

Accessibility and Inclusion in e-Learning

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Abstract. Rapid development of technology is opening new perspectives for business, entertainment, and education. Learning with the help of technology is providing new opportunities for learners. E-learning is grasping with big steps into diverse areas engaging more and more different methods and activities. Lot of developments and lot of experiences are present in the field of e-learning everywhere in the world. One of the important features of technology is allowing access to unprivileged, either with permanent or temporary disability. Using technology to make everything more inclusive has become important issue in developed countries. The focus of any new development is to be accessible to as wider audience as possible. How accessibility affects e-learning? This paper intends to review current experiences in the field of e-learning with the focus on accessibility. It will present basic accessibility guidelines and will reflect on how learners with special needs can access e-learning environment.

Keywords: e-learning, accessibility, inclusivity

1 Introduction

New technologies and especially Internet have become very important part of our everyday work and life. Being so, the question has arisen how accessible it is to all groups of population. Internet, or web, accessibility for all has grown to be a burning issue in European Union. Some of the countries have adopted laws on accessibility, the others are implementing different projects' activities in order to improve the accessibility of own web sites. US have adopted legislation on accessibility followed by rules and standards for accessible electronic and information technology purchased by federal agencies. There are a lot of initiatives on the international level that are helping in designing and evaluating if and how much the web site and its content are accessible. Imperative for a successful accessible web site is to start from the very beginning - in the planning phase. The web site should be planned inclusive and accessible.

Web accessibility means that it will be possible to meaningfully use the web for all people regardless of their abilities, preferences or available technologies [9]. Web accessibility means two ways communication: every person can perceive, understand, navigate, and interact with the web, and everybody can contribute to the web. From web accessibility benefits all, people with disabilities but also older people with

changing abilities due to aging, or people with temporary disabilities or just changing preferences of the web use. Web accessibility includes all abilities, including visual, auditory, physical, speech, cognitive, and neurological different level abilities.

E-learning is a new way of learning where learner is using available technology to learn in own way, on its own pace, with the tools and methods that are most adequate for him/her. E-learning is already present in our everyday life. It has influenced and changed a lot the curricula and academic teaching and learning [5]. The Web and e-learning offers the possibility of unmatched access to information and interaction for different groups of people, including disadvantaged and people with disabilities. That is, the accessibility barriers to audio and visual media can be much more easily overcome through web technologies. The web is becoming important source in many areas of our life: education, employment, government, commerce, health care, recreation. Vital is that the web is accessible to all in order to provide equal opportunity to everybody regardless their abilities or preferences [1]. An accessible web to all can also help different groups of people to participate in society more actively.

New technologies such as mobile telephony are adding to the complexity of the issue. Now the web can be accessible through most of the today's mobile devices. That is helping final users and is increasing chances for accessibility. On the other hand, it is increasing the requirements placed in front of the web developers, since everything should be working properly and should be accessible, regardless which browser is used or from which mobile device the access is required.

Another important consideration is that web accessibility is required by laws and policies in some countries. Government legislation and organizational policies can encourage inclusive design by fostering awareness of the need for inclusion and by setting broad expectations for society [4].

Web is becoming more accessible in different parts of the world and it is creating new opportunities for all users. Accessibility of web based materials is introducing a shift in education also. Accessible web is opening new doors for learners and is increasing their chances for success. So, how is this improvement of web accessibility influencing education and e-learning is important research question.

2 Making the Web Accessible

There are two aspects when talking about web accessibility. Most of the stress on web accessibility has been on the web developers' responsibilities. But also web software has an important role in web accessibility. Software needs to help developers produce and evaluate accessible web sites, and be usable by people with different types of abilities.

World Wide Web Consortium (W3C) has started an initiative Web Accessibility Initiative (WAI) [11]. One of the roles of the WAI is to develop guidelines and techniques that describe accessibility solutions for Web software and Web developers. These WAI guidelines are considered the international standard for web accessibility and are used as basis for concrete national accessibility guidelines, legislations or standards. There can be found a lot of documents describing the different web acces-

sibilities, and how concrete improvements could increase Web accessibility. It can be very useful tool while developing new web sites or wanting to improve accessibility of already existing sites, to have at least some check list with all basic requirements for web accessibility.

