



E-Learning Accessibility for blind students

M. Arrigo^{*,1}

¹ Italian National Research Council - Institute for Educational Technology - Via Ugo la Malfa, 153 - 90146 Palermo, ITALY

Since the middle of the 1990s, the number of colleges and universities which provide courses and degree programs via distance education has been growing dramatically. The advantages of the online learning have been widely described in the literature. However, the prospective promised with the digital era often has not become the reality for most people with disabilities, especially in educational context. Some studies of the statistical accesses of distance education web pages of the major organizations for distance learning have revealed a high percentage of inaccessible pages. In this scenario where almost all universities which offer traditional programs have started to, or plan to offer distance education programs using the Internet, it is very important to redesign traditional pedagogical approaches by integrating information and communication technologies into courses. The aim of this paper is to introduce some studies about the accessibility of the e-learning and to introduce an online learning environment designed for blind students.

Keywords Visually disabled students; online education; accessibility; Internet

1. Introduction

In today's society, where information plays an important role, being able to use Information and Communication Technologies opens up opportunities for holding more responsible social positions. It is also more convenient for governments, institutions, public and private enterprises to use the Internet to provide information services. Moreover, ICT offers great opportunities of social inclusion. Technological development can enable people with disabilities to improve their quality of life [1, 2, 3, 4, 5]. They can accomplish tasks that would be impossible to do without the computer, such as: writing a letter, communicating, drawing a picture, etc. Moreover, the digitalization of many public services such as education (school, university), shopping, banking, library, or even sending a letter allows people with disabilities to live in much the same way as those who are not disabled. They can acquire an "independent life" and achieve social integration. However, the prospective promised with the digital era often has not become the reality for most people with disabilities.

In educational context, since the middle of the 1990s, the number of colleges and universities which provide courses and degree programs via distance education has been growing dramatically. The advantages of the online learning have been widely described in the literature. However, most literature concerns the Internet as an educational tool, and only in the last few years, have publications, in the core distance educational journals, addressed the issue of accessibility for people with disabilities in using online distance education environment [6].

As reported by Waits & Lewis [7], 33% of US institutions that offered distance education courses in 2000–2001 did not know if their web sites followed accessibility guidelines, 28% followed the guidelines to a moderate extent and 18% followed the guidelines to a minor extent. Furthermore, Schmetzke [8] reveals and high percentage of inaccessible pages for the major US organization for distance learning. These studies prove that most online educational environments are still not accessible to students with disabilities. While the information and activities posted to internet sites are not appropriately accessible with adaptive technology the blind and visually impaired people will not benefit from these online opportunities.

In the next section, the author provides some advantages and disadvantages of Internet as an educational tool for students with disabilities. Then some consideration related to the accessibility of online

* Corresponding author: e-mail: marco.arrigo@itd.cnr.it, Phone: +39 0916809206

1 course for visual disabled people are reported. These considerations are followed by a presentation of an
2 online learning environment designed for blind students.

3 4 **2. Advantages and disadvantages of Internet for students with disabilities** 5

6 The advantages of using the Internet in the classroom are as diverse as the services offered by the net-
7 work. The Internet for students is the largest and most diverse information source. Moreover, the Com-
8 puter Mediated Communication (CMC), such as asynchronous communication (e-mail) and synchronous
9 communication (chat) would give the learner the chance to participate actively in cooperative learning
10 activities and to communicate easily with other learners. On major advantage of the CMC is they can
11 play an important role in social relationship. In fact, for a person with a disability, the internet communi-
12 cation tools can be a viable opportunity to interact with others without having the other participant's
13 preconceived notions of disability affecting the relationship [9]. Furthermore, the disabled are able to
14 interact with others with similar interests and concerns.

15 According to the Royal National Institute for the Blind [10] "the internet is one of the most significant
16 communication developments since the invention of Braille. For the first time ever, many blind and par-
17 tially sighted people have access to the same wealth of information as sighted people and on the same
18 terms". The digitalization of many public services such as education (school, university), government,
19 may allow people with disabilities to live in much the same way as those who are not disabled.

20 On the other hand, if the information and services provided by governments, institutions and public
21 enterprises are not fully accessible, there is a serious risk they erect new barriers increasing the informa-
22 tion gap and create a "digital divide" between those who can benefit from opportunities provided by ICT
23 and those who cannot. Another disadvantage of the Internet for students with disabilities is s/he has to
24 purchase special adaptive technology to make the computer accessible.

