LESSON D5_EN. GUIDELINES FOR THE CREATION AND IMPLEMENTATION OF eLearning MATERIALS: ASPECTS RELATED TO THE TARGET GROUP

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After having learned this lesson you will be able to reach more with the following knowledge:
On the benefits and added value of e-Learning for motor impaired persons
On how e-Learning could be accessed and practiced for persons from this group

CONTENT OF LESSON.

LEARNING OBJECTIVES:

After having learned this lesson you will accomplish the ability to:

- Know how to use the eLearning tools for the creation of eLearning components
- What kind of production process may be helpful for the development of eLearning components
- Interesting guidelines and aspects for the production of static and interactive content

1. Usability Aspects of eLearning Tools and Technologies for the Target Group

E-Learning, a form of ICT, as a basic right

E- Learning can be regarded upon as a specific form of learning using Information and Communication Technology (ICT). Handicapped persons may benefit from ICT in many ways. Above all, they may be ICT users and producers of ICT services like any other. There are strong legal arguments to make ICT products also available to persons with special needs. Handicapped persons have an equal right to ICT based information, services and provisions. This so called citizenship paradigm (in which handicapped persons are regarded upon as citizens with equal right and duties) is more and more seen as a basic right embedded in formal laws (e.g. anti discrimination legislation) in many European countries as well as in EU legislation. Handicapped persons are an important part of today's society. Some 10 % of all inhabitants of the EU, 38 million citizens, suffer from some form of impairment (1). E.g. in the United States 6,8 % of the population (17,4 million people) have a mobility impairment (2).

ICT use to compensate for mobility impairments

There are not only formal and legal reasons to give persons with mobility impairments full access to ICT provisions and services. ICT is a form of handling information in an almost non- physical way. Due to its nature it is able to bridge distance and time without need for physical replacements not demanding mobility of its users. ICT services and provisions are extremely suitable to compensate for the handicaps of mobility impaired persons. ICT will contribute to the social integration and participation in many domains of the lives of mobility impaired persons, including the participation in education and employment.

Exclusion from ICT and e-Learning

The use of ICT in general and e-Learning specifically by mobility impaired persons to date is still far from common. Numerous barriers for handicapped persons in the use of ICT are known. Many of these exclusions have to do with limited accessibility and usability of devices, services and technologies.
In 2001 and 2002 iRv, the Dutch Institute for Rehabilitation Research, investigated the barriers the motor impaired persons actually meet in the use of ICT provisions (3). The barriers are manifold and very varying. Just to mention some major problems:

- The lack of universal guidelines for the accessibility and usability for designers of operating systems, application software, websites and so on. Because of this lack impaired users cannot benefit from a Universal

Access approach (giving access to every user, whether handicapped, having any other special need or not). Also the configurability of the computer is often not supported. Further, there is a lack of knowledge about universal guidelines;

- Lacking awareness in the world of non- handicapped persons about the needs for universal access;
- In many countries there is not one well recognized and easy- to find service provision for information about ICT and handicap (e.g. on technical aids, their use, legal aspects);
- The social- economic position of handicapped persons often leads to diminished computer- and ICT use and – due to lacking equipment - also often leads to a lack of skills in their use;
- The lack of adequate structures for information and advice on assistive ICT devices;
- The lack of adequate possibilities for coaching and instruction once ICT provision and additional technical aids have been realized.
- Problems with different laws that are not really integrated or attuned to each other or even lacking legislation on the provision of technical aids at a national level;
- The lack of governmental policy or visions on the access to ICT for handicapped persons.

The here mentioned barriers do exist in many countries of the European Union. Through its E-Accessibility program the EU has now made steps at the community level. However, much remains to be done and it is a responsibility of designers and developers of technology and services to take into account the guidelines that do exist. In the chapters eight and nine will therefore attention be paid to the needs of 'special' users, especially persons with mobility impairments, in order to meet their demands.

Specifically on the use of e-Learning for e-Inclusion several specific mental barriers do exist. Some of them, like lack of trust or lack of motivation, are directly user related aspects, but there are also barriers included in the production of the e-learning system. Such barriers are formal approaches, non adaptive technologies, lack of meaningful context and generalist methodologies which do not pay proper attention to the social and cultural context of the use of the materials (4).