US have reviewed WAI guidelines and have developed own Section 508 [10], an amendment that requires electronic and information technology developed by or purchased by the Federal Agencies to be accessible by people with disabilities. Federal Agency's purchase power is tremendous. IT developers and market in general, faced with accessibility requirements from Federal Agencies will not be able to develop two parallel lines, so, will continue developing accessibility technology and software for all its clients. Most of web accessibility guidelines are present in Section 508, but are appended with technical standards, functional performance criteria and part about information, documentation and support. Representatives from industry, academics, government, and disability advocacy organizations have proposed standards for accessible electronic and information technology.

The most effective way to ensure that some web site is accessible, is to plan accessibility while starting with the sketch of the site. Making a web site accessible can be simple or complex, depending on many factors such as the type of content, the size and complexity of the site, and the development tools and environment. If planned from the beginning, many accessibility features are easily implemented. It is regardless of if it is about starting completely new Web site development or redesigning the existing one. Fixing inaccessible Web sites can require significant effort, especially sites that were not originally "coded" properly, or sites with specific types of content such as multimedia.

Web accessibility guidelines are requiring web content to be perceivable, operable, understandable and robust.

Perceivable Content.

Text alternatives for non-text content convey the purpose of an image or function to provide an equivalent user experience. Text alternatives should be provided for non-text content such as: short equivalents for images, including icons, buttons, and graphics; description of data represented on charts, diagrams, and illustrations; brief descriptions of non-text content such as audio and video files; text description for labels for form controls, input, and other user interface components.

People who cannot hear audio or see video need alternatives for multimedia. Well written text records containing the correct sequence of any auditory or visual information provide a basic level of accessibility and facilitate the production of captions and audio descriptions. Examples can be: text record and captions of audio content, such as recordings of people speaking; audio descriptions, which are narrations to describe important visual details in a video; sign language interpretation of audio content, including relevant auditory experiences.

Content should be developed in that way that it will be given the possibility to present it in different ways for different users. In order for users to be able to change the presentation of content: headings, lists, tables, and other structures in the content are marked-up properly; sequences of information or instructions are independent of any

presentation way; browsers and assistive technologies provide settings to customize the presentation.

Content should be made in such a manner that it will be easier to see and hear. Distinguishable content is easier to see and hear. Meeting this requirement helps separate foreground from background, to make important information more noticeable.

Operable Content.

Functionality should be available also from a keyboard. Many people do not use the mouse and rely on the keyboard to interact with the Web. This requires keyboard access to all functionality, including form controls, input, and other user interface components. Meeting this requirement helps keyboard users, including people using alternative keyboards such as keyboards with ergonomic layouts, on-screen keyboards, or switch devices. It also helps people using voice recognition (speech input) to operate websites and to dictate text through the keyboard interface.

Users should have enough time to read and use the content. Some people need more time than others to read and use the content. That means that users should be able to stop, extend or adjust time limits.

Users can easily navigate, find content, and determine where they are. Content that is well organized helps users to orient themselves and to navigate effectively. Meeting the above requirement helps people to navigate through web pages in different ways, meeting their particular needs and preferences. Some people may be using the content with only a mouse or a keyboard, while others may be using both. While some people rely on hierarchical navigation structures to find specific web pages, others rely on search functions on websites instead. Some people may be seeing the content while others may be hearing it, or seeing and hearing it at the same time.

Understandable Content.

Material presented by text is readable and understandable for majority of users. Content authors need to ensure that text is readable and understandable to the broadest audience possible, including when it is read aloud by text-to-speech software. Software, including assistive technology, will be able to process text content correctly having all above requirements met. These requirements help software to generate page summaries, and to provide definitions for unusual words such as technical jargon. It also helps people who have difficulty understanding more complex sentences, phrases, and vocabulary. In particular, it helps people with different types of cognitive disabilities.

Many people rely on predictable user interfaces and consistent appearance. Users can be disoriented or distracted by inconsistent appearance or behavior. That is why web developers should ensure that content appears and operates in predictable ways throughout the all pages on the web. People can easy and quickly learn the functionality and navigation mechanisms on a website. So, people can use them according to own specific needs and preferences. Some people assign personalized shortcut keys to functions they frequently use to enhance keyboard navigation. Others memorize the steps to reach certain pages or to complete processes on a website. That can be done

with predictable content because they both rely on predictable and consistent functionality of the web sites.

