

# IMPROVING DESIGN OF E-LEARNING COURSES TO MEET SPECIAL NEEDS

Ileana Hamburg

*Institute for Work and Technology, Munscheidstr. 14, 45886 Gelsenkirchen, Germany*

Thorsten Busse

*Institute for Work and Technology, Munscheidstr. 14, 45886 Gelsenkirchen, Germany*

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**Abstract:** Web-based e-Learning could provide additional educational opportunities for disabled people to improve their qualification and to support their social integration especially into the knowledge-based economy. However, the requirements and wishes of disabled people are frequently not understood or taken into account by the designers of learning environments based on new media. Often, the users can not articulate their wishes about the learning environments and what they would like to learn for their future. In this paper scenario planning is presented as a method to help disabled people to express their wishes and plan their careers. Designers too, are addressed to increase their awareness about special needs of disabled people to improve the usability and accessibility of Web-based e-Learning. Examples of on-going projects are shortly presented.

## 1 INTRODUCTION

The use of the Internet is growing worldwide at a rapid rate. Its technologies in particular Web-based services have the potential to revolutionise approaches to learning (online, e-Learning). There has been a rise in the availability of e-Learning education and training programmes and complementing this growth, the popularity of online education is increasing.

The potential of new technologies particularly the Web should be used in a way that both students and staff have benefits. Additionally, learning options available for students should increase, rather than using e-Learning as a cut-price approach that leads to a reduction in quality. These new forms of learning could provide additional educational opportunities for disabled people to support their social integration and integration into the knowledge-based economy. However, people with disabilities are among the least considered in the context of online learning (Kinash et al. 2004). This is particularly disconcerting, because estimated 10% of students are disabled in the European Community (Paciello 2000) and even estimated 13% in Germany (Ham-

burg et al. 2002). Estimated 60% of disabled students in the UK are dyslexic, though the representation in the general population is much smaller. This indicates the continuing barriers to further and higher education encountered by other groups of disabled people. In conclusion, in most countries a substantial subset of the total population is potentially excluded from full advantages of the Internet and online education.

There exist guidelines that outline means for accommodating individuals with special needs into online courses. However, many courses still contain barriers for this population (Burgstahler 2004).

e-Learning tends to use technologies and approaches developed in other contexts, such as in the industry, which are not necessarily appropriate for e-Learning applications for people with disabilities. There is still a general lack of awareness of the need for accessible Web-based design, although there exist web accessibility guidelines produced by the World Wide Web Consortium (see chapter two) (Hersh et al. 2004).

There are concerns that increasing the accessibility for disabled will erode academic standards (Wagner, 1989). Such concerns are largely based on

misunderstandings and ignorance of the importance of and requirements for accessibility, as well as the types of measures that will result in accessible learning environments (Gosden and Hampton 2000). However, increasing accessibility is likely to lead to benefits for all students, including non-disabled students. It is unlikely to have any deleterious effects on quality or academic standards (Hamburg et al. 2005; Muscan et al. 2004).

Some teachers consider that accessibility is unnecessary due to the very small numbers of disabled students. However, inaccessibility of courses, buildings and other facilities are one of the reasons for the continuing under representation of disabled people in further and higher education.

The requirements and wishes of disabled people are frequently not understood or taken into account by the developers of learning environments based on new media (Hamburg et al. 2003). Many designers believe erroneously that assistive technologies alone can remove all access barriers.

Often the users can not articulate their wishes about the learning environments and what they would like to learn for their future.

In this paper the scenario planning is presented as one method to help disabled people to express their wishes and to plan their careers on one hand. On the other hand scenario planning is meant to support designers in decision making which addresses the special needs of disabled people at e-Learning courses to improve usability and accessibility. It is intended to anticipate potential problems before any code or HTML is written at all.

e-Learning in our understanding is "... the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration." (White Paper, 2003).

## 2 E-LEARNING COURSES TO MEET SPECIAL NEEDS

Distance learning courses and environments that are Internet and Web-based (e-Learning) can be used to apply the potential of the Internet. Other information and communications technologies too, can support education and training of disabled people through:

- Facilitating needs-oriented learning by providing tools for searching information and learning content in the Internet which corresponds both to the learning topic and to the learning situation of the student.

