes or radio buttons. This means that screen readers don't need to guess the title of different fields and controls.

A dropdown menu <option> must be selected by default

If a dropdown menu doesn't display a selected <option> by default, some old browsers and assistive technologies won't navigate to it (set focus on it).

Addendum F

Table of Figures formulated for Content Analysis

Task	Assistive Technology					
	Zoom Text		Screen magnifier		Screen reader	
	Task complete	Task incomplete	Task complete	Task incomplete	Task complete	Task incomplete
Google	3	0	4	0	3	0
OLS	3	0	1	1	3	0
Woolworths	1	2	3	1	1	2
Computicket	2	1	1	3	1	2

Table 1: Assistive technology against Task completion

Task	Disability			
	Blind		Visually impaired	
	Task completed	Task incomplete	Task completed	Task incomplete
Google	3	0	7	0
OLS	2	1	4	1
Woolworths	1	2	4	3
Computicket	1	2	3	4

Table 2: Degree of disability against task

Task	Disability			
	Blind		Visually impaired	
	Satisfied	Dissatisfied	Satisfied	Dissatisfied
Google	3	0	2	5
OLS	2	1	4	1
Woolworths	0	3	2	5
Computicket	2	1	3	4

Table 3: Degree of disability against Task satisfaction

<i>PARTICIPANT</i>	<i>Task1 (Google): Completion of task</i>	<i>Efficiency (Time to complete task)</i>
1	Completed	5 mins
2 (Blind)	Completed but experienced problems	10 mins
3 (Blind)	Completed the task	1.5 mins
4	Completed task	2 mins
5	Completed task	2 mins
6	Completed task	2 mins
7	Completed task	3 mins
8	Completed task	2 mins
9	Completed task	3 mins
10 (Blind)	Completed task	3 mins

Table 4: Participant and Task completion with Google

<i>PARTICIPANT</i>	<i>Task 2 (OLS): Completion of task</i>	<i>Efficiency (Time to complete task)</i>
1	Completed	3 mins
2 (Blind)	Completed but with problems	5 mins
3 (Blind)	Did not complete task	5 mins
4	Completed task	2 mins
5	Did not perform task as the participant does not use OLS	
6	Did not perform task as the participant does not use OLS	
7	Completed task	3 mins
8	Did not complete task	3 mins
9	Completed task	3 mins
10 (Blind)	Completed task	3 mins

Table 5: Participant and Task completion with OLS

<i>PARTICIPANT</i>	<i>Task 3 (Computicket): Completion of task</i>	<i>Efficiency (Time to complete task)</i>
1	Completed	5 mins
2 (Blind)	Completed task	5 mins
3 (Blind)	Did not complete task	Took 5 mins to find information on the Homepage relating to purchasing of a bus ticket.
4	Completed task	3 mins
5	Completed task	3 mins
6	Did not complete task	3 mins
7	Complete task	3 mins
8	Complete task	3 mins
9	Did not complete task	3 mins
10 (Blind)	Complete task	2.5 mins

Table 6: Participant and Task completion with Computicket

<i>PARTICIPANT</i>	<i>Task 4 (Woolworths):Completion of task</i>	<i>Efficiency (Time to complete task)</i>
1	Completed task	15 mins
2 (Blind)	Difficulty in completing task	20 mins
3 (Blind)	Did not complete task	15 mins
4	Completed task	3 mins
5	Completed task	3 mins
6	Completed task	2 mins
7	Did not complete task	3 mins
8	Completed task	2 mins
9	Complete task	3 mins
10 (Blind)	Completed task but with difficulty	13 mins

Table 7: Participant and Task completion with Woolworths

Addendum G

Ethical Clearance and Informed Consent

- I. Approval of Ethical Clearance
- II. Statement of Informed Consent

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