Forms and other interaction can be confusing or difficult to use for many people. As a result, they may be more likely to make mistakes. Web site should have explanatory interactions. If web site itself helps to avoid mistakes, or explains what mistakes were, it will be much easier for users to interact on the web. Helping users to avoid and correct mistakes can be done by: descriptive instructions, error messages, and suggestions for correction; context-sensitive help for more complex functionality and interaction; opportunity to review, correct, or reverse submissions if necessary.

Robust Content.

Robust content means it can be used with all possible browsers, assistive technologies or other agents, existing in the moment of development, without losing any information or feature. This will maximize compatibility with current and future user agents, including assistive technologies and all kind of browsers. It enables assistive technologies to reliably process the content, and to present or to operate it in different ways. This includes non-standard (scripted) buttons, input fields, and other controls.

2.1 Accessible Content Management Systems

Education, especially e-learning, is based on databases with necessary data and information used for learning processes. These databases are important part of a learning structure. Content Management Systems (CMS) are systems that are allowing storing, publishing, editing or modifying content, while big number of user can access, share and contribute to the stored data. CMS can be commercial or open source and all are with varying features. Content published on the CMS can be documents, videos, audio, text, pictures, diverse types of data, articles, etc. Therefore, evaluating CMS is necessary to determine at what level content is accessible and which one to use.

CMS are systems that, no matter how fancy and good-looking are, still are remaining just tools for managing data. If it does not comply with necessary accessibility requirements, it should be changed with something more accessible. First step in selecting CMS is thinking about its functional requirements. CMS should be able to deliver what is needed for the activities. After the functional requirements are determined, decide whether you want to follow any kind of accessibility standards or guidelines. It is advisable to follow the W3C Web Content Accessibility Guidelines (WCAG). It gives a list of recommendations, which will help to make the system more accessible. It is important to check accessibility of all the CMS: theme, module of the CMS, but also administrator part.

CMS systems are penetrating in the area of learning, hence their accessibility should be observed from the perspective of user/learner too [2]. They are increasingly drawing and maintaining the attention of a learner due to use of new technologies. Learning is taking place only in cases when learners are actively involved in it. In order to have active learners, existing content should be attractive to them, which is

taking us to the basic precondition that learners need to be able to access it in a first place. Furthermore, content generated or uploaded by learners while using CMS should be stored and could be retrieved and used by other learners/users. That is why it is crucial to conduct capacity building activities with those users that will be filling the system with information in terms of accessibility and its requirements. All users of the CMS must have some knowledge of accessibility. Without this knowledge, no CMS can ensure that only accessible content is published to the site. Personnel using a CMS must have the necessary training and support to enable them to produce and publish accessible content.

2.2 Web Interactivity

Interactive web sites are web sites that are not just transmitting information to the users, but are allowing communication with users. They are not just simply delivering information but are adapting it according to the users' actions. There are different ways to provoke interactivity on the web sites.

The most effective way of learning is by providing interactivity. Interactivity should be secured by content that is allowing learners to communicate virtually, to exchange, to share, to collaborate. This means that both content and software are to have interactive nature that is attractive for learners. In such environment, the role of teacher/educator is changed from person that possesses the knowledge into person that is facilitating the learning processes. Interactivity is narrowing down the boundaries between learner and educator; they are starting to disappear. Both categories of users of these systems should be aware of the accessibility rules and to apply them. Especially, the content that is developed by users need to be developed according accessibility rules. Namely, learners with disabilities access and navigate the web in different ways, depending on their individual needs and preferences. Sometimes even learners without disabilities configure standard software and hardware according to their needs, and sometimes people use specialized software or hardware that helps them perform certain tasks. Acting this way, equal opportunities for learning, and inclusiveness of all learners is secured.

Some common approaches for interacting with the web include:

- Assistive Technologies - software or hardware that people with disabilities use to improve interaction with the web. These include screen readers that read aloud web pages for people who cannot read text, screen magnifiers for people with some types of low vision, and voice recognition software and selection switches for people who cannot use a keyboard or mouse.
- Adaptive Strategies - techniques that people with disabilities use to improve interaction with the web, such as increasing text size, reducing mouse speed, or turning on captions. Adaptive strategies include techniques with standard software, mainstream browsers, or with assistive technologies.