Specific advantages

E-Learning has numerous specific advantageous aspects for mobility impaired persons. Just to mention some of the most important aspects:

- The first advantage has to do with the fact that e-Learning is a form of distance learning. Learning can be done at virtually any location where the person lives or stays (place independence). There is a limited need for physical mobility.
- The second major advantage has to do with the fact that e-Learning is less dependent of strict school hours and can be done at almost any time (time independence). Disabled persons, due to other working methods or fatigue, often have a need to do things in their own pace. Apart from that they often have an agenda in which personal care is consuming much time and needs to be done at strict times.
- Another big advantage is the fact that, thanks to available modern technical aids and especially computer adaptations, materials can be made accessible to persons who could not handle these materials efficiently before or could not deal with them at all. For many of them it would for instance not be possible to make college notes without ICT use or handle printed materials.
- E-learning is a new concept without the 'burden' of traditional school systems. It has the ability to offer disability related content and to integrate the specific demands and needs of mobility impaired persons in the curriculum from onset. 'E-learning as a social equalizer'.

When it comes to M-learning, mobile learning as a specific form of E-learning, we apparently seem to deal with a contradiction. Why do we want to bring mobility impaired persons 'on the move' by offering them forms of m-learning if e-learning in general takes away the needs to do? It is all about having the freedom to choose and offering the same possibilities that non- handicapped persons have. In principle it is up to mobility impaired persons themselves to use the possibilities of M-learning or not. Authors of learning materials however have the obligation to create optimal conditions (from an accessibility and usability point of view) that allow to make the choice between static and mobile learning!

The first prerequisite for m- learning is adequate mobility. When it comes to solutions, one way to go is integrating ICT hardware with mobility. There is already much knowledge and technology available to integrate ICT provisions in recent mobility aids. Therefore, m-learning will be a real success for mobility impaired persons if they have access to efficient mobility aids- and provisions. ICT in m-learning for impaired persons is a part of a chain of services and provisions available to them.

Fig. 1: a computer integrated in an electronic wheelchair. From: iRv.

2. An example of a motor impaired person using e-learning

Willem is a 19 years old boy living in a small town ina Western European country. In his early childhood, when he was about 18 months old, his family doctor did a close examination of his nervous system and muscular functions. His parents were worried about the fact that he was very slow in learning to stand and walk independently. 'He walked like a drunken sailor' his father said at that time. After further examinations at a hospital by a neurologist he was diagnosed having a slow progressive, hereditary form of muscle disease. In the late 80's it was already common for handicapped children to go to a normal school, and Willem went to the kindergarten just like the kids from his neighborhood. He also spent the first few years at a regular primary school which he enjoyed very much. However, his mobility impairment gradually worsened and caused always more problems. Willem needed much help to go to the toilet, he could not attend the regular gym classes and there was a need to have frequent physical therapy treatment during school hours. Therefore, at the age of nine, his parents decided that he would be better of at a school for special education in his home town. Once there, he was provided with a manual wheelchair and followed an individual educational program at the basic level. At the age of thirteen he went into special secondary education at the middle school level. He could still walk small distances using crutches but used an electric wheelchair most of the time, also due to the fact that the chair of this provision supported his body posture optimally. He used common educational resources like the library or the computer in his classroom. He had no problems in mastering common computer use, which he partly had already learned at home. Initially there was no need for computer adaptations, however due to his worsening hand function his Occupational Therapist had to learn him at the age of 14 to use the specific settings of his computer. Through the use of the 'Accessibility menu' in the Windows Configuration screen he could change the mouse pointer movements. He also could adjust the reactions of his keyboard on involuntarily pressing two adjacent buttons. By now he is using is specific small keyboard, the Cherry mini keyboard, which makes it possible for him to do keyboard operations with minor movements of the underarm and hand. He also uses a sensible and very small joystick as a mouse replacement (see the illustrations below).

Fig. 2. Mini keyboard 'Cherry'. Courtesy of Kompagne.

Fig. 3. Mini joystick 'Easystick'. Courtesy of Kompagne.

3. How mobility impaired persons may generate eLearning components

At the age of 17 Willem finished his secondary education. By now he had to learn a job. It was his wish to become a bookkeeper just like his dad, and he was convinced that he could perform such a job for a long time. To be educated as such he could go into special professional education but this could not be done nearby and Willem was not willing to leave his beloved parents and girlfriend for two years. With the help of a regular regional center for professional education, which makes the materials available for online publications and periodically coaches him, as well as with the help of a web school for the handicapped (www.webschool.nl) serving as a service provider he is now following the courses from his home. He can do so in his own pace and expects that his studies will take three years. He will still need an adapted work place to practice but the practical problems to obtain such a work place will be solved by a job coach.

