Disabilities & ICTs for learning: developing an accessible learning environment from a User Centred Design perspective

Social Justice. Education & Employment of Persons with Disabilities

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1 INTRODUCTION

In today's society, people with disabilities are increasingly socially integrated. However, this process still needs to be developed to achieve overall integration. In this sense, information and communication technologies (ICT) are both an opportunity to improve this overall integration and a risk known as the digital divide.

The eduWAI project (funded by the Spanish Ministry of Industry, Tourism and Trade) was created in order to develop a specific learning environment for the inclusion of people with disabilities into the job market. To achieve this aim, a user-centred perspective is needed to flag up the needs of people with disabilities and detect opportunities for improvement through ICT. The aim of eduWAI is to achieve this improvement through the use of user-centred development methodologies.

Data are gathered from two different groups with disabilities: intellectual disabilities and visual disabilities. In the case of people with intellectual disabilities, ICT make the construction of flexible and personalised learning routes possible (Beale, 2005). Besides this, it is clear that people with intellectual disabilities improve their quality of life when they have a job (Eggleton et al., 1999; O'Brien and Dempsey, 2005; Kraemer, 2003). Therefore, the question is how ICT can improve the employment inclusion process of people with intellectual disabilities; although we have found several examples of how technology helps people with intellectual disabilities in different areas (Dattilo et al., 2003; Davies et al., 2003a; Davies et al., 2003b, Davies et al., 2004), it is disconcerting how little research there is to help ascertain how technology may help people with intellectual disabilities to become included in the job market. For example, a review by Alper, & Raharinirina (2006) of literature concerning the use of assistive technology for people with disabilities did not find any study in which AT focused on the inclusion of people with intellectual disabilities into the job market. Only Sauer et al. (2010), following a review of the literature into the effect of assistive technology in the work performance of people with intellectual disabilities and finding positive results for this performance, have provided guidelines for the incorporation of AT into professional training programmes in schools and the community.

On the other hand, in terms of students with visual disabilities, it has been demonstrated that the accessibility and e-learning communion does not guarantee a satisfactory experience for people with visual disabilities (Lawton & Grossnickle, 2005). The clearest example is the screen reader, which reads the website in a linear way, where reading in sighted people is holistic and hypertextual (Lazar, J. et al. 2006). This means that as well as complying with accessibility standards, user requirements for students with visual disabilities must also be compiled; one of the documented ways of achieving this objective is to conduct usability tests with people with visual disabilities which not only assess accessibility but also usability for all websites, as in Lazar et al. 2006; Nielsen, 2001; Porras. & Ribera, 2008; Theofanos & Redish, 2003; Theofanos & Redish, 2005. However, this research was based on web environments that were already developed, and with no specific reference for e-learning environments.

To compile the needs and requirements of both groups regarding the use of technology and how this can help with their incorporation into the job market, two contexts were selected where users could be observed in their everyday education environment.

In the case of users with intellectual disabilities, we visited an institution, the Prodis Foundation, which educates students with intellectual disabilities to help with their inclusion into the job market. The aim was to understand the educational and job inclusion process for students with intellectual disabilities, so that we would be able to detect the main difficulties in this educational and job inclusion process and see how ICT could improve this process. For students with visual disabilities, we interviewed 17 students from the Universitat Oberta de Catalunya (UOC), an institution which offers education through ICT only; the aim was to ascertain the main difficulties and needs that students with visual disabilities have and how they solve them when undertaking online education. In both cases, a series of recommendations were drawn up regarding the use of ICT in the education of both groups.

2 METHODOLOGY AND SAMPLE

In both cases, ethnographical observations were made of the everyday study contexts of both profiles. For students with intellectual disabilities, these observations took place at the Autonomous University of Madrid, where the Prodis Foundation runs a training programme for incorporation into the job market. The Prodis Foundation trains students with intellectual disabilities to help them access, adapt and remain in the professional environment. The education programme consists of two periods: one concerning training and the other professionalisation, and the profile studied is that of administration assistant/auxiliary. To compile the observations, we visited 3 different classes (social skills, machine operation level 1 and office skills level 1 classes). Each class contained about 12 students, divided by gender, with most of the students having Down Syndrome (primarily Trysomy 21 with some cases of mosaicism) and aged between 18 and 30.

Observations and interviews were also carried out in this context with educators, employment mediators and students within the work structure of the Living Lab Madrid4Inclusion run by the Prodis Foundation in conjunction with Ariadna Servicios Informáticos. The Living Lab Madrid4Inclusion was officially recognised by ENoLL in the 3rd Wave and since then has taken part in numerous technological projects for the development of solutions to facilitate incorporation into the job and training market for this group. The use of a user-centred methodology means that, rather than analysis of traditional requirements, it is technology users who define their technological needs and motivations, and who iteratively validate the proposed developments, stressing the effectiveness of the technological solution created.

In the case of students with visual disabilities, 17 of the total number of UOC students with visual disabilities were interviewed, 7 men and 10 women, aged between 22 and 64. Most of the students lived with their spouse and children or with their parents. They are all studying for a degree in the arts or social sciences, primarily humanities, law and psychology. They are mainly studying as a hobby. With regard to the typhlotechnical tools used, only two students used a screen reader, one of them for a month (Fig. 1). As for the other students, half used a magnifier (some also the screen reader on the magnifier) and the other half used the zoom on the PC. The interviews focused on ascertaining the main difficulties and needs that students with visual disabilities have and how they solve them when undertaking online education, and also learning first-hand about their everyday study context.

