

Universal Design and Accessibility Standards in Online Learning Objects

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Abstract. This article notes that the media used in distance learning mode can create barriers to access such content for people who have some form of disabilities. Introduces the principles of universal design, aggregates the standards, guidelines and recommendations for creating accessible web content, developing a set of guidelines for creating accessible learning objects, aiming to support content-developing teachers in creating learning objects accessible to people with disabilities.

Keywords: Distance Education, Learning Objects, accessibility.

1 Introduction

The computerized environments that foment distance learning have become tools of great potential in formalized educational institutions, in organizations and even more in self-regulated learning.

Digital content that power the web-based education in the form of learning objects are present at all levels of teaching and learning educational segments. These resources can provide new learning opportunities closer to the learning objectives for a population previously exposed to the difficulties of access to formal education. However, the creation of these resources while favoring the answers to the heterogeneity of the students; may represent an exclusion factor for individuals who do not possess access to technological resources or who are unable to access them due to possible disabilities.

2 Media in Distance Learning

The main basis for a program of Distance Education (DE) is to take learning anywhere, anytime, to anyone, which makes this method suitable to the demands of the current individual by means of conveniences such as flexibility of time, use of varied resources and independence of the local study. Currently in Brazil, in classroom

teaching, educational institutions admit hybrid programs, in which a portion of the content is taught completely through DE, using mainly computational media.

The DE is a planned education system that requires deepening of the methods and special strategies for creating courses, educational content, using various media and technologies appropriate to the circumstances of teaching and learning. [1].

Several factors influence the selection and mix of media, and according to [2], [3] and [4], the most important item of influence is the adequacy of the media to the profile of the student and the needs of the content.

According to [3], p. 102, "One of the key steps in the selection process of media and technology is to identify the attributes of media required by the instruction objects or by the learning activities, as well as the characteristics of the students and the environment, reliability and simplicity of serving systems, which suggest or eliminate certain media and economic factors or organizational that may affect its viability."

The contents used in Web-based distance learning, are developed by content-developing teachers, supported by instructional designers or media producers, and are rendered available in digital libraries, repositories of learning objects, virtual learning environments, blogs, etc. ., according to the established educational strategies and goals. However, they are created in formats, presentation styles and contexts not always suitable to the needs of the users.

In this paper, we present accessibility issues that should be considered in the preparation of the materials that compose the web based distance-learning.

3 Accessibility in Web Content

The current DE favors the use of assistive technologies and enhances the process of inclusive education and continuing education, despite the possible accessibility barriers; it is today the most suitable means of disseminating knowledge to the group of people with some form of disability.

The number of people in the world recognized as having some form of disability exceeds 750 million, and in Brazil, this number approaches 45.6 million people representing 23.9% of the population. The care of these individuals without discrimination and support their participation in society is a worldwide concern, especially in the countries members of the Organization of the United Nations, (UN).

The web accessibility envelops access for all individuals regardless of their characteristics, disabilities or special needs, situation or preferred tools; it notes the deficiencies inherent to the individual's age, cognitive handicap, social and cultural issues, along with the use of alternative browsers, outdated devices, use of assistive technology and critical environmental access situations.

The inclusive education focuses on the participation of people with disabilities and with special needs at all levels and learning situations, along with digital inclusion, which relates to the elimination of any barrier to access, even if temporary. In the area of educational technology, it represents the use of appropriate equipment and programs, content and presentation of information in accessible formats or alternative capable of the learning outcomes equivalent to any individual. [1].

According to the World Wide Web Consortium (W3C) web accessibility means that people with disabilities can use the web, or can perceive, understand, navigate and interact with the environment and contribute. The accessibility of the web content is the main goal of the W3C, which provides recommendations of communications accessibility, likewise, the Institute Management Systems - Accessibility (IMS-ACC), aims to find solutions to make learning accessible online. [5], [6].

3.1 Deficiencies on the Access of Digital Media

The most common deficiencies found in web access, according to [7] and [8]; are visual, auditory, motor, mental and cognitive deficiencies. This does not exclude the gifted people, people in different conditions in the social, emotional and intellectual level, the hyperactive, the marginalized, and other atypical situations of access to information.

Among the visually impaired are the blind, those with low vision, color blindness, the nearsighted, elderly, and those exposed to environments with low luminosity, those using very small screens; the main difficulties of such users is viewing maps, links, animations, colors, font size, navigation, tables, forms, and images in general. As access resources, they use Braille displays, alternative text, screen readers, special monitors, magnifiers, different contrast settings, monochrome monitors, and narration about the images.

As hearing impaired are considered the deaf, or with low hearing, people who work in noisy environments, those with speech disabilities, and those who use different languagesç they have difficulties understanding of audio clips, beeps, or any transcript textual. They are usually aided by subtitles on videos or presentation by interpreters.