Fig. 4. Adaptive computer use: head pointing.. www.rtdhetdorp.nl

4. How mobility impaired persons may generate eLearning components

Access is all: Rules and standards for accessibility

'Unless information technology is truly accessible to all, the potential of information to empower all countries and all people will not be realized'.

Kofi Annan, UN Secretary General
United Nations, 2000

Introduction
There are 37 million people with disabilities in the EU, while the number of older Europeans is steadily increasing. As *e*Government interactive services become increasingly central to our lives, these groups risk severe social exclusion due to a range of technical barriers they face when using the internet. Limited or no access to resources like websites is the most prominent barrier. Most of these barriers can be easily avoided if site designers were to follow a set of simple rules covering site content, structure and coding and materials that are accessible for all persons. To do so in a common and well- structured way universal guidelines for web accessibility were developed. Acceptance and application of accessibility standards is the first and most important prerequisite in generating E-learning materials!

Content Accessibility Guidelines
The international World Wide Web Consortium (W3C) develops interoperable technologies (specifications, guidelines, software, and tools) to lead the web to its full potential as a forum for information, commerce, communication, and collective understanding. Hence its Web Accessibility Initiative (WAI) creates guidelines regarding content, browsers, authoring tools and is actively present for the specification of the new web technologies. The **Web Content Accessibility Guidelines (WCAG version 1.0)** are recognized as a *de facto* standard for the design of accessible Web sites.
The W3C/WAI Content Guidelines were adopted for public web sites in the EU in the context of the *e*Europe 2002 Action Plan. The adoption helps improving Web access throughout the public sector, particularly in e-Health, e-Government, and e-Learning.

Fig. 5. Level Double- A Conformance icon.
Pages bearing this logo claim conformance level double A with the W3C- WAI guidelines.

Fig. 6. W3C- WAI logo

How do these rules and guidelines make websites accessible to people with disabilities and older people?
Motor impaired persons often have great difficulties in fine motor skills like mouse use or scrolling. Blind people, for example, 'read' Web pages using software tools known as *screen readers*, which generate speech and/or refreshable Braille output. Even the simplest web pages generally feature images and use tables to format their navigation menus and content, while many others use user-side scripts, animation and other technologies to - supposedly - make their navigation systems more user-friendly. This often creates problems for people with visual impairments, as they cannot see the images and their screen readers can have serious problems interpreting tables, animation and possibly java script. In many cases this renders entire sites unusable.

The guidelines provide a number of solutions, particularly if they are followed from the beginning of the site design process. Java scripts and animations should be complemented with alternatives methods, for example, while special codes and extra text can be used to describe images and table's structures, in ways that *screen readers* can exploit. These codes are not difficult to implement, but even if they are aware of them, most website builders - along with the designers of web authoring tools - generally consider them optional.

The guidelines cover many more issues than these examples suggest. Between them, they should improve web sites for all users. Some of the guidelines, for example, address the fact that older people can find some complex web sites hard to navigate. Users with low literacy levels may also benefit from it. In addition the application of the guidelines can help non disabled people using new technologies (for example digital assistants, mobile phone browsers, with limited Web capabilities or with hand-free/eye-free interfaces, and possibly over lower-bandwidth connections) or people using devices in noisy or under/over lighted environments. Therefore by following the guidelines and meeting the needs of these users, designers can create more useable and friendly sites for everyone. That is called Design for All.

Usability

Why you should make your website accessible
Using the web standards of the World Wide Web Consortium (W3C) means that pages use valid code and that content and presentation are separated by using style sheets. This means that sites are generally less voluminous, have faster loading time, are better accessible for visitors and are easier to maintain.

By applying the W3C Web Content Accessibility Guidelines 1.0, any site is more accessible to all, including people with disabilities and the elderly. Sides built folowing these standards will more easily comply with accessibility legislation in an increasing number of countries worldwide.

Lower costs
By using a valid code that also complies with the Web Content Accessibility Guidelines 1.0, sites mostly work on multiple platforms and in different browsers. In that case there is no need to make separate sites for different browsers and platforms. This can significantly reduce costs of developing a website.