- Usage in the context of action-oriented learning, with the further aim of obtaining Internet skills.
- Supporting a searching and exploring process with the learner as focal point and the trainer or tutor in a support role. Furthermore, to provide a loose framework in which learning is carried out.
- The provision of additional functions, such as computer-supported acquisition, distribution and creation of knowledge as well as collaborative learning.

The subject of open Web-based e-Learning has engaged researchers world-wide for a number of years and different approaches have been proposed for Internet-based distance learning. Methods for synchronous learning (Eschelbeck 1995; Boegh et al. 1998), asynchronous learning (McDaid et al. 1999), as well as environments to cover communication needs of collaborative work in a learning environment (McGreal 1998) were proposed.

e-Learning techniques can either be the sole (or main) teaching approach or supplementary to traditional courses. There are advantages of using them in addition to traditional courses, because this allows students to examine material from different view points and/or to choose the learning approach that they prefer. The opportunity to study material in different ways generally increases understanding and learning. In addition, the combination of e-Learning and traditional classes gives students who can not attend particular classes the opportunity to complement missed study material. This can be principally beneficial to those groups of disabled students, which prefer to work at home. There is anecdotal evidence that many disabled students prefer to work at home. This is of course dependent on the student's access to the Web and the material which is available on the Web in an appropriate format.

Making the best use of the medium to encourage student interests and active learning requires appropriate teaching approaches. It is not effective to simply place a set of notes on the Web or transmit a traditional lecture across a video (or audio link). Therefore, teaching staff will require training and access to suitable materials that are more appropriate for the new media. Web-based and other learning materials too, need to be updated just as frequently as materials used in traditional classrooms.

Unless e-Learning environments are not well designed, they can increase, rather than overcome social isolation. Individual learning without interaction with other students and teachers will be the reason. However, learning paradigms based on "networked learning", that is learning in a learning

community and/or "blended learning" i.e. an appropriate mix of e-learning and traditional class-room tuition can be used to overcome this disadvantage.

Studies show that there is an endless list of design elements of e-Learning courses conflicting themselves due to imposing barriers and at the same time providing support for students with special needs. To create a manageable list, it is necessary to focus on elements which affect the student to participate fully in e-Learning courses.

Results of a literature review and of discussions with disabled people were that the main factors for the design of Web-based courses can be grouped in five categories: Focus on disabilities, Design of the Web-site, Applied Technology, Instructional Methodologies and Support Systems. These will also constitute the descriptors for our scenarios (see next part) and are complex elements.

When focussing on disabilities it needs to be considered that specific elements addressing different disabilities must be present. In this essay as an example visual and hearing impairments are considered.

The World Wide Web Consortium (W3C) defines standards and gives recommendations of what a good and informative Web-site is. The accessibility of Web-sites for disabled persons was especially taken into account. The chapter titles of the 'Guidelines Web Content' (W3C 1999) are:

1. Provide equivalent alternatives to auditory and visual content
2. Don't rely on colour alone
3. Use markup and style sheets and do so properly
4. Clarify natural language usage
5. Create tables that transform gracefully
6. Ensure that pages featuring new technologies transform gracefully
7. Ensure user control of time-sensitive content changes
8. Ensure direct accessibility of embedded user interfaces
9. Design for device-independence
10. Use interim solutions
11. Use W3C technologies and guidelines
12. Provide context and orientation information.
13. Provide clear navigation mechanisms
14. Ensure that documents are clear and simple.

These guidelines provide a good first idea about what is necessary in the category Design of the Web-site to ensure good accessibility.

When referring to Applied Technology, it becomes obvious that additional technologies (cameras, video conferencing systems, chat rooms,

screen readers, etc) pose barriers for individuals with special needs.

Furthermore, it is important to consider that both Web-based and non-Web-based technologies are necessary to guarantee an efficient participation in an e-Learning course.

The category Instructional Methodology refers to assigned activities during the learning sessions, communication, timing requirements, and curricular content.

Support Systems include internal support (content sensitive help) as well as external support coming from other persons than the course's teacher.

In the following we describe shortly the scenario method used in our projects.

