More Convenient for Disabled People:an Accessibility Framework in Online Learning

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Abstract: Web accessibility has attracted significant attention in the United States, which has led to the construction of online courses among colleges and universities. Inspired by the research about learning disabilities of deaf students, to create an online learning environment with more possibilities for students with disabilities, this paper tries to build a framework suitable for all kinds of disabled students, which can be used as a reference for distance education designers.

Keywords: Accessibility; Framework; Online Learning; Disabilities

1. Introduction

In the United States, to establish a clear and comprehensive prohibition of discrimination based on disability, Section 504 of the 1973 Rehabilitation Act, which is the first disability civil rights law to be enacted, as well as the Americans with Disabilities Act of 1990, implicit accessibility requirements on public accommodations. Congress expanded the Rehabilitation Act in 1998 to add Section 508, which demands that electronic and information technology developed, procured, maintained, or used by the Federal government be accessible to the disabled. Section 508 also applies to educational tissues that receive federal funding, including most school districts, including private and public colleges and universities. The background of the transition from public facilities to the web, accompanied by the booming trend of online learning, puts new requests on designers, developers, and professors of online education. Web accessibility is the practice of designing web-based content to be easily accessible by people with visual, auditory, speech, cognitive (including learning and neurological), or motor disabilities.

2. Accessibility problems and barriers

In 2009, the issues of online learning for disabled people were investigated in a Canadian exploratory study. It covered over 300 multiple stakeholders, including students with disabilities, campus disability service providers, professors, and e-learning professionals from colleges and universities. There are some problems commonly mentioned by every group (Table 1): accessibility of websites and course/learning management systems (CMS/LMS); accessibility of digital audio and video; inflexible time limits built into online exams; PowerPoint/data projection during lectures; course materials in PDF, and lack of needed adaptive technologies (Fichten et al., 2009). Clustering of these problems can be found mainly around the adaptive technology used by the students. The subject of the course-embedded web pages or systems and different forms of course materials have been problematic.

Table 1. e-Learning Problems (Fichten et al., 2009)

Class	Details
Adaptive technologies CMS	lack of needed adaptive technologies Accessibility of websites and course/learning management systems Inflexible time limits built into online exams
Material	Accessibility of digital audio and video; PowerPoint/data projection during lectures; Course materials in PDF

Taking deaf learners as the concerned object, Caitlin McKeown and Julia McKeown proposes a model (Figure 1) to describe three kinds of barriers that deaf learners may suffer in online learning: learning management system barriers, course content and material

barriers, and communication barriers (McKeown & McKeown, 2019). Deaf learners have to overcome the LMS barriers, course materials barriers, and communication and language barriers. Then they could go to access the content meaningfully. The study pointed out that deaf learners' first language was American Sign Language (ASL), not English. As a result, deaf learners face the same challenge as other second language learners. This fundamental challenge in the mainstream educational setting is English literacy. English literacy will affect learners' reading level and comprehension ability. For example, students may have difficulty understanding idioms and metaphors in the learning materials. The strength of this study is its comprehensiveness. This paper not only takes into account the dominant challenges that may be caused by the physical characteristics of deaf learners in the process of online learning. Meanwhile, the author also analyzed the inherent problems in the process of learning generated by the cognitive differences of deaf students.

Figure 1. The barriers faced by the deaf in online courses (McKeown & McKeown, 2019)

As we mentioned earlier, online learners with disabilities can be classified according to different physical disabilities. Drawing on the basic framework of this article, we can take into account the characteristics of different types of learners and try to build a basic framework suitable for all disabled learners. For example, blind people cannot read visual materials directly, and some physically disabled people need to use an adaptive keyboard or mouse to complete the operation. It is the difference in requirements for adaptive technologies, and learners' cognitive differences caused by physiological differences.

3. Solutions：Accessibility framework

In actual online learning, learners may have one or more disabilities. In general, therefore, design as many possible scenarios as possible. This framework covers all aspects that may cause problems in the accessibility of network learning. All of the issues we mentioned in the previous article can be found in place within this framework. Be able to help the designer, developer, or teacher see the big picture throughout the process.

The basic principle of using this framework is that we need to think comprehensively from four perspectives and try to solve the accessibility problems existing in each layer barrier. At the same time, we also need to consider the possible issues arising from the interaction between adjacent two layers. The framework can not only serve as a preparatory solution during design and development but also provide a solution to locate problems after they have occurred.