- By separating content from presentation, web pages are more easily accessible, files are smaller and load faster. On Dutch government sites, a volume reduction of up to 60% was achieved by using a validated and accessible code. This can significantly reduce the cost for server load and bandwidth;
- By using valid code and complying with the Web Content Accessibility Guidelines 1.0, it is generally easier and less expensive to change a website. Examples: changing the look-and-feel of a website only requires the adaptation of the relevant style sheet without having to change the content. By storing the content separately will also allow to use content for another website and for other media like mobile phone, PDA etc;
- Search engine robots that access a site can be considered to be handicapped; complex scripts and other inaccessible aspects of a website may prohibit access. Accessible sites are indexed faster and provide optimal results.

Increased usability

By reducing the volume of pages, loading times are shorter, so visitors will spend less time waiting for pages to appear on their screen. This can increase the number of pages users can visit at the same time. If you have an internet store this can be a very valuable aspect;

- The site will load in most older and new browsers, but also in text browsers etc. This means that more people can use a site;
- By reducing the size of the pages, anysite will be available longer and load faster in case of emergency when many people try to reach a site;

Ready for the future
Now that many countries implement laws to enforce the WCAG 1.0 guidelines for accessibility, one's site will be able to meet almost all country or region-specific accessibility standards.
WCAG 1.0 standards are internationally accepted and drawn up with input from all stakeholders, including the companies that make the browsers. Standardization more or less guarantees a website's usability in the future. The standards are well explained on the W3C website and, in most cases, it is easy to test these standards for compliance.

If WCAG 1.0 techniques are used for a website, maintenance and development will be easier in the future. The code and structure of the site is easier to pass on to internal and external developers, thus providing a good technical basis for the work.

The techniques used for one website can be applied to others. This is extra attractive because of the standardization, guaranteeing compliance of techniques in the future and making them usable for other modalities and platforms. Examples are use of a website on a mobile phone or PDA.

5. The production process of learning materials for eVET also accessible for the target group

Why do we need to make learning materials for eVET also accessible for motor impaired persons and for disabled persons in general?

- Access to information and learning is essential to a free society.
- Our moral responsibility is to ensure that people's ability to participate in the information age is not limited by a disability.
- Making the Web accessible allows people with disabilities to participate as equals at school, at the workplace, at home and in the world beyond.
- Accessible information helps in making handicapped persons economically interdependent, and increasing participation in the economy is good for everyone.

Web resources are "accessible" if people with disabilities can use them as effectively as non-disabled people. Many Web pages and digital media in general present barriers to people with physical, visual, hearing, and cognitive/neurological disabilities. Common accessibility problems on Web sites include:

- sites that are hard to navigate on due to complex structure
- small objects, icons, applets or even moving objects to click on
- need to scroll frequently; vertical scrollbars
- images without alternative text
- lack of alternative text for image map hot-spots
- misleading use of structural elements on pages
- uncaptioned audio or undescribed video
- lack of alternative information for users who cannot access frames or scripts
- tables that are difficult to decipher when liberalized
- sites with poor color contrast.

Educational software presents challenges for students with disabilities in a number of ways. E.g. tools for graphing and solving equations in mathematics allow students today to approach math from an entirely new perspective, learning constructively rather than memorizing algorithms. But if students can't use the software that makes such an exploration possible, they will not have the same valuable learning experiences that other students have. In some cases, the child with a physical disability may be "excused" from the computer lesson and sent to another area of the room for a different activity.

This lack of accessibility stigmatizes children by preventing them from using the same materials as their peers and limits their educational opportunities. Accessible interactive software can bring the benefits of multimedia and experimental learning to students who may otherwise be left out. Interactive learning experiences will be especially enriching for students who may otherwise have more limited experiences. Because students with disabilities may not be exposed to as wide a range of activities and environments as other students, software can contribute positively toward filling in some of those gaps.

Chemistry experiments, for example, may be more easily carried out in a simulation than in a wet lab for some students. Biology lessons learned from dissections may be more meaningful to some students using simulation software with an effective keyboard interface than watching others use a scalpel. The importance of hands-on science learning should not be forgotten, but when electronic alternatives are appropriate they must be accessible if they are to benefit all students. The guidelines in this document, as well as the software accessibility guidelines make it possible to create accessible interactive software. Software should allow fonts to be adjusted, provide clear contrast for objects that students must locate and manipulate, include keyboard commands to reduce mouse dependence, and provide a system cursor that moves with important screen events.