### 3 SCENARIOS

Scenarios are "narrative descriptions of assumptions, risks and environmental factors and how they may affect operations. Scenarios attempt to explore the effect of changing several variables at once with objective analysis and subjective interpretations" (Wikipedia 2005).

"Scenarios are narratives of alternative environments in which today's decisions may be played out. They are not predictions. Nor are they strategies" (Ogilvy and Schwartz 2004).

Scenario planning derives from the observation of the given impossibility of knowing precisely how the future will play out. A good decision or strategy adopted is the one that plays out well across several possible futures. To find that "robust" strategy, a variety of scenarios are created in a way that each scenario diverges markedly from the other. These sets of scenarios are essentially constructed stories about the future. Each of the scenarios is modelling a distinct, plausible world in which we might someday have to live and work.

To be an effective planning tool, scenarios should be written in a form of absorbing and convincing stories that describe a broad range of alternative futures. Scenario planning can contain elements that are difficult to formalise such as subjective interpretations of facts, shifts in values, new regulations or inventions. It is important for scenarios to include plausible, but unexpectedly important situations and problems that already exist in small scales in the present.

Some steps in the planning of scenarios are as in the following (Wikipedia 2005):

- Decide on the key question to be answered by the analysis



- Set the time and scope of the analysis
- Identify major stakeholders
- Identify main descriptors (factors of influence or driving forces)
- Identify the extremes of the possible outcomes of the (two) driving forces and check the dimensions for consistency and plausibility
- Define and write out scenarios
- Assess the scenarios. Are they relevant for the goal? Are they internally consistent?
- Identify research needs and develop quantitative methods
- Converge towards decision scenarios

#### 4 EXAMPLES OF SCENARIOS WITHIN EUROPEAN PROJECTS

In the following two projects scenarios in which the authors are involved, were developed about people with different kinds of disabilities using Web-based e-Learning modules.

A project within the GRUNDTVIG programme of the European Commission is the project IECUVADVLA (Hamburg et al. 2005). IECUVADVLA means "Improvement of Employment Chances of the Unemployed and the Visual and Auditive Disabled by Innovative Applications". IECUVADVLA was initiated in the context of a participatory learning partnership of five countries: Romania, Germany, Hungary, England and the Netherlands. Investigations of the existing situation in the participating countries were already carried out. These are, concerning the educational assistance by electronic means, that especially senior disabled often have moderate levels of education. In the current phase of the project, informative assistance will be provided based on the results of the investigations. Furthermore, some specific Web-based e-Learning courses will be designed in order to improve computer skills, the employment application techniques of the target groups, and the awareness and knowledge about the target group's rights.

Scenarios are also used in the European project TYAEST. Within this project alternative education models for young adult education, particularly for young disabled adults, were developed to increase "consumption" of education. Furthermore, it provides an alternative perspective upon continuous education and enables the planning of careers.

It was planned to disseminate and analyse the scenarios within a workshop held together with

disabled young people at a special school in Germany.

One of the goals of this project is to use scenarios to determine patterns of interaction of a disabled person in a Web-based e-Learning course. Additionally, functions protecting the software from irreversible actions of users need to be developed, for instance "warning"-alerts need to pop-up. Another goal is to motivate users to achieve Web-competence and to facilitate the planning of their future. The chosen scenario approach in the projects is slightly different from the traditional use of the scenario technique. Scenario technique is conventionally used either as a teaching method in educational systems, or as a planning tool in business or politics. The scenarios developed and used in the projects IECUVADVLA and TYAEST combine the teaching and the planning aspects. They are to generate benefits for students, for developers of specialised e-Learning applications, and to increase knowledge about e-Learning applications for disabled people even at political decision-making levels. In literature a lot of learning scenarios for disabled can be found. However, the literature mainly targets the group of developers of e-Learning applications and is mostly provided by scientists or university students (Florénn and Lindén 2003). The DEMOS project in England examined learning needs of disabled persons by interviewing them (for more information about the project: <http://jarmin.com/demos/project/index.html>). In IECUVADVLA and TYAEST it is intended to develop the scenarios in intensive cooperation with the affected group. The demands and wishes of disabled learners will be linked together with experiences and knowledge of scientists and developers of learning applications. Even if aspects of usability and accessibility are already taken into account in nowadays e-Learning programs, it is important to respect the learners' wishes. To introduce the scenario technique a "dummy scenario" has been presented to the students from the special school in Bochum during the first workshop.

