Usability for all: Towards the improvement of the e-learning experience for visually impaired users

Abstract (no more than 50 words)

E-learning is a powerful tool towards social inclusion. However, the use of accessibility and e-learning standards does not guarantee a satisfactory inclusion for those with a disability. This presentation describes a project aimed to design virtual educative applications specifically for the visually impaired following a user centered design perspective.

Introduction

The new context of Information Society entails new risks of social exclusion due to digital exclusion at the same time that it generates new possibilities for inclusion thanks to the accessibility of the Information and Communication Technologies (ICT) and universal design (15). In this context, we think that e-learning provides a powerful tool towards social inclusion. However, we have seen that compliance with accessibility and e-learning standards together with the usage of adequate devices does not guarantee a satisfactory experience for those with a disability (9). As a result, we are initiated a project in which we tackle the design of virtual educative applications specifically developed for the visually impaired following a user centered design perspective.

As mentioned, new ICT provide us with the key elements to facilitate social inclusion for those who for one reason or another can experience social exclusion. However, without the guarantee of universal access and the adaptation of designs to the needs of various different collectives, we run the risk of running into new kinds of social exclusion, known as the digital gap (4). Of these collectives, those with a disability (especially the visually impaired given the great importance images have in the Information Society) can easily find themselves excluded from the access to new technologies.

At the Open University of Catalonia we have developed several initiatives aimed to the inclusion of people with disabilities. We began our work by making our virtual campus comply with accessibility standards and have continued with the development of an output format for learning materials specific for students with visual disabilities. In the current project, we wanted to go a step further using ethnographic methodology to analyze the overall learning experience, taking into account both the learning contexts and the acquired knowledge.

By means of an ethnographic methodology we can obtain information about the learning and technological requirements for the visually impaired. This information is used to guide the design of an e-learning material prototype, which therefore takes into account both the aspects of usability and the psycho-pedagogical aspects. The prototype is evaluated in a laboratory with both visually impaired and standard users, so that we can not only validate the prototype and the obtained knowledge but see to what extent is it possible a universal design.

New perspectives about disabilities and the use of ICT

Traditionally studies have regarded disabilities from a medical perspective, from which the disability is understood to be pathological, associated with an individual and, therefore, considering that the problem should be resolved individually. However, various voices have started to opt for a new environmental model (17). From this perspective, disabilities correspond with determined interactions that lead individuals to certain situations. Therefore certain disabilities can be corrected if we put into play key devices and tools to facilitate interactions, like for example installing access ramps in buildings, or designing web pages following the standards of accessibility. This environment model is taking us to a different definition, which considers that the disability is a conjunction of restrictive conditions that
emerge because society is not capable of satisfying the needs of those affected by a disability (13).

New concepts of disabilities enhance the importance of the psychosocial process and the contexts associated with the problem of the disability. To better analyze the context of the disabilities we need to use the right tools. For example, ethnmethodology allows considering psychosocial issues, the context and the experience of the user. Ethnmethodology has already been used in a design perspective focusing on the user (3), although up to now they have been applied little in the area of accessibility. This psychosocial dimension has also been backed by what is known as the paradigm of the social perspective of disabilities (1, 2, 13). From this perspective, new technologies play a relevant role, as it permits a dilution of the disability at the same time allowing a high level of quality of life for this collective.

From this point of view, we support that e-learning and training by means of new technologies can be a key instrument to bridge the digital gap, providing that the instruments are designed adequately so as to facilitate the learning of people with disabilities as a collective, furthermore promoting knowledge of the use of these technologies considerably betters digital inclusion.

The importance of the user experience

At present, people with any type of disability do not have the same advantages to navigate on the Internet as those with no disability, because they have numerous difficulties accessing long distance learning. Therefore, for several years now, we have addressed this issue within our University in order to find solutions to these difficulties. Next we describe shortly the changes that we have carried out with this goal and that lead us to the project presented here.

We started our work with accessibility by ensuring that the virtual campus complied with accessibility standards. There are several actions on the Internet aiming to standardize accessibility. From these, two key norms have to be considered, the "section 508" (16) and the Web Accessibility Initiative (WAI) (17). This last norm is divided in three levels: A, AA, AAA. The level AA of WAI is similar to "section 508" as shown by the Thatcher analysis (18). The AA level project took the following steps to accomplish its mission: first, we taught a course on accessible design for in-house web designers; second, we chose a set of pilots to apply the W3C recommendations for the design of web pages; third, we evaluated the accessibility of the obtained pages; the last step was to progressively make accessible all remaining web sections and to create a style guide for new developments.

