

@Science - Towards an Accessible Science

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Abstract

Higher education institutions all over Europe confess themselves to offering equal opportunities for people with disabilities. In fact there are still differences amongst study conditions, legal regulations, architectural access to university buildings and especially access to scientific study materials such as lecture notes, literature and other scientific materials. Above all blind and visually impaired students often face barriers regarding the access to digital scientific resources. Solutions for overcoming these barriers exist but only on local basis. Thus, the need for the setup of a European network for knowledge transfer regarding possible solutions, guidelines and best practices for access to digital scientific resources is obvious. This issue has been the initial point for the establishment of a project promoting access to university studies for blind and visually impaired people within Europe.

1. Introduction

In recent years increasing attempts concerning awareness and action towards inclusion and equal opportunities for people with disabilities could have been noticed within the European Union Area. Several resolutions refer to equal opportunities in education and training [1] as well as improving access to the knowledge based society [2]. Higher education institutions themselves emphasize to making science more accessible. Enabling and fostering access to digital scientific resources also contributes to a high extent to a full participation to "university life" consequently encouraging increased chances at the open labour market and social inclusion of people with disabilities, especially regarding blind and visually impaired people.

The proposed paper will describe a European Union research project dealing with enhancing the

access to digital scientific resources for blind and visually impaired people at university level and the creation of an information network among European scientific universities for knowledge transfer.

2. General Information on the Project

In order to enhance the access to scientific resources and materials during university studies for blind and visually impaired students a project called "@Science" has been established. The ongoing research project has been developed within the framework of the European Union eContentplus programme and is coordinated by the Universita` degli studi di Milano in Italy. The project started with the 1st of October 2006 and has a duration of 2 years. The aim of this project is to facilitate the enjoyment of digitally available scientific resources to visually impaired students and researchers. The consortium of partners consists of the coordinating Universita` degli Studi di Milano (Italy), the University of Linz, Institute Integriert Studieren (Austria), the Katholieke University Leuven (Belgium), the Comenius University, faculty of Mathematics, physics and informatics (Slovakia), the Union of the Blind in Verona (Italy) and the Pierre et Marie Curie Université (France).

3. Background and Idea of @Science

The main barriers encountered by visually impaired students going through scientific materials are firstly the poor accessibility in text books, mainly referring to mathematical expressions, and devoted educational materials (exercises, professor's notes, etc.); secondly the difficulties to get graphs, diagrams and technical drawings in tactile format or other alternative formats (e.g. through haptic devices) and thirdly the lack of personal software and hardware tools to perform the main activities involved in scientific research [3].

These issues can be faced and eventually overcome by sharing knowledge about previously and locally implemented solutions. Many solutions already exist but they are developed mainly on local bases [3]. The same texts and instruments are often newly adapted each time they are needed. This is an extremely expensive and time consuming process and it is due to an almost complete missing communication among the different actors involved in the scholarly flow. The main actors involved in this process are the scientific resources providers (digital resources providers, university libraries, publishers of educational resources, etc.), the end users (students, tutors, teachers), the tools developers (educational software and hardware manufacturers, assistive technology companies), the support services for students with disabilities within universities. A better integration and communication will lead to concrete results to support scientific studies approaching. Therefore, the purpose of @Science is to support the creation of an information network among European scientific universities, visually impaired students, scientific contents providers and hardware and software developers to empower fruition of scholarly material and courses by visually impaired students.

4. Rationale

At present visually impaired students face many difficulties in going through scientific studies. Because of the nature of scientific documentation, they have to be able to work with text, mathematical expressions and graphical representations.

4.1. Main barriers

Many barriers prevent blind people from accessing scientific documentation at university. In the first place mainstream assistive technologies, such as screen readers, Braille displays, speech synthesizers and Braille embossers, do not provide viable and quick access to digital scientific resources. That is due both to inherent structural complexity of mathematical expressions [4] and to the need of converters to Braille and speech output [5]. One more difficulty concerns the difference among national Braille codes, especially as for mathematical expressions. Therefore, Braille books on paper can be usually read only in a specific country and Braille display configurations have to be properly suited from country to country or translation software have to be run before reading a document. Moreover, the necessity to adapt mainstream formats for the blind has to be mentioned. For example, some scientific

electronic resources, such as PostScript and PDF files, have to be converted to LaTeX source files or to formats specific for the blind (e.g. DAISY format or text-based or XML-based formats). These conversions often cannot be achieved automatically, so they imply a time-consuming process, which generally delays the student's learning activity. In addition to that audio resources (e.g. audio books) are often language dependent since they are recorded by human readers. Therefore, cross country diffusion is extremely difficult [3].

The crucial point is that there is no cross country working network which allows exchange of information and resources (e.g. electronic resources, tools, etc.) among visually impaired students, especially as far as scientific documentation is concerned. There are many producers of digital contents usable by blind students (e.g. university support centres for handicapped people, national blind unions, national libraries for the blind, student initiatives, etc.). The lack of continuous communication often leads to redundant production and additional research efforts by the student.

4.2. New and unexploited opportunities

There are some opportunities which could lead to a competing approach for the improvement of the present situation.

The first possible occasion would be that some university libraries, above all those dealing with scientific books, provide online access to catalogues and to some resources (lecture notes, technical reports, papers, etc.). Because of web accessibility issues, some of these very useful services are not usable by visually impaired people. Slight changes could provide full access to a large variety of resources.

The next supposable opportunity is that some publishers provide online access to technical and scientific documentation, in particular to journals and manuals. These resources and their usability level are often unknown by blind students and by their tutors.

Furthermore emerging initiatives about multimodal access to information will provide full multimodal descriptions for scientific contents, too. Therefore, according to simple working practices, teachers, tutors and publishers could provide scientific electronic documents, usable both by visually impaired students and ordinary ones.

One more feasible practice is the use of speech technologies (e.g. digital audio players, text to speech translators, voice recognition engines, etc.). They are widespread and can improve multilingual speech access to scientific documentation.

4. @Science – The Information Network

An innovative approach to the above mentioned principles would be the setup and implementation of a cross country network about usability and accessibility of scientific resources by visually impaired students. This kind of network would contribute to inform professors, tutors and students about the problem and possible existing solutions; collect scientific documentation in specific usable formats; collect software speech and tactile tools helpful in studying science; widespread best practices and student experiences in using scientific resources with mainstream assistive technologies. These goals are meant to be achieved through technical meetings aiming to define and share best practices, web-based repositories or communication tools and devoted informative events organized by the @Science network. Technical meetings will involve working groups, digital content providers, institutions and assistive technology manufacturers. For example, at present there are many online scientific resources providers. Most of the mathematical expressions are published in web pages as images. The use of textual descriptions linked to images or the description of mathematical content through MathML markup language [6] would highly improve the accessibility level of these resources. Devoted technical meetings could inform interested digital resources providers about this problem and its possible solution thus coming to effective practices for distributing accessible web-based scientific contents.

The access point to the thematic network on Internet is a multilingual web portal. It can be browsed at the address: <http://www.ascience.eu>. This website collects pages concerning the aims of the thematic network, guidelines, examples, best experiences being collected by the network members, dates of relevant events about science accessibility by visually impaired people, how institutions can join the network, how to contact network members and how to subscribe to the services being delivered by the network (e.g. the newsletter, the document delivery, etc.). The main parts of the website are available in national languages. This website is also the portal to the repository of documents and tools. This repository will be enriched by members of the network during the project lifetime and it will collect scientific documents in accessible formats. For example, many educational resources are developed by university professors and they are distributed as PostScript files or PDF files. These formats are not completely accessible through assistive

technologies. So, the repository will collect mainly files in source format (e.g. LaTeX) or documents adapted in special formats (e.g. DAISY format, audio files, etc.). There exist also many tools useful in science learning. They are usually extensions to mainstream software (e.g. modules for numeric or symbolic computation software) or routines addressing one specific problem (e.g. the generation of non-visual descriptions of real function through tables of values). Some of these programs are developed on local basis and they are often not documented and not totally assessed. They will be assessed, documented and distributed through the repository. In order to support collaboration among universities about the problem of science accessibility, the website provides access to distance collaboration tools (e.g. a forum and a mailing list) which will be available in the coming stages of the project. This website was developed taking into account the most strict guidelines for web content accessibility developed by the W3C Web Accessibility Initiative.

Devoted events will be organized by the @Science network. In particular, two international conferences aiming to reach mainly universities and many conferences on local basis aiming to reach visually impaired students in secondary schools, associations for blind and visually impaired and assistants and experts in non-visual learning. These conferences aim to inform about new opportunities in science learning.

5. Added value of @Science

The @Science project highly contributes to improve the quality of learning among visually impaired students. This project allows taking one more step towards equal opportunities in studying for people with disabilities. At present, visually impaired persons are strongly discouraged in going through scientific studies. Furthermore, the network developed contributes to really achieve the concepts of universal usability and accessibility in the context of scientific learning.

6. References

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