Basic Requirements for Providing Access

The following are general principles that should be followed in ensuring that distance education courses are accessible to students with disabilities. They represent the general concepts of the Americans with Disabilities Act, ADA, (comparative legislation is not in force in Europe and legislation on the issue of the right to equal access still is lacking) but which can be seen as a set of minimal requirement. In the next pages of this paragraph, specific guidelines will be provided for resolving access issues with respect to particular delivery modes commonly used in distance education. These guidelines were mainly derived from California Community Colleges (7).

1. One of the primary concepts of distance education is to offer students "Learning anytime, anywhere." Therefore, all distance education resources must be designed to afford students with disabilities maximum opportunity to access distance education resources "anytime, anywhere" , if possible without the need for outside assistance (i.e. technical aids, personal caregivers, etc.).

2. Distance education resources must be designed to provide "built-in" accommodation where possible (i.e. closed captioning, descriptive narration) and/or interface design/content layout which is accessible to "industry standard" assistive computer technology in common use by persons with disabilities.

3. Whenever possible, information should be provided in the alternative format preferred by the student (i.e. electronic format for use as a spoken book , descriptive narration, , large print, electronic text). When choosing between possible alternative formats or methods of delivery, consideration should be given to the fact that methods which are adequate for short, simple or less important communications may not be equally effective or appropriate for longer, more complex, or more critical material (Example: Use of a telephone relay service may be an acceptable method for a faculty member to respond to a brief question from a deaf student during his/her office hours, but probably would not be appropriate as a means of permitting that same student to participate in a class discussions in a course conducted by teleconference.)

4. Adoption of access solutions which include assigning assistants (i.e. page turning, readers) to work with an individual student to provide access to distance education resources should only be considered as a last resort when all efforts to enhance the native accessibility of the course material have failed.

5. Access to distance education courses, resources and materials include the audio, video and text components of courses or communication delivered via satellite, Instructional Television Fixed Services (ITFS), cable, compressed video, Local Area Network/Wide Area Network (LAN/WAN networks), Internet, telephone or any other form of electronic transmission. Access to resources and materials include the audio, video, multimedia and text components of Web sites, electronic chat rooms, e-mail, instructional software, CDROM, DVD, laser disc, video tape, audio tape, electronic text and print materials. Where access to Web sites not controlled by the college is required or realistically necessary to completion of a course, the college must take steps to ensure that such sites are accessible or provide the same material by another means that is accessible.

6. Distance education courses, resources and materials must be designed and delivered in such a way that the level of communication and course taking experience is the same for students with or without disabilities.

7. After the adoption of these guidelines, any distance education courses, resources or materials purchased or leased from a third-party provider or created or substantially modified "in-house" must be accessible to students with disabilities unless doing so would fundamentally alter the nature of the instructional activity or result in undue financial and administrative burdens on the district.

8. Colleges are encouraged to review all existing distance education curriculum, materials and resources as quickly as possible and make necessary modifications to ensure access for students with disabilities.

9. The college will be responsible for acting in a timely manner to making any requested modifications to the curriculum, materials or resources used in the course, unless doing so would fundamentally alter the nature of the instructional activity or result in undue financial and administrative burdens.

10. In all cases, even where the college can demonstrate that a requested accommodation would involve a fundamental alteration in the nature of the instructional activity or would impose an undue financial and administrative burden, it must nevertheless provide an alternative accommodation which is equally effective for the student if such an accommodation is available.

11. Ensuring that distance education courses, materials and resources are accessible to students with disabilities is a shared college responsibility. All college administrators, faculty and staff who are involved in the use of this instructional mode share this obligation.

General demands of persons with motor disabilities on learning materials:

The nature of physical disabilities varies widely. Some physically disabled users experience complete paralysis in some portion of their bodies. Others are restricted by muscular weakness. Some may have a very limited range of motion but may possess very fine movement control within that range. Others may have feeling in their limbs but little control over them. Still others have to work with uncontrolled, sporadic movements that interfere with their purposeful movements. Users with arthritis report that the joints in the hand and elsewhere are restricted in their range of motion both mechanically and by pain. Some users have posture difficulties that present problems solved only by mounting the computer screen in a non-standard orientation.

Physical disabilities by themselves do not usually affect a person's ability to perceive information displayed on the computer screen. They can, however, interfere with the interactive experience by preventing users from easily manipulating the interface.

