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Web-based Education and Accessibility

Emre Dinc

Abstract

Technology has been affecting education for a long time. Websites occupy a significant place and web-based learning is an important example. The Internet today plays several critical roles in education such as: providing information, fostering communication, providing an environment for creativity, and delivering instruction. Currently, websites are gaining importance in education. This paper presents information about web-based learning, using websites in education, and reports information about what researchers have discovered in this regard. In addition, a critical topic, which is web accessibility, is discussed related to multimedia elements. Consequently, a website can be used as a source of information, as a tool for assessment, and as a platform to produce and share a product.

Keywords: Educational websites, web-based learning, accessibility, educational technology, multimedia.

Introduction

In this paper, the history of technology in a classroom environment, the importance of web-based education which is ubiquitous in the 21st century and accessibility which is one of the critical issues of the web that needs to be considered while designing a product are reviewed. Technology has been affecting education for a long time. In the 1920s, motion pictures were quite popular in education, and even Thomas Edison thought that this would create a revolution in education. However, Cuban (1986) pointed out that the motion pictures were not in demand by teachers. In the 1930s and 1940s, people began to see the importance of radio to use in education, but educators did not use it in classrooms as much as they could have. By the 1950s, television, with visual and motion power, started to be seen as a fruitful tool for education. Nonetheless, teachers rarely used TV in the classroom. Computer-based programming was taken into account to solve the problems in schools, but research results showed that those systems did not give expected results (Cognition and Technology Group at Vanderbilt, 1996). As seen from the process of educational technology, in recent history, using those technologies failed to affect learning. The reason for this failure was not the use of technology, but the approach adopted. Education systems adopted the technology-centered approach instead of the learner-centered approach.

Technological tools have been used for transferring the information. However, if we use technology to build and share knowledge, technology will be more useful. At this juncture, we should ask ourselves "How?". In today's world, everyone is familiar with computers. With the advent of the Internet, computers gained additional importance. People now communicate online, work online, and more importantly educate themselves online. Therefore, the importance of websites in our lives cannot be ignored. In this century, websites are being used as tools to reach people for various purposes, such as business, education, marketing, advertisement, health, and as platforms to produce appropriate software and applications.

In education, websites occupy a significant place, and web-based learning is an important example. The Internet today has several critical roles in education, such as providing information, fostering communication, providing an environment for creativity, and delivering instruction (Nachmias et al., 1998). According to educators, online databases and museums on the internet have a positive effect on learners. Besides this, thanks to the Internet, learners can communicate with other learners and teachers. Online communities can share their documents and improve and build their knowledge together. Several websites provide activities and courses for all levels of education (Hackbarth, 1997; Khan, 1997; Nachmias et al., 1998). In the academic literature, websites are referred to in detail within the scope of web-based learning. There are many studies that have been conducted about web-based learning (Liu, 2017; Ekici & Delen, 2016; El-Seoud et al., 2013; Coiro & Foglemon, 2011; Choi & Bakken, 2010; Chen, Chang and Wang, 2008; Chiu & Wang, 2008; Harper & DeWaters, 2008; Wall, 2007; Woo & Reeves, 2007; Nguyen, Hsieh and Allen, 2006; Hillier, 2003; McKimm, Jollie and Cantillon, 2003; Chumley-Jones, Dobbie and Alford, 2002; Mioduser et al., 2000; Nachmias et al., 1998).

Literature

In the study carried out by Liu (2017), it was stated that web-based learning began to appear more and more in distance education and related areas. The researcher examined an English teaching model in a multimedia classroom using web-based learning. The web-based learning activities were categorized as: *web-supported*, which is posting or distributing materials in a face-to-face course, *web-enhanced*, which is to improve a face-to-face course with internet resources, *web-enabled*, which supports face-to-face courses with online learning activities, and *web-delivered*, which is completely online.

Ekici and Delen (2016) aimed to examine the diaries shared by preservice teachers in the fields of science and mathematics in web-based environments within the context of "teaching practice" during their teaching practicum course. Two websites have been created to ensure that preservice teachers share their experiences. This ensures that the ideas of the participants are visible for the researchers to see the participants' understanding (National Research Council, 2000). The authors analyzed the 195 postings that the 65 preservice teachers shared about the three activities on the website. When the research findings were examined, it was determined that more detailed information about the subjects; *evaluating the teaching methods* used in the learning process and *emphasizing the preparations before the lesson* has been provided in the diaries of preservice mathematics teachers. Likewise, based on the results of the study of Tüzel and Tok (2013), learners have many advantages in web-based environments such as: comfort, time-saving, economic efficiency, easy sharing opportunities, visual use, legible writing, reduction of writing and punctuation problems, and page layout.

