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Designing accessible on-line environments for the visually impaired

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ABSTRACT

Providing accessible Web pages is becoming a key concern for many providers of electronic information. There are many people who find accessing Web pages difficult and among these, vision impaired users are perhaps the group with the greatest needs. The Web is a strong visual environment and most designers use this aspect of the environment as a critical element in their interface and information design. Such strategies, while providing many opportunities for mainstream Web users, provide limiting and impeding outcomes for visually impaired Web users.

There are a number of accessibility standards that now exist to inform and guide the designers of Web pages but little is known about precisely how best these standards can be applied and achieved. This paper will describe a study undertaken in the Australian context that sought to explore how the goals of accessibility influenced the design process and the design outcomes of an online learning environment designed to cater for visually impaired users. It is a study of the TruVision Project, a Web-based learning setting, designed to aid visually impaired users to gain an elementary qualification in Information Technology.

INTRODUCTION

The World Wide Web (WWW) has opened up a whole new realm of communication opportunities. It offers an inexpensive, efficient means for accessing and delivering information that contains text, graphics, audio, and video throughout the world (Mayfield 2002, Sullivan & Matson 2001). Because it is still in its infancy, to date there has been only scant interest in considering issues of equity in access to this technology and few accessibility design guidelines exist to guide the design of electronic resources for WWW.

New information technologies offer great potential to improve information access for vision impaired people. Accessibility and usability are closely related, as both can improve satisfaction, efficiency and effectiveness for users. Usability is aimed at increasing the target users' interactions with Web resources more effective and more efficient, accessibility is aimed at making the Web site open to a wider user population. (Paciello 2000, Spool et al. 1999, Valdes 2001, Webable 2001, UseableNet 2001, Education and Outreach Working Group 2002). Accessibility means providing flexibility to serve each user's needs and preferences, whereas usability is determined by user satisfaction and ease of use.

In relation to the Internet, accessibility is enabling computer and Internet resources to become available to more people than any other previous medium (Sensus 1999, Valdes 2001).With an ever-increasing amount of information and services available over the Internet, there are many advantages that can be gained from having Web sites accessible and usable by all facets of society (Sullivan & Matson 2001). Wade and Power (1998) argue that while people with disabilities are now being offered opportunities to access information and services over the Internet, there are also barriers to this access. These barriers are currently being dealt with by three key devices used by vision impaired users: Screen readers, Screen Magnifiers, and Braille displays (Koufogiannakis 1997, Mayfield 2002).

There are a number of groups that have provided guidelines to inform the design of accessible Web pages that cater in a general way for the broad range of Web users with specific needs e.g. The World Wide Web Consortium (W3C), Yale Style Manual and Section 508 Guidelines. However, there has not been extensive research into the needs for the vision impaired and as yet there are no specific guidelines created specifically for the design of Web accessible pages for the vision impaired . Furthermore, most of the proposed guidelines are not supported by experimental research or designs (Borges & Morales 1996).

At present, the leader in establishing accessibility guidelines for Web page development is the Web Accessibility Initiative (WAI), a sub-committee of the World Wide Web Consortium (W3C). The goal of this group includes development of a high degree of usability for people with disabilities (Harrison 2001). W3C guidelines explain how to make Web pages accessible to people with disabilities. These guidelines are intended to provide the information needed by Web developers and Web designers to design accessible Web pages. To follow them assists also to make Web content more available to all users, for whatever user agent, for example, desktop browser, voice browser, mobile phone (W3C 2001). Following these guidelines also help users find information on the Web more rapidly. W3C does not discourage content developers from using images, video and other visual material. Rather, they explain how to apply multimedia content, which is more accessible to a wide audience.

However, serious accessibility problems are posed for blind users and users with visual impairments (VI) because most Web pages focus on visual displays which do not distinguish strongly between colours (Brown 2000). For example, it is quite common to see combinations of background and foreground colours that make pages virtually unreadable for colour blind users. Therefore, design attention is needed to cater for the vision impaired user. The TruVision Project, a Web-based learning setting aims to address these concerns.