Fig. 1. Student using a screen reader

3 STUDENTS WITH INTELLECTUAL DISABILITIES: MAIN DIFFICULTIES

Generally speaking, the main difficulty for students with intellectual disabilities is the generalisation of what they learn. In other words, translating what they learn within one context to another. To promote the transfer of what they have learnt in the school context to the work context, the teachers at the institution present examples of real company situations to explain and/or question a content. Also, in task subjects materials regularly used in companies were used to teach and practise tasks, such as classifying payrolls, invoices, receipts, handling staplers, bookbinders, etc. For social skills training, the role playing method is sometimes used, despite its not being very effective (in the words of the teachers).

Generalisation of what students have learnt has a greater consequence on social skills learning, as the use of social skills is closely linked to the context in which they occur. This way, social skills training becomes cross-disciplinary, due to its difficult generalisation and therefore its application in a context such as employment. In fact, students with intellectual disabilities do experience generalised difficulty in handling social skills, be it by default or excess, and in relation to problems of emotional self-control and responsibility.

With regard to tasks, however, although students also have problems in learning them, their generalisation means less involvement due to the fact that for subjects which focus on skills learning the students have direct contact with machinery and the tasks that will occur in their future jobs. In order to consolidate the learning of both social skills and tasks, to ensure their subsequent repetition, the teaching method used by the teachers is one of repetition. This involves a content or concept being repeated until learning has been consolidated. In the context of the class, we observed how in this sense the main difficulty lay with the varying abilities of the students, which meant that the context to be learnt had to be personalised.

3.1 Recommendations

The following is a list of recommendations that should ideally be taken into account when developing a technological platform or tool:

Recommendations
Useful for learning social skills and tasks
It facilitates the generalisation of what students have learnt
It enables content to be taught through repetition using a range of strategies
It should foster student autonomy
It should allow personalisation to adapt to each student

Priority given to visual content over read content
It should help families and work colleagues to learn the correct way to interact with students
It should adapt to the different stages of the student's training (in class, practical sessions, while employed, the time between stages, etc.)

Table 1. Main recommendations for developing a technological platform or tool:

4 STUDENTS WITH VISUAL DISABILITIES

The students with visual disabilities interviewed study the same way as any other student without visual disabilities: the only difference is the type of interaction they have with the web or materials due to the use of typhlotechnical tools, such as magnifiers or screen readers. In fact, the type of tool used conditions the study method and difficulties encountered rather than the type or degree of visual disability that they may have.

In their places of study, we observed how, as well as the PC, other tools or devices are available to students, such as the remote magnifying glass, magnifying glasses, book rests, Braille printers, etc. In this case, each student uses the tool that is most comfortable for them. For example, some of the students who read contents using the zoom on the PC also use a book rest and a magnifying glass to read on paper; or the case of a student who uses a magnifier and prefers to read using a remote magnifying glass and paper instead of just the magnifier.

Besides this, students make full use of the different formats available to them, including pdf, audio, Word, etc., and even have favourites as to which format they use. For example, the audio format is widely used as a way of revising and studying or as an alternative to the web format to allow them to rest their sight, although most of the time it is the students themselves who make audio recordings or who ask a family member to do so. Another favourite format is Word, due to the fact that it can be edited, unlike the pdf format.

As we have observed, it should be stressed that students with visual disabilities form a very heterogeneous group in the sense that it may include different types of disabilities (e.g. totally blind or partially sighted); as a result, they use different tools; some users experience a gradual loss of sight, which requires them to learn how to use other typhlotechnical tools and adapt to other materials; and finally, and although it may seem obvious, these students have different methodologies and preferences when it comes to studying. Therefore, they have different difficulties according to the disability, the tool that they use, the severity of the disability, etc. Consequently, the main difficulties and recommendations involved are:

Inaccessible and/or scarcely usable materials: inaccessible pdfs, scanned pdfs, images, videos, flash format, inaccessible html material, etc., are materials that regularly cause problems for students, as they have to invest time in making this material accessible, whether this is asking the teacher for alternative material, the student adapting the material to make it accessible or asking a family member for help.

Inherent slowness of using a typhlotechnical tool: most students assume that because they have to use a typhlotechnical tool, their reading and working speed is much slower than if they did not use a typhlotechnical tool.

Having material sufficiently in advance: many students would prefer to have the contents in advance, as well as the descriptions of the assessment activity, to give them enough time to read and complete the activities given the time invested in transforming inaccessible material into accessible material and the slowness associated with using and reading a typhlotechnical tool.

Learning how to use new typhlotechnical tools: due to having a progressive visual disability, which means that they have to learn new tools in order to interact with the materials or computer.

4.1 Recommendations

The following is a list of recommendations that should ideally be taken into account when providing online learning.

Recommendations
Provide all possible formats (audio, Word, pdf, Braille, web, etc.)
Provide accessible and usable materials
Train teaching staff in accessibility
Provide the materials in advance
Alternative accessible materials
Access to accessible materials

Table 2. Main recommendations for providing online learning

5 CONCLUSIONS

Thanks to our ethnographical approach, we have been able to identify a number of difficulties and propose a series of recommendations geared towards the development or selection of a technological tool to help train people with intellectual disabilities regarding their incorporation into the job market. These recommendations are primarily linked to the fact that this technological tool has to generalise what students have learnt, mainly in terms of social skills.

We have also identified the main difficulties regarding education through the use of ICT for people with visual disabilities and have made a series of recommendations to this effect relating to two factors: the heterogeneity of the group and teacher training. Intragroup differences mean that first and foremost we need to consider personalisable solutions to help students with visual disabilities in their daily lives when undertaking online training, such as providing all possible formats. As well as this, to ensure that the material is also accessible and usable, it is essential that teachers in charge of preparing the materials have advanced accessibility training.

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