To increase the accessibility of software for people with physical disabilities and ensure compatibility with assistive technologies, developers can:

- avoid timed responses or, when they cannot be avoided, lengthen the time allowed for a user to respond.
- provide keyboard access to all toolbars, menus, and dialog boxes.
- allow the user to access helpful features already built into the operating system, such as Sticky Keys, Slow Keys and Key Repeating.

6. Guidelines and important aspects for the production of content

Introduction
As we learned in 8.3, important accessibility guidelines are described in the WAI-W3C web accessibility guidelines. These guidelines will also apply to digitized media in general – to the learner it is important what media or technology is used, but whether or not he or she can make use of it. The WAI guidelines excerpted below fall into three priority levels, in these materials the guidelines of Priority 1 are given since they should *at least* be maintained. For Priority 2 and 3 see the WAI-W3C references.

Priority 1

This guideline must be followed by an author, or one or more groups of users will find it impossible to access information in the document. Implementing this guideline is a basic requirement for some groups to be able to use Web documents.

- Provide alternative text for images, applets, and image maps.
- Provide descriptions for important graphics, scripts, or applets if they are not fully described through alternative text or in the document’s content.
- Provide textual equivalents for audio information (captioning).
- Provide verbal descriptions of moving visual information in both auditory and text form.
- Ensure that text and graphics are perceivable and understandable when viewed without color.
- Ensure that moving, blinking, scrolling, or auto-updating objects or pages may be paused or frozen.
- Ensure that pages using newer HTML features (i.e. style sheets, forms, tables) will transform gracefully into an accessible form.
- Use features that enable activation of page elements via input devices other than a pointing device (e.g., via keyboard, voice, etc.).
- For frames, provide sufficient information to determine the purpose of the frames and how they relate to each other.
  Ensure that tables (not used for layout) have necessary markup to be properly structured or presented by accessible browsers and other user agents.
- Only use technologies defined.

WAI-W3C web accessibility guidelines are most important ones, but not the only ones that apply. Excellent, detailed guidelines for CD-ROM and Web-based multimedia, published by the American National Center for Accessible Media at WGBH-TV, Boston. The guidelines aim at education, but are much more broadly applicable. Site includes downloadable prototypes and information about accessibility issues related to specific development platforms. Originally published in 2000, the Guidelines were updated in January 2003 (6).

Two more important sets of accessibility guidelines also relating to eVet materials are:

1. Distance Education: Access Guidelines for Students with Disabilities. The California Community College System's comprehensive accessibility guidelines for its distance learning applications, published in 1999.
2. SALT: Specifications for Accessible Learning Technologies, by the American National Center for Accessible Media in collaboration with the IMS Global Learning Consortium. Provides comprehensive recommendations for developing teaching and learning applications and materials that are both interoperable and accessible.

Here below a brief practical overview of requirements on the production text, graphics, diagrams, Images and Charts is given. We must bear in mind that, when it comes to specific requirements to motor disabled persons, we are not entitled to exclude other disabled groups of persons, e.g. visually disabled persons or persons who (also) are hard of hearing. Therefore, specific requirements and guidelines should respect general guidelines and especially the generally recognized WAI-W3C accessibility guidelines.

Text

The use of "correspondence" has a long history in distance education and will likely continue as an element of some courses. Print-based materials are easy to handle, modify, distribute and store. Print materials allow students to work at their own pace.

Delivery Medium - Print Medium

Access Issue

Students who are blind or have low vision will be unable to read print material. Some students with severe learning disabilities may also be unable to effectively read print materials.

Remedies

Provide print material in alternate formats including: Braille, large print, audiotape, digital sound files and e-text. Whenever possible, information should be provided in the alternative format preferred by the student.

Analysis:

Large Print

Large print documents printed from electronic files should be produced using a font size of 14 point (or larger) and sans serif type faces such as Helvetica for visual clarity. Documents should be reformatted as necessary to preserve critical page layout elements. All colors should be set for maximum print contrast.

Electronic Text

Electronic text should be available in multiple operating system formats (i.e. Windows, Macintosh), plain text, and industry standard word processing formats (i.e. Word, WordPerfect, etc.). These media are typically used by both visually impaired and learning disabled students.

Icons

Provide large icons for easy access and separate icons properly. Graphic buttons, such as those found in some kinds of forms, must always have alt-text explaining what the button does. See Guideline 3 for more information about forms and form controls.