In their analysis of web-based education through cloud computing, El-Seoud et al. (2013) drew our attention to the learning activities of asynchronous e-learning web-based modules. Eighty-five undergraduate students from three different departments participated in a survey that included learning activities, such as quizzes, discussions, websites, and chatrooms to vote according to their importance. The researchers stated that collaboration among students and teachers, sharing bookmarks that the students find interesting, and web-based evaluation that enables the instant feedback, adding questions, and active learning are significant in the eyes of participants regarding web-based learning.

Coiro and Fogleman (2011) suggested that if websites are used wisely, they would deepen understanding and support learning. As they indicated, in Web-based Informational Reading Systems, which is one of the three types of web-based environments, such websites offer concepts of specific areas by using texts, videos, and photographs. The learner uses such websites for reading and viewing the information provided. Teachers use these kinds of websites to give homework and assignments, such as reading a story on the site. When the students read the information, the teacher asks them to write their feelings or thoughts about it or asks them to identify the facts related to the information just the way students use these kinds of websites to inform themselves. In addition, the researchers suggested that teachers could select some websites that students would be interested in. By using the chosen websites, students could read informational texts of their interest and at their level.

Choi and Bakken's (2010) research aimed to demonstrate the effectiveness of their website, which was designed to educate parents who have low health literacy by using a variety of visuals, such as photos and clip art. These visual elements supported the text to improve users' understanding. The website was designed according to the cognitive theory of multimedia learning, and accordingly, participants commented positively that the website was useful. Besides, using limited text, color, text-size, pop-ups leads the researchers to conclude the themes as simplicity in design, content and technical features.

Chen, Chang, and Wang (2008) developed a ubiquitous learning environment with the support of a learning website. The website was created to provide resources and enhance learning outcomes. Learning status awareness, schedule reminders, and mentor arrangements were also added to the web-based learning system. The web-based learning system, which is supported with a website, performed the work on the Microsoft Internet Services web server and supported reading, quizzes, discussions, assignments, and examinations. A total of 54 college students participated in the study, and the findings indicated that the ubiquitous learning website enhances academic performance, the task accomplishment rate, and the learning goals achievement rate.

Chiu and Wang (2008) looked at web-based learning from a different perspective – continuance. In their study, the researchers gathered data from 286 participants via a survey to investigate reasons participants intended to continue using web-based learning. Findings showed that while *performance expectancy* and *utility value* affected the intention of utilizing web-based learning continually at the same level, *social isolation*, *delay response*, and *risk of arbitrary learning* had no effect on the continuance. The study indicates that *effort*

expectancy, *computer self-efficacy*, *attainment value*, and *intrinsic value* also had a significant effect, but *anxiety* had an adverse effect on the continuance.

In a study conducted by Wall (2007), an alcohol abuse prevention program delivered through an interactive web-based format was evaluated. Wall examined the differences between participants (20,150 individuals) who did receive the web-based program and those who did not. The evaluation concluded that web-based health education programs that are interactive and designed according to participants' interests and learning needs are valuable. Another notable result was that the delivery format of the program affected outcomes the most.

Woo and Reeves (2007) studied "interaction" in web-based learning regarding social constructivism. It is stated that keeping interaction ongoing is more challenging in the web-based learning environment than in a face-to-face setting due to time and space differences. The study focused on online interaction to ensure meaningful learning and alleged that analyzing this interaction might uncover ways to improve the quality of web-based learning environments. The researchers pointed out that web-based learning programs should focus on human to human interaction rather than human to context interaction, and authentic tasks should be taken into account because, in this way, meaningful interaction can be more likely.

Nguyen, Hsieh, and Allen (2006) conducted a study by using qualitative and quantitative methods to examine whether or not web-based assessment positively affects mathematics teaching and learning. According to the study, assessment in this way would provide instruction and learning enhancement, appropriate feedback for students, and also increase students' attitude towards mathematics. The study demonstrated that receiving immediate feedback and computerized scores helps students to have more control over their learning. Practicing anytime and getting feedback instantly in a web-based learning setting encourages students to spend more time on the tasks and to have better performance. Further, it supports students to be more confident in problem-solving and be more motivated to learn mathematics, and it lowers anxiety.