After this initial accessibility project, we started working on our learning materials in order to define different output formats, one of them specific to visually impaired students. The Digital Audio-Based Information System (DAISY) (5) is a new technology to develop and distribute books and contents. With DAISY it is possible to use the Digital Talking Books (TDB) in order to meet the needs of visually impaired people. Books in DAISY format grant greater speed of reading and greater easiness of access to different parts of the book. This format can be read by small portable devices and by a personal computer with special software like the system to play digital talking books on a PC analyzed by Morley (10).

The creation of different output formats for learning materials followed a user-centered design process. We initially gathered quantitative and qualitative information to build user profiles. The resulting profiles were the basis for the recruitment screening for user testing. We run ten user tests per profile and used a high-fidelity prototype of the materials where students could reproduce the way they work with interactive materials. The user tests were the basis for the interface improvements, based on which we built a new prototype to run a second set of user tests. The results of the second iteration showed an improvement of more than 50% from the first set of tests.

Both projects were extremely successful and helped us realize that the use of standards and devices do not guarantee by themselves a satisfactory experience for the user with a disability, nor do they guarantee that the applications are going to have optimum conditions to reach their formative objectives. For example; a person that is visually impaired can use a screen reader to access the internet; a device that can only give access to those pages that have been designed following the standards of accessibility. However, those standards do not
to guarantee that the navigating experience for certain pages is going to be satisfactory (9), mainly due to the fact that screen readers read in a linear format the contents of a webpage. Even if this linear format is optimum for an in depth lecture of written material, it is not adequate for hypertextual material. Clearly the wording of web pages for sighted people requires different strategies, more holistic and global than the ones used for written materials.

On the other hand, the processing of the information depends on the way the information is accessed. For example, Braille gives a far more effective comprehension of a text than audio for the visually impaired (8) and this ought to be taken into account in the design of virtual learning materials and e-learning systems. As a result, to enable access to virtual platforms of learning for the visually impaired, it is necessary to recognize the contexts in which the visually impaired students carry out their learning and teaching, as well as the cognitive process that intervenes in their strategies at the time of learning the subject. It is also essential to study the appropriation that they have of technology (10). This allows us to better their experiences as users, and of course improve the process that they follow to carry on with their plans of learning and the formative objectives that they develop.

**Usability for all**

The general aim of our project is therefore twofold; on one hand we aim to use ethnomethodological skills to obtain basic knowledge about the use of ICT and the requirements of visually impaired users, at the same time that we analyze the processes and contexts in different learning scenarios. As demonstrated in previous studies (7, 11), such information can be translated to requirements of the functionalities of devices, and strong recommendations for the design of multimodal interfaces that take into account both the usability and the pedagogical objectives of the educative contents.

Therefore, the project is divided in two main phases: the theoretical and information gathering phase and the prototype development and evaluation phase; the former one guiding the design of the prototype. The following tasks form the initial phase:

1. Creation of a theoretical framework regarding the impact of new technologies in the education of visually impaired people.
2. Analysis of sociodemographical characteristics of visually impaired people in Spain.
3. Quantitative study of the level of education and learning needs of visually impaired people in Spain, their usage of ICT and other relevant variables identified by the theoretical framework.
4. Analysis of the technological requirements and user profiles of visually impaired people in the different learning scenarios.

During the second phase, which aims to apply the results of the theoretical framework and guarantee the usability and the pedagogical objectives of the learning material, we will design a prototype of a learning material designed specifically for this collective. This prototype will be assessed in a usability and accessibility laboratory specific to evaluate technological applications destined for visually impaired people.

The portable usability laboratory consists of a PC with TechSmith’s usability software and a video camera. Morae Software records the user speech and face, along with the computer screen and the user interactions with the tested application. Observers can follow the evaluation in real-time from other computers. In order to make the laboratory accessible, we will add a screen reader, a screen magnifier, a Braille printer and a reader of digital talking books.

We carry out a two phase in-context evaluation, with prototypes of low and high fidelity that will take into account visually impaired users as well as standard users. In this way we can study if a universal design is possible, or if the applications have to be designed in function of the characteristics of the specific users. As an overall outcome, this project will allow us to obtain the theoretical basis to advance in e-inclusion and digital literacy without barriers.
Bibliography