Figure 2. Accessibility Framework

We can start from any direction of VASM (Visual, Auditory, Speech, Motor disabilities), and solve the problem from the outer layer to the inner layer, and finally reach the content to realize the accessibility of online courses. There are four layers in the framework. Problems at each layer include:

Layer 1: Adaptive technologies. Commonly used software includes writing helpers (e.g., Inspiration, WYNN), screen readers (e.g., JAWS, ReadPlease), Scanning, and optical character recognition (OCR), and Voice dictation software. The lack of adaptive technology in online learning may be due to a lack of appropriate access to tools for students, or it may be due to a lack of training and proficiency in using available tools. Be aware that LMS is compatible with adaptive technology when providing students with adaptive technology. Sometimes students need to use a combination of two or more adaptive technologies. In this case, it is necessary to consider whether these technologies can work well together.
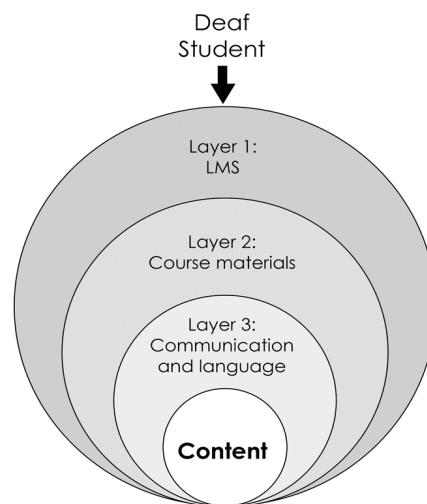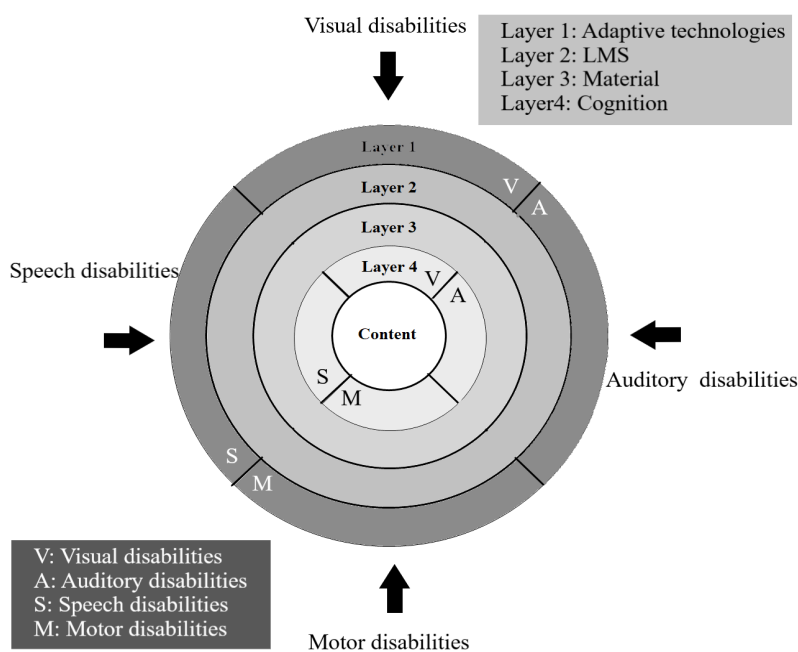
Layer 2: LMS. Inaccessibility of websites and CMS/LMS is the most common problem. Problems reported with these is hardly surprising given that these are the most popular means of delivering e-learning in postsecondary education (Malik, Asuncion, & Fichten, 2005). It can reflect both accessibility and usability issues with CMS systems, such as WebCT, as well as problems with course websites developed by individual professors, departments, and schools. Besides, problems experienced can be due both to software issues as well as to content put into a CMS and websites.

Layer 3: Material. There are many formats for teaching materials, such as PPT, video, and audio, or simple text materials. Take the PDF as an example. PDF is a universal file format for course notes or materials used in online learning. It is also one of the file formats prone to accessibility problems. According to the research, the problem with PDF is that its accessibility is dependent on how the PDF was made. Adobe Acrobat Pro could make PDFs accessible, check the accessibility of PDFs, and fix accessibility issues, which is highly helpful for online teachers or designers who need to develop PDFs with the consideration of accessibilities. Take an example. Many PDF problems can be fixed by a technique which is called tagging. Tagging is adding labels that are not visible to the readers of a document but which are used by suitable reading tools such as screen readers.

Layer 4: Cognition. As mentioned before, about the language problems of deaf learners, the learning activities of disabled people occur in different ways because they are different from healthy people. It is not directly assumed that their learning activities occur in the same way as healthy people, but it is necessary to understand their cognitive rules through research to provide learning strategies.

4. Student-centered evaluation

A study proves that the student-centered approach is an integral part of e-learning accessibility assessment, and both moderate and inappropriate student-centered assessment forms can produce useful data (Kumar & Owston. 2016). Automated assessment tools and the accessibility guidelines they are based on are ineffective in identifying all potential barriers to accessibility and can ignore those that have a significant impact on student success. It highlights a pivotal point in guiding efforts to ensure that students understand e-learning content and the importance of using e-learning interfaces through student-centered accessibility assessments. Besides, students with disabilities are not the only students who are disadvantaged by an inaccessible e-learning environment, and therefore accessibility is an essential variable for all students.

5. Conclusion

Accessibility is the law that also requires the call of our field. According to the recent Association for Educational Communications and Technology (AECT) definition of Educational Technology (ET) in 2017, the ET field also pays more and more attention to ethical issues. The word ethical turns to the fact that the professors must maintain a high level of professional conduct (Reiser, 2012, p. 4). "Ethical issues are not the kind of abstract pine the sky things that end up on ethical standards" (Green & Molenda, 2014). Whenever moral issues should be the first consideration in any case!

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