3 Evaluating the Web Accessibility

Evaluating accessibility early and throughout the development process is a must when developing a new one or redesigning an existing site. It can identify accessibility problems when it is easier to address them. Simple techniques such as changing settings in a browser can determine if a Web page meets some accessibility guidelines. Or, trying to access the web site through different mobile devices can point some of the possible issues needed improvement. A comprehensive evaluation to determine if a site meets all accessibility guidelines is much more complex.

There are different evaluation tools that can be found online and can help with evaluation. However, no tool alone can determine if a site meets accessibility guidelines. Knowledgeable human evaluation is necessary to determine if a site is accessible and to what extent [6].

Most commonly available browsers provide bookmark functionality, and screen readers provide functions to list headings, links, and other structures on a web page. Nevertheless, the design of the content is an essential factor to support different styles of navigation [3]. Examples include:

- Person with visual disabilities or from any other reason not being able to see the screen, needs to get an overview and orient themselves by scanning the headings on a web page; the headings need to be designed to also support such purposes.
- After screen magnification, person can only seeing small portions of the screen at a time, and need to orient him/herself using visual cues; the visual design needs to also support such purposes.
- The structure of web pages need to be designed to support and effective use of the keyboard because there can be a person using only the keyboard (or keyboard alternatives) to navigate through the web content.
- Web browsers need to provide supporting functionality that is easy to use and remember, since some person can have difficulty remembering the addresses, names, or particular functionality of websites.
- Websites need to provide alternative mechanisms for navigation because user can be a person who does not think and organize concepts hierarchically, as how most navigation menus are designed to be.

There are a few pitfalls to avoid when creating an accessible document (printed or electronic).

Floating graphics are a particular issue and these are generally not accessible. Word art is one example that is interpreted as a graphic and is supposed to be text. This also includes images set to float behind or in front of text.

Headers and footers are accessible by screen reader software, but the user needs to know that they are there. It can't be assumed that an access technology user will automatically look for headers and footers. Depending on the document it may be appropriate to include a line to say that information is contained in the header or footer or simply to ensure that important information is also repeated in the main body of the text.

Preparing for other needs. No matter how well designed and produced your document is, any printed material will never meet the needs of all people. Some people will not be able to read print, and may prefer the same information in another format like braille or audio, or simply by accessing the electronic file. It is always a good idea to keep a text based electronic original of your document.

Web based materials should be inclusive for all [7]. E-learning can be online and offline, but should be supportive to widest possible audience in order to be able to secure successful results. There are a lot of materials for e-learning with big variety of topics covered. Not all of them are inclusive and accessible to wide audience. Some, developed for concrete known target group, can stay that way. But others, developed for wide population should be adapted to be accessible for all. Assessment is a starting point in improving the accessibility of already existing e-learning materials.

4 Conclusion

People navigate through the web and find content using different strategies and approaches depending on their preferences, skills, and abilities. Someone using a website for the first time may need more thorough guidance than someone who has more experience with that particular website. Many functions to support different styles of navigation are built directly into web browsers and assistive technologies.

Using the Web on a mobile device with a small screen may need more orientation cues than someone using a desktop computer. While these are generally considered to be usability aspects that affect people with and without disabilities, some situations affect people with disabilities more directly. Accessibility solutions are beneficial for people with and without disabilities and are becoming increasingly available in standard computer hardware, mobile devices, operating systems, web browsers, and other tools.

E-learning materials are designed to support learning. A research of e-learning interactive materials' usage shows that different users use different approaches in order to secure cognitive learning [8]. It is clear that it depends on learning styles and also on available technology and its functionality. E-learning materials should have built-in accessibility and inclusiveness in them in order to be successful in delivering learning tool for all learners.

According to the UN's millennium development goals, access to learning must be secured for all. The audience that is using technologies for various purposes is rapidly increasing on a daily basis, as well as, possibilities for learning via web content. Various learners might have various disabilities (temporary or long-term) that might be limiting their access to digital learning content. Or, some learners might need to be able to customize the learning content. In such case, it is inevitable, that all learning content should be developed according to accessibility guidelines.

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