Diagrams

Reading and manipulating tables is an important way of processing. Motor impaired persons having hand function problems may have a problem in frequently scrolling. Using data in a table requires referring to the headings for each row and column in order to interpret the information in a single cell. When navigating tables, blind users often don't even know what cell they

are in at any time, or the column and row headers. A standard method for providing programmatic information about reading location and which headers apply to each cell will provide compatibility with assistive technologies that support the standard. One such standard is included as part of the W3C's HTML 4.0 (or higher) specification.

Images
Most Web sites use images to convey content and may have corresponding text referencing these images. When content is provided in photographs, diagrams, or charts people who are blind or visually impaired will miss some or all of the information. Related to this topic is the problem of data table accessibility. For more information, please see Guideline 4.

Currently, static images may be made accessible via alt-text and, where necessary, d-links (descriptive links), literally the letter "d" placed next to an image. A d-link leads to a text description of the image and provides more information than is possible or practical in alt-text. D-links can be supplemented by HTML's <longdesc> attribute; however, user-agent support for <longdesc> is not widespread so d-links are, for the time being, the most reliable method of providing a long description of an image.

Image maps are commonly used for navigation within a Web site. Client-side image maps may be made accessible through the use of alt-text in <area> regions. Avoid using server-side image maps, as they can't be accessed from a keyboard or with a screen reader. If you absolutely must use a server-side image map, always place redundant text links adjacent to the map so someone with a screen reader, or someone who can't use a mouse, can access the information.

Forms
Forms are extremely useful for gathering all kinds of information. Web sites often present users with a log-in page that requires that a name and password be entered into text fields. Radio buttons or check boxes are regularly used to determine user preferences, and users can answer test questions by typing answers into text fields. Small radio buttons or check boxes are difficult for motor impaired persons to click on. Forms can present problems for blind or reading impaired users when the elements aren't marked up in a manner that makes them accessible to screen-reading software.

To insure complete access to information, use properly marked-up HTML forms instead of PDF forms. Some screen readers can access information in properly marked-up PDF forms, but support is inconsistent and unreliable at this time.

A standard method for labeling and identifying form elements will provide compatibility with assistive technologies that support the standard. One such standard is included as part of the W3C's HTML 4.0 (or higher) specification.

7. Guidelines for interactive content

The basic principles of creating accessible interactive activities come from general software design guidelines. However, there are some aspects of an interactive activity that deserve particular attention in educational software. Techniques for meeting these checkpoints are found in the software design guidelines for specific development environments, as well as in the general software accessibility guidelines.

Providing a complete keyboard interface for an activity means that users who cannot use a mouse will be able to complete the activity. Users with physical disabilities frequently use the keyboard or an alternative input device that passes keystrokes to the operating system. Pay particular attention to activities where users are expected to "drag and drop" one item onto another or must use the mouse to select an item from among alternatives. The Windows OS provides a common and well-known model of a keyboard interface to a graphical user interface. Using the conventions provided by this model allows users to avoid learning a new keyboard interface.
Note that it is possible to provide access to all users on platforms that do not include a keyboard, such as kiosks.

Animations
Multimedia presentations are one clear example of the need for multimodal information, as discussed in Guideline 2, but other aspects of a program's educational content and interface should be considered as well. If important warnings or instructions are provided in more than one mode, they will be immediately useful to more users. And when educational content is provided multimodal, many other students can benefit in addition to those with disabilities. For example, Tindall-Ford and colleagues showed in several different experiments that when information was presented in audio and visual form, performance on complex tasks was improved (1997). And J.R. Williams reviewed about 100 studies from the literature on use of multimedia in instruction and found that combining visual and verbal information can lead to enhanced comprehension (1998). The groups of students who may better understand text both seen and heard includes those with learning disabilities or difficulty reading, students learning a second language, and students who learn better auditory rather than visually.

Users of assistive technology may not be able to respond to on-screen events as quickly as other users. For example, it may take longer to hear a message using text-to-speech technology than it would to read it visually. A user with a magnified screen may need extra time to locate a message on screen before reading it. And users with physical disabilities may have slower response time to messages. For all of these reasons, users should have the option to change or eliminate any

requirement for timed responses. This includes the ability to freeze and repeat any audio or visual presentations. Allowing changes in the timing of required actions also helps to solve some of the problems described in Checkpoint 6.4 for users who cannot attend to two sources of information at once.