The TruVision Project is designed to aid visually impaired users to gain an elementary qualification in Information Technology, which is being developed by Elearn WA. It opens up the borders or barriers that have prevented visually impaired users gaining effective access to the Internet. Elearn WA is funded by Australian National Training Authority (ANTA), which seeks to develop a flexible approach to online learning for vision impaired learners. Through the establishment of a simulated Help Desk entity, TruVision provides a rich variety of iconic symbols and illustrations that resemble an actual office work environment. This will prepare vision impaired learners for interacting in actual vocational work spaces. The tool is based on a flexible 400 hours instruction given in online form and delivered by teachers. Learning is students centred.

The learning design that underpins TruVision is a form of problem based learning (Barrows 1996). The learner is cast as an employee in a virtual work environment and is given tasks to undertake a complete. Learning is achieved through active participation in completing the tasks and undertaking the forms of training necessary. The environment enables learners to select the various resources requited to gain knowledge about the underpinning skills needed to complete the tasks.

Figure 1: TruVision – Homepage (Reception): The reception provides an option of being greeted by the TruVision receptionist. The receptionist directs learners to three main areas of TruVision: Orientation Room. IT Support Room, and Trainee Workstation.

INTERFACE

The TruVision Project uses an interface, which represents an actual office workstation. This consists of a reception room with desk and office worker, and other rooms that represent an office workplace. The display includes bold colours and strong geometric designs for visual impact. The theme of the office workplace is also emphasised on page links, which include textual information given in the format of an office memo, for example (Figures 1, 2, 3).

The interface was designed to give a context for the large number of learning resources. TruVision is built on the principle of activity-driven learning and support by the appropriate content. All of the learning materials have been addressed into four major learning spaces:

- An Orientation Room where learners can get familiar with the TruVision environment. There are images of the desk in the meeting room surrounded by all of the staffs in TruVision. This room also shows the image of the blackboard showing the lists of the units from the Certificate I in Information Technology (Figure 2).

- The IT Support Room where learners can access the contents from behind the metaphor of an IT Support Officer and material for discussion and group work. This room displays the variety of an actual IT working environment by using simple icons, such as the desk, computer, book shelf, and the notice board (Figure 3).

- The Trainee Workstations where learners can access activities (work assignments). Using the icons of the workstation for example, the desk, chair, notice board, and the files and boxes of tasks that need to be done by learners. The learners can feel as part of the working environment by starting to browse around the workstation and start the task (Figure 4).

- A Training Room (accessed via the IT Support Officer) where learners can access IT training activities to support their learning. This room is designed by using the metaphors of the officer, the desk, computer and the filing cabinet to guide the learners to each activity in the unit (Figure 5).

While it may seem strange that a Web product designed for vision impaired users might have such a visually oriented interface, this was felt to be important for a number of reasons. The intention was to provide an on-line experience for vision-impaired users that provided the same form of experience as

might be gained by sighted users. For this reason, the interface was designed to represent best-practice from an instructional design perspective and an accessible version was then planned that could provide this same experience for vision-impaired learners.

TruVision has been developed to comply with W3C guidelines. Two versions of the on-line product run on every Web page. A text based version runs behind a graphical version to enable people who are totally vision impaired to hear an interpretation of the graphical environment via a screen reader. The graphical version provides an intuitive environment that is built to enable people who are sighted and people with partial vision impairment to see the product using screen magnifier.

The following design guidelines were followed to make provide accessibility for the various elements within TruVision:

- Flexible text and background colours are used.
- High contrast images are used.
- Frames are only use where necessary.
- All frames are labelled.
- High contrast colours are used.
- All tables are labelled.
- Text-based interpretations of the graphics run behind all pages, minimising word descriptions when using the alt tag.
- Text has been used for hyperlinks.