The cognitive deficiencies relate to individuals with limited perception of information by means of using a different language, to computer beginners, people lacking motivation, the individual's age, the gifted, the autistic or hyperactive. These people have difficulty reading, interpreting the used language, disorientation in navigation or in the response time when answering question and filling out forms. Content developers using clear and simple language, orientation of information, mechanisms facilitating navigation, flexibility of interaction time or repeated presentations, assist them.

Among the mentally or motion impaired are dyslexic individuals, those with memory or attention deficit, those with intellectual disabilities, mental retardation, Down syndrome, cerebral palsy and epilepsy. These users have difficulties in navigation, links access, interaction, in the use of keyboard or mouse; they use special keyboards and mouse, physical supports, voice synthesizers, special screens, and software adapted for human-machine interaction.

Some difficulties in viewing pictures or download files may also be due to equipment or used device, such as connection speed, outdated equipment, and screen size, the use of unusual devices or operating systems. [1].

4 Digital Learning Objects

Learning objects were created based on the object-oriented paradigm of computer science. Its main goal is the reuse in different contexts and interchangeability. The most used definition for learning objects is given by the Institute of Electrical and Electronics Engineers - Learning Technology Standards Committee (IEEE - LTSC): "Any digital or not entity, that can be used, reused and referenced during learning supported by technology ". [9] Under this definition may be included media content, instructional content, instructional software and software tools. These resources in digital format can be: electronic texts, multimedia content, images, animations, video clips, simulations, readings, presentations, educational games, web sites, digital movies, Java applets, online tutorials, courses, tests, questions, projects, study guides, study case, exercises, glossaries, or anything otherwise used for educational purposes.

The main characteristics of these materials are flexibility, customization, and interoperability, ease of search, update and management. These features are described by metadata and content. The metadata allows its localization and reuse from repositories or external links, but also allow one to obtain information about the context of use, quality, characteristics or conditions of use of the learning object. The content, regardless of granularity, is complete and modular, platform-independent, non-sequential, attends a single established learning objective, and is unique in its metadata description.

5 DE Accessibility – Principles and Recommendations

The development of accessible distance learning courses must consider the participation of students and instructors with visual impairment, difficulty in learning, mobility impairments or hearing. If an individual teacher, tutor or student with disabilities enters into a distance-learning course, all the material in this course must be accessible to that individual. [1].

The accommodation of individuals with disabilities in distance courses via the Web is consistent with web accessibility in general and provides a greater degree of independence to the individual.

In this research, a set of guidelines was developed which derived from the following general recommendations of accessibility from international organizations: IMS GLC-and W3C-WCAG 1.0 and 2.0, and the principles of Universal Design applied to the creation of content for the web. From the recommendations, we selected those that are, if observed by teachers authors of learning objects in the act of creation, should extend the use of this object to learners with possible disabilities. [1].

5.1 Universal Design

In the eyes of universal design, a product is universally accessible if perceptible to all individuals without the need for adaptation. One way to allow access pages and digital materials for a distance course is the application of these principles, which are

more sensitive to individual preferences and abilities, in the creation of the content, without the need for adaptation or special design for people with disabilities. CUD – NCSU, apud [10].

The CUD defines universal design as "Designing spaces, artifacts and products that aim to meet simultaneously people with different characteristics [...] based on the elements or solutions that make up accessibility."

In inclusive education, all individuals should have access to the same educational and pedagogical content have the same perception about everything that is presented without information loss or detriment of content relevant to the understanding of a topic. This approach complies with the Universal Design principles of multiple media: the representation to allow access to information and knowledge, action and expression so that the student can demonstrate his knowledge, to assess the student's interests, to offer appropriate challenges and extend motivation.

The universal design principles established by the Center for Universal Design (CUD) at North Carolina State University (NCSU) apply to all study materials without the need for adaptation or special design for disabled students, and products designed according to these principles facilitate the work of all individuals, with or without disabilities. [8].

The universal design incorporates accessibility requirements in the design instead of giving an alternative design to meet specific needs. This is not about developing other content specific and targeted to meet deficiencies, but to enable the individual with disabilities the access to the same information.

5.2 W3C

The recommendations of the W3C web accessibility standards are the most widely used worldwide. Its recommendations and accessibility guidelines are introduced in Essential Components of Web Accessibility 2.0 of the WCAG (Web Content Accessibility Guidelines), published in December 2008. These patterns describe how to make accessible Web sites and Web-based content, applicable to any learning material based on electronic resources. [1]

In policies for accessibility of Web content, the W3C is explicit when it says that although there is a multitude of situations, every page design, in order to enhance accessibility, must assess several groups of disabilities or deficiencies simultaneously, and by extension the universe of Web users.