Klaus is a 16 year old boy visiting the 10<sup>th</sup> grade. His hobbies are swimming, reading and computer gaming. So far he is an ordinary teenager but he has got a handicap, he is blind. At the age of three he drunk antifreeze (smelled like citron) which contains methyl alcohol and for the reason his eyesight is completely gone. Nevertheless he has plans for his vocational future. In former times a blind person had very few possibilities for working, best known professions were piano tuner or beggar. In nowadays handicapped people have more opportunities. Klaus is interested in working as a clerk in an office. For-

fortunately most of the work in an office is done with computers. In school he is trained to use a Braille-device and a speech output device for reading the screen contents. Therefore he is able to cope with most of the work as well as a seeing person. To improve his skills and his employability he wants to learn building up a Web-homepage. Therefore he attends an e-Learning course for HTML and homepage design especially developed for blind users. He found this course by visiting an online portal for blind users. This course is adjusted to the needs of blind users in different ways. It is HTML based and needs no further software but a standard browser e.g. Firefox or Microsoft Internet Explorer. The course works without video clips or flash animations so neither the screen reader nor the Braille-output device has problems to present the content of the e-Learning platform in a suitable way. To raise accessibility the platform is set up in a simple way and all learning modules have the same structure. The course is supplied by specially trained and certified e-Learning-trainers which communicate with the learners via e-mail, phone, chat, forums or online conferences.

The animated scenario was presented to the students with different disabilities of this special school in Bochum Germany. Questions about plausibility and consequences of it have been discussed. Some students express that the scenario could help them to think more positive about learning and future careers.

The students like scenario methods and want to work themselves in groups to develop other new scenarios. The topics they proposed were about using Web for learning by: visually impaired users with hand tremor, users with dyslexia, deaf or hearing impaired, user with colour blindness. The key question for the scenarios is "how the Web can make some e-learning tasks easier for people with disabilities". The two main factors of influence are the type of disability and the technology used.

In the next workshops these scenarios will be presented and discussed. They will be analysed in connection with their consistency and relevance for the target group. Strategies for lifelong learning will be developed together with the students in this context. From the previous discussions with the students it could be concluded that the students do not understand what means and how important is lifelong learning for their integration into social and working life.

It is intended to find patterns of interaction of a disabled person in a Web-based e-Learning course. Two developers of e-learning environments will be

invited to the workshops. They will try to make some adaptations at the Web-based learning environment developed within the past Leonardo project EURO H about distance learning for people with disabilities (Hamburg et al. 2004).

Additionally, functions protecting the software from irreversible actions of users will be developed, for instance "warning"-alerts need to pop-up.

The adapted Web-based learning environment together with two learning modules about Internet and its applications for disabled-oriented information searching will be offered to the students for testing.

The scenarios developed by young people with different disabilities and improved will be presented to a group of elderly people (50-65 years old) being participants within the project IECUVADVLA. The main topic of the discussion with this group will be the lifelong learning of elderly people by using the Web.

Also the adapted Web-based learning environment will be presented and tested. This will be available for elderly people who would like to learn within the European Distance Learning Centre developed within EURO H.

## 5 CONCLUSIONS

The importance of e-learning and particularly of the Web for disabled is recognized but the process of designing accessible e-learning courses for them is very complex. It requires attention to many variables and considerations of needs what are often unpredictable. Disabled people can not always express their needs or wishes or have not awareness to plan their future career.

Scenarios which resemble a set of stories, written or spoken, can express multiple perspectives on complex events giving meaning to these events. We consider that they are suitable for shaping learning environments for disabled because they present alternatives images.

Effective scenarios need not to be always right; they need to foster discussions that are very important for disabled people who are often isolated socially. If the endpoints of a scenario are unbelievably extreme, then the uncertainties as variables can be moved closer to what should be achieved. It is important to determine disabled people to articulate their needs and the developers of e-Learning environments to understand and to try to integrate these needs and wishes into the systems.

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