Figure 2: Orientation Room: The orientation room provides access to instructions and guidelines concerning the various instructional elements within the site.

Figure 3: IT Support Room: The support room provides access to contact each of the IT support officers. The noticeboard in the IT support room provides the learner with interesting discussion/ group work topics

Figure 4: Trainee Workstation: The trainee workstation is where the learner will complete their interactive work assignments at TruVision. Each unit of competency has a workstation associated with it. Learners should check the box on the whiteboard to select the workstation they required.
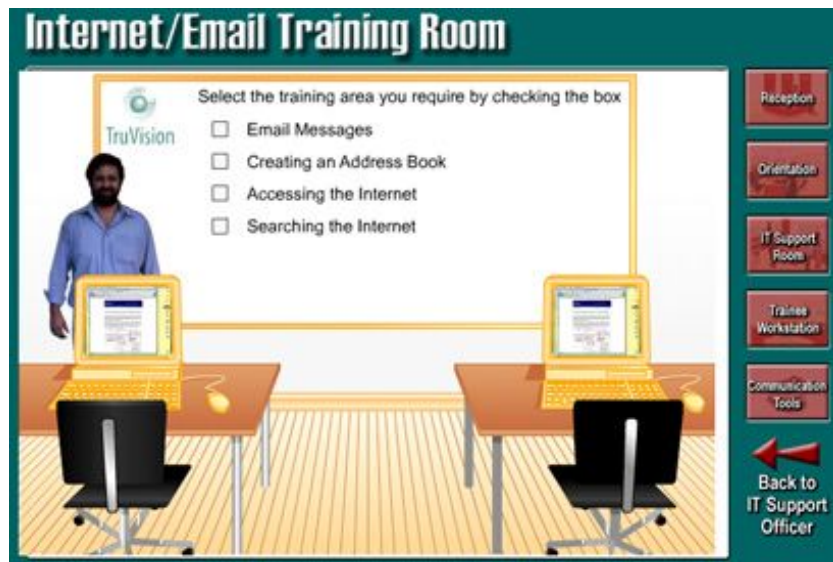
Figure 5: Training Room: The training room is designed as an authentic space where trainees (learners) can increase their skills and knowledge and develop their IT skills needed to complete their work assignments at TruVision. The training room also gives access to:

- details of the competencies covered in the training activities (accesses from the computer on the right).
- the support material needed to complete the training activities (accessed from the computer on the left).

(Australian National Training Authority 2002)

The TruVision Project uses text links as its navigation system, using flexible navigation for Job Access With Speech software (JAWS) as hidden links and using visible links through office metaphor for screen magnifier software as Zoom text. This strategy fitted well with the structure of the work patterns of the self centred on-line teaching and learning. In this case, the students need to go through all of the rooms as follows:

- Register to the Web site by entering student name.
- Enter each room and each section and find out the details of each activity. For example, the pathway may consists of the Orientation room, Work station room, and Training room
- Posting of results and answers from the activities.

TruVision was designed to let learners navigating though the learning material by simple and straightforward links. Navigational links are provided on the right hand side of every screen. These links allow movement around TruVision. The links provided are:
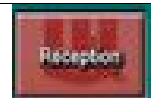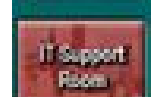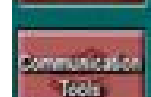
Reception	The reception link takes the learners to the TruVision reception area.
Orientation	The Orientation link takes the learners to the orientation Room.
IT Support Room	The IT Support Room link takes the learners to the IT Support Room. From this room the learner can contact each of the IT Support Officers. They can get access the IT Support Officer's detailed notes in their area of expertise (found in their filing cabinet) and get access to the Training Room for training activities.
Trainee Workstation	The Trainee Workstation link takes the learner to the Trainee Workstation where the work assignments can be accessed.
Communication Tools	The communication Tools link takes the learner to the communication tools, which are provided for the learner's use.