Navigation

On issues regarding navigation in educational web environments, firstly Guideline 13 of the WAI-W3C web accessibility guidelines applies. The content of this Guideline is:

- *Provide clear navigation mechanisms.*

This guideline has 10 checkpoints, ranging in importance from Level "AA" (should be addressed for the site to be accessible), to Level "AAA" (beneficial to ensure the accessibility of your site). Like in other Guidelines, the
Checkpoints explain the do's and don'ts and lead the way to common accessibility solutions. The Checkpoints are:

Checkpoint 13.1	Clearly identify the target of each link;
Checkpoint 13.2	Provide metadata to add semantic information
Checkpoint 13.3	Provide information about the general layout of a site
Checkpoint 13.4	Use navigation mechanisms in a consistent manner
Checkpoint 13.5	Provide navigation bars
Checkpoint 13.6	Group related links
Checkpoint 13.7	Enable different types of searches
Checkpoint 13.8	Distinguish information at the beginning of headings, paragraphs, lists etc.
Checkpoint 13.9	Provide information about document collections.
Checkpoint 13.10	Provide a means to skip over multi-line ASCII art.

For more information: see http://www.juicystudio.com/tutorial/accessibility/navigation.asp#navigation

No specific guidelines on navigational aspects in HTML and multimedia materials for motor disabled persons do exist so far, and only recommendations from practice can be given (8). These recommendations mainly deal with possible hand function problems and the need to click, scroll or make cursor movements as little as possible. Therefore:

- Limit needs for scrolling as much as possible,
- Avoid vertical scrolling,
- Avoid time bound reactions or the need to click on moving elements. Users should be able to set time bound reactions themselves,
- Icons and clickable buttons should have sufficient sizes,
- Icons and buttons should be clickable all over the surface,
- Do not use links within texts,
- Use icons for navigation consequently,
- Do not use pop- up screens,
- Present information after a clear path: consequently and step- by – step,
- Each subject on a homepage or in an information package should be reached within three mouse clicks.

Key Point Summary Conclusions and Recommendations

1. All materials, whether in printed or in digital format, should optimally be accessible for users with special needs.
2. Recent internet accessibility guidelines, primarily after the W3C consortium, should be followed. Accessibility is a basic right and there are no excuses for the production of inaccessible materials.
3. Individual users may use various adaptations, but should first of all use the options in the Accessibility menu of their computer. If no sufficient solutions are found, specific hard- or software adaptations may be required. All kinds of dedicated adaptations are available. If necessary, a specialized core centre (often in the field of rehabilitation) can be consulted.

Study Guide

ESSENTIAL QUESTIONS FOR THE VERIFICATION OF THE ACCOMPLISHED KNOWLEDGE

1. Can you give an example of the working method used by a motor impaired e-learner having mild dexterity problems, who solves these problems by the use of an accessibility option in his O/S?
2. What is an important reason for providing alternative text for images, applets and image maps in all eLearning materials?
3. Which authority plays an important role in making up guidelines and promoting an internet that is usable and accessible for all?

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[6.] 'Making Educational software and Web sites accessible'. http://ncam.wgbh.org/cdrom/guideline/. From Internet 18-04-2005.

'*Zorg dat het klikt*' ('Make it click'). Building websites for intellectually disabled persons. 2003. Fvo/ iRv, Utrecht, The Netherlands.

SUPPLEMENTARY IMPORTANT BIBLIOGRAPHY. REFERENCES. (www)

[SUP. 1] 'Distance Education: access Guidelines for Students with Disabilities'. http://www.htctu.net/publications/guidelines/distance_ed/disted.htm. Chancellor's Office California Community Colleges. From Internet 18-04-2005.

SUPPLEMENTARY INDICATIONS ABOUT THE CONTENT OF THE LESSON

Check available eLearning materials after the WAI-W3C accessibility guidelines yourself! Learning about their practical application can best be done by doing.

RESPONSES TO THE QUESTIONS

1. The use of enlarged cursors, the use of options to avoid need to do two keystrokes simultaneously, the use of synthetic speech (in English IE versions).
2. To make graphic elements accessible for visually impaired persons; to support reading by cognitively impaired persons.
3. The World Wide Web (W3C) Consortium.

WORDS TO THE LEARNER:

Suggestions for the reader: if you want to do some advanced reading, firstly go to WAI-W3C web accessibility guidelines.