25 The accessibility issue of the Internet could be posed in two ways. One way is to demand that Internet
26 providers self-regulate their services in order to be accessible. However, this way is almost impossible to
27 implement, because of cyberspace enormous and disconnected components. Moreover, users would often
28 maintain the freedom of publishing. Another approach is to allow market forces to regulate the Internet
29 because the number of users who need accessible information and services has grown significantly (users
30 who need to access the net without GUI interface are in some ways like the blind users) [11].

31 32 **2. Considerations about e-learning accessibility** 33

34 There are two main aspects to take into account in designing the accessibility of the e-learning environ-
35 ments: technological and methodological issues. Both of them are vital for obtaining a fully accessible
36 online learning environment. For example, an LMS which has some fully accessible tools for learning
37 may be unsatisfactory for visually disabled users if the learning methodology was designed for sighted
38 users. Thus, the enabling technologies are very important but not enough. Similarly, a well designed
39 learning contents methodology, if not supported by a set of accessible tools, is not enough to allow the
40 disabled students to learn on the net.

41 The accessible learning management system presented in this paper, takes into account both aspects. It
42 is based on the tool described in [12, 13] which includes and introduces some research about the design
43 of the learning contents methodology for blind and visually impaired people.

44 45 **2.1 Technologies** 46

47 The most frequently used network technologies in e-learning are email and the Web. Today the mail is
48 still the most used service on the Internet. Because email is the main network communication tool it is
49 extremely useful to include it as part of any e-learning environment. Although email presents no signifi-
50 cant problems for users with disabilities, some research proposes techniques for improving email acces-
51 sibility [14].
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1 Likewise, the web is the most used tool for accessing information on the Internet and it is the best
2 solution for distributing educational material for e-learning. Despite WAI guidelines, Universal Design
3 principles, ISO standards and government policies, many web pages are still inaccessible for the dis-
4 abled. For example, blind users, and users who do not use GUI, for accessing the web cannot get an
5 overview of the structure of a text with one quick glance at the screen. Thus these users can be “lost in
6 hyperspace” very quickly. Producing a document overview is one of the main issues to be considered in
7 an application for surfing the Web which has a vocal interface.

8 Moreover, teachers and students can interact with each other using text chat in order to communicate
9 in a synchronous way. Real-time chat communication is difficult to use for users who can not interact
10 quickly with the computer, for example, who have limited hand function, learning disabilities or simple
11 students who use mobile equipments. Moreover, some chat is inaccessible for visually disabled people.
12 In [12, 13, 15] some considerations about the accessibility of the web and the communication service are
13 reported and some tools for improving accessibility are presented.

15 2.2 Methodology

17 In an educational context designing the content interaction is extremely important in order to reach a
18 learning goal. Moreover, in online learning the methodology is crucial. For example, a tool may meet
19 technical accessibility requirements, but it may be unusable for a blind student because it is designed
20 with a visual interface in mind. Likewise, the design of a lesson could be perfect if it is delivered using a
21 multimedia system, but may be poor if it uses adaptive technologies like a speech synthesizer.

22 Therefore, it is very important to redesign traditional pedagogical approaches by integrating informa-
23 tion and communication technologies into courses.

24 The main steps we follow for e-learning accessibility are: accessibility goals for the education content,
25 study of the disabilities of groups target, designing of the content to make sure they comply with the
26 accessibility guidelines, system testing and monitoring of the e-learning platform usage.

28 3. An LMS for visual disable students

30 The learning environment introduced is based on the tool described in [12, 13] which includes. In par-
31 ticular, all the learning resources are web-based and designed to make them easier to understand and to
32 interact with. Moreover, in order to provide accessible materials for blind and vision impaired learners,
33 we have designed a tool which helps teachers to test their online learning materials and expose and repair
34 barriers to accessibility. The tool complies with the existing accessibility guidelines (such as W3C's,
35 WCAG and Section 508).

37 3.1 The architecture

39 The architecture of the system is based on the client-server model. Figure 1 shows the framework func-
40 tions and the system modules. The client-server communication is based on standard Internet protocols
41 http and tcp/ip. All modules (server and client) have been developed in java language. The server pro-
42 vides search, chat and mail functions for client modules.

43 Furthermore, most of the tools developed are client adaptable (they show a specific interface depend-
44 ing on user client: PDA, browser, mobile phone).