The WCAG 2.0 accessibility features four principles: Noticeable, Operable, Understandable and Robust. To meet these principles, it has twelve recommendations, with the basic goals that authors should fulfill to make a content accessible. For each recommendation, it presents a list of success criteria classified into three levels that must be met to be in accordance with these recommendations [5]. The WCAG 2.0 covers the largest number of Web technology, and is testable by automatic or human evaluators.

5.3 IMS

IMS GLC - Accessibility Project Group - provides specifications for the development of learning technology. The IMS-ACCGuide, vol. 1.0 classifies the various

shortcomings and difficulties that may be presented by users of online educational materials, related to the resources and assistive technologies used by these individuals, and recommends procedures to developers so that their contents are accessible, whether accessed directly or supported by assistive technologies. [6].

In these recommendations are offered six principles of accessibility for persons with mobility disabilities or cognitive impairment: 1- Customization based on user preferences, 2- Equivalent access to audio or visual content, 3- Compatibility with assistive technologies, 4-Context information and navigation guidance, 5-IMS specifications or other relevant specifications, 6-Use the XML language.

6 Directives for the Creation on Accessible Learning Objects

The accessibility in digital media is connected to the media presentation, so, in order to render these materials are accessible, its creators should consider the possible shortcomings of potential users who interact with the content, during the selection and customization of media since the first moment of its creation.

The definition of media used in creating a learning object originates from the analysis of the objectives of the learning resource and instructional and adopted instructional strategies. Thus, it is understood that while the author-teacher sets the content, sequence, segregation, approaches, and media presentation, can expand the accessibility of his learning object.

The research of applied and qualitative nature, developed with the goal to orient content-creating teachers during the construction of accessible learning objects, demonstrated the integration of the principles of universal design, with the recommendations of accessibility in web content, to determine a set of guidelines for creating accessible learning objects. These guidelines are sufficient and synthesized set of recommendations, structured in topics aimed at each type of media that can be used to make a learning object.

The created guidelines, combined with the educational objectives of an instructional event, form the basis of the knowledge of authors, reducing the need to create versions tailored for each possible disability of the individual users. These guidelines were tested by a group of university professors, experienced in the development of digital educational content.

The research instruments in this verification were a basic guide to creating learning object following pedagogic approaches and accessibility guidelines that subjects should follow to develop their educational content. This first test showed satisfactory results; learning objects from different areas of knowledge were created, accessible to individuals with disabilities.

The digital learning objects are displayed and distributed through one or more media elements, for having a measurable learning objective, any content or interaction contained in a learning object should be perceivable through used media and translated into knowledge by all users.

The guidelines provide recommendations designed to make media elements accessible through the provision of alternative media, since the main point of researched

recommendations is connected to the provision of alternative or equivalent content. The W3C recommends that equivalent text be provided to all non-textual content, so the content should not be associated with textual equivalent text, images have alt-text, audio and video have transcription, and animations have descriptions.

The IMS features two types of accessible content: alternative and equivalent [6]. A content is defined as equivalent when it is identical to another, but supplied in a different mode, for example, a text available in audio and even associated with a file for printing in Braille. However, an alternative content is an extension of equivalents content and are provided in different ways, but with the same ultimate goal of learning. According to W3C, the equivalent text responds to the same functions and covers the same information as the non-text content.

The first recommendation of the universal design sets that it must be provided the same means of use for all users, identical or equivalent when possible, and when not, alternative, and that any segregation or exclusion of individuals in general be avoided. It also recommends that the user may be capable of choosing between different content presentation options with ease.

In the generated guidelines, it is recommended that alternate access the contents be created only when the use of equivalent content is not sufficient. This position assesses the principles of universal design and the recommendations of the IMS, and are suited to the characteristics of reusability of learning objects, since they have identical content in another modality.

7 Conclusions

The educational inclusion also constitutes the provision of necessary resources to overcome any barriers identified by individuals during the access to information and educational content. The accessibility of learning objects used in distance education must be seen as an integral aspect of the design process; it must consider all media and teaching strategies used to make the courses accessible. This approach ensures the use of these resources by anyone, anywhere, regardless of physical, technical, or environmental limitations; and they facilitate the personalized teaching learning. The possible deficiencies presented by an individual cease to be a factor of exclusion and are seen as special features that characterize the differences between all subjects.

The use of the accessibility guidelines in web content described by the W3C WCAG 2.0, along with the indications of IMS, support the developers and authors of web content in the use of techniques that enhance accessibility. They relate to alternatives likely to be included in the creation of content, conditioned to individual characteristics, equipment of access, user agents, and the use of assistive technologies.

Learning objects built considering the factors of accessibility and universal design can be used by people with disabilities just as effectively as if used by any other user.

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