McKimm, Jollie, and Cantillon (2003) discussed how web-based education could be supportive and helpful for educator and their students in medical education. It is stated that accessing a vast amount of information on the Internet (e.g., online libraries) is easier with the help of hyperlinks that web pages host. The researchers indicated some advantages of web-based learning: enabling learners to connect with many resources, providing an easy way to deliver content, being portable if necessary, and making possible independent and active learning. The researchers also mentioned that discussion boards to bring isolated individuals together and getting instant feedback are also benefits of this kind of leaning.

A research report published by Nachmias et al. in 1998 investigated the taxonomy of educational websites. The researchers stated that currently many students, teachers, researchers are getting involved in building educational websites. The aims of the structure of the sites are different in various ways such as the variety of information presented, the kind of research conducted, and technology employed in building them. While constructing their taxonomy, they took into account four dimensions: *basic identification and reference indexes*, *pedagogical dimension*, *knowledge dimension*, and *communication dimension*. Moiduser et al. in 2000 examined sample educational websites according to the taxonomy and conclude the research with *one step ahead for the technology*, *two steps back for the pedagogy*. This means that many educational websites are still mostly text-based, and they do not have a pedagogical approach. Additionally, many websites have enormous information, hyperlinks to external sources, and online activities giving feedback automatically such as multiple-choice questions and answers.

According to these studies regarding many aspects of web-based learning, websites have vital importance in the learning process today. Educators and learners need to use the web wisely to improve the quality of learning outcomes because websites contain the necessary information, enable appropriate assessment, provide instant feedback and collaboration. Additionally, the web makes it easy to access information, encourages participants to learn, motivates learners to spend time on tasks, helps learners to express themselves clearly, and eases the implementation of learning activities.

Accessibility: Critical Aspect of the Web

Multimedia is a highly attractive medium to most people because it informs them easily according to their learning style. It represents the consolidation of all aspects of technology as they combine sound, image, video, drawing, and text with high quality in addition to the interactive environment (Fouda, 2008; Aloraini, 2012). According to the Multimedia Literacy Textbook written by Hofstetter (2001), reading itself has been changed by multimedia from linear to dynamic. As mentioned in the book, people retain only 20% of what they see and

30% of what they hear, but they recall 80% of what they see, hear and do simultaneously (Computer Technology Research [CTR] Corporation reports). When we consider a web page without pictures, videos and audio, it would be just a page of text. It would look quite dreary. Briefly, multimedia elements help to convey the information and reach the targeted community easily. Using multimedia elements should not be random; the designers should consider the users' learning style, learning pace, and special conditions.

As mentioned above, students, designers, and educators are involved in the process of building websites. No matter who is building a website, specifically an educational one, there is an important issue that cannot be ignored, which is accessibility. If the website is designed to address students, for example, the characteristics of students should be taken into consideration. There may be some students with disabilities, such as color blindness, low vision, learning disabilities, cognitive disabilities, limited movement, photosensitivity or combination of some of these (Web Content Accessibility Guidelines Working Group, 2008). Therefore, the website must be created and designed to appeal to them as well.

Also, some elements of multimedia (some videos or images) cannot be uploaded by the browsers according to their formats that viewers use. Using accessible formats or finding alternative ways to eliminate the problem would enrich the website. In such cases, when the designer uses a photo embedded with HTML code as a title, the user will know what should be there. With that advantage, the website would attract more viewers regardless of which browser they use.

There are some studies related to web-accessibility in the academic literature (Giannoumi et al., 2017; Iniesto et al., 2017; Rodriguez et al., 2017; Aizpurua, Harper, & Vigo, 2016; Yesilada et al., 2012; Brajnik, Yesilada & Harper, 2010; Abou-Zahra, 2008; Hanson, Richards & Swart, 2008; Harper & Yesilada, 2008; Friedman & Bryen, 2007; Vigo et al., 2007). This indicates that many researchers are working on this subject in various countries. It is understood that the nations have attached utmost importance to this issue.

There is no single definition of accessibility. Therefore, Yesilada et al. (2012) conducted a study to compile the views of people who are interested in accessibility by providing them some proposed definitions for their feedback. The researchers questioned: the relationship between web accessibility and usability, web accessibility for all or only for disabled people, the evaluation methods, and the importance of the context. They gathered detailed data related to *the age, the country