Table 1: Navigation links

When the learner enters the Training Room the following navigation options are also provided:

- Back to IT Support Officer: Available on the right hand side of the screen, at the bottom of the navigation icons, when the learner first enters the Training Room.
- Back to Training Room: Available on the right hand side of the screen, at the bottom of the navigation icons, after the learner has selected a training area from the whiteboard.
- Cabinet: Available on the bottom of the screen, after the learner has accessed a training activity.

(Australian National Training Authority 2002)

TruVision provides a number of navigation supports for vision impaired learners. The office metaphor supported by the link-based version enables the vision impaired users to experience the same form of interactions through a similar navigational experience.

ORIENTATION
The design of TruVision provides an audio and textual equivalents and textual descriptions interface. These textual elements can be displayed with JAWS for the learner that are totally blind so they can hear the learning context and know their next step by the combination of screen reader and streamed audio.

TruVision lets the learner explore the whole Web site by trying to reach each section of the tool by hitting the tab key and entering for the details of each task. If they encounter an error in their activities they are alerted to the problem through sound from JAWS. In the successful completion of the task they are able to move to the next level.

Orientation within TruVision is supported by the office metaphor and the room-based organisational strategy. The replication of the office metaphor within the text-based version of the site was intended to provide the vision impaired users with the same forms of orientation cues and structures.

INFORMATION

The site is full of information of a text form, which can read through JAWS. Some parts of the information need to be done as more details compare to the inaccessible Web site as to make it to suit totally blind learner.

The whiteboard on four major learning spaces also provides the learner with access to specific unit information through the hidden links. This information includes:

- Details of the elements of competency and performance criteria
- Prerequisites
- Facilitator contact details
- Assessment details, noting how these relate to the performance criteria
- Recommended resources
- A study schedule that suggests a learning sequence
- How to navigate through TruVision including an explanation of the functions of the buttons and icons
- Information about on-line communication tools and how these can be used
- Tips for working on-line

(Australian National Training Authority 2002)

The noticeboard in the IT Support Room (Figure 3) also provides the learner with interesting discussing/group work topics. Discussion/group work topics are available for each unit of competency. These topics are designed to be collaborative. Once again, the design of the various resources was planned to provide similar learning experiences for the sighted learners and those who are vision-impaired. The content was designed with a predominance of text-based elements and few graphics and visual resources to minimise the learning experiences between the vision and sighted learners.

SUMMARY & CONCLUSIONS

TruVision is built and now being tested and will be reported on with further studies to explore the success. It is important to note the limitations of the research as only a small number of the learners are currently involved in the research. But overall the outcomes seem positive. Both students and teachers share responded positively to the online setting and initial results suggest most students are achieving intended learning outcomes. Further research will help explore all forms of earning outcomes.

The vision impaired students have appeared to find the interface very accessible and users of both Screen readers and Screen magnifiers have given feedback to enable this assessment to be made. As well, the study of the design and development issues associated with TruVision has yielded guidelines that can help other s to design more accessible materials for vision students.

The current usability study being undertaken with TruVision is looking to explore how the vision impaired users respond to the alternative interface that has been implemented and the extent to which the fidelity of such environments can be replicated through textual descriptions for the vision impaired users. The study will observe vision impaired users interacting with the system and the efficiency of their interactions and how these are supported or hindered by the interface and implementation that has been developed. The TruVision designs will be evaluated throughout the study. For example, the number of correct responses to the tasks given will be used to measure the effectiveness of the designs.

The study will seek to explore those aspects of the design which contribute to the quality of the learning experience for the vision impaired users and to establish possible design guidelines from these that can applied to the development of other learning settings for the vision impaired.

The use of such learning environments as TruVision hold great degrees of promise for learners of all forms. The online format enables education to delivered in a global fashion, the accessibility enables many more learners to participate in education. TruVision is a product that truly supports borderless education removing more than simply geographical borders.

WEBSITE

To view TruVision, go to http://www.elearn.wa.edu.au/truvision

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