46 3.2 Some tools to give the internet a voice

48 In order to support the blind students in their learning activities, we have provided some tools that, using
49 a vocal interface, allow blind people to: use a synchronous (chat) and asynchronous (email) communica-
50 tion system, surf the Web, and to search for information on the internet. In fact, using the CMC tools the
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learners can realize their potential to participate fully in online collaborative educational activities. Figure 2 shows the framework functions.

All the tools developed can support multiple languages including English, French, Italian, German, Spanish, so the user who installs multiple language TTS, has the advantage of either working in one language or switching between languages.

In addition, we have designed a specialized search service that allows students both to search using VocalSe@rch® [12] as well as to retrieve only fully accessible Web documents. In this way the student can choose to have a subset of search results which respect accessibility guidelines or to access all documents (even those which do not comply).

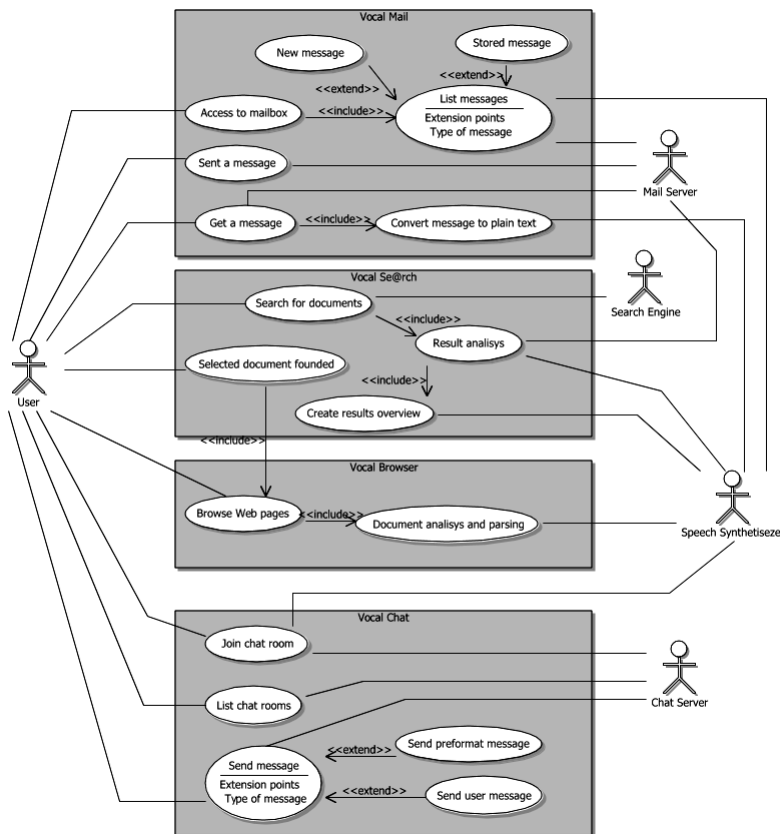


Fig. 1 Vocal tools use case view. Framework functions and the system module.

Finally, a number of tools have been designed which allow the teacher and/or course administrator to manage course activities such as creating a new course, selecting a course list of students and publishing lessons.

4. Conclusion

The Commission of the European Communities in the resolution [16] invites member states “To tap the information society’s potential for people with disabilities and, in particular, tackle the removal of technical, legal and other barriers to their effective participation in the knowledge based economy and society”. Despite all government policies and the introduction of numerous standards and guidelines concerning the usability, accessibility and universal design of the Internet for the visually disabled, as stated earlier in the paper, some digital barriers to using ICT are difficult to overcome.

1 Thus, even though the Internet today has become a communication media for everybody and the larg-
2 est distributed digital information space in the world, there is a risk that people who do not have access
3 will miss out on all the advantages and opportunities offered by the information age. Therefore, the
4 Internet could become a new barrier for the disabled increasing the information gap and creating a new
5 digital divide. People with disabilities will benefit from the significant social, cultural and economic
6 benefits of ICT as long as the information and services on the Internet are designed appropriately.

7 ICT offers great benefits to students with disabilities and enables them to participate fully in the so-
8 cial, cultural and economic development of their community.

9 This paper has presented some studies about the accessibility of the e-learning and some tools to give
10 the Internet a voice. These vocal tools have proved to be effective in supporting blind and visually im-
11 paired people in using Internet information and communication services especially for educational pur-
12 poses.

13 Our conclusions suggest that when designing technology for people with disabilities it is necessary not
14 simply to respond to their disadvantages but to take a more comprehensive view of their communicative
15 and social needs as well as considering their overall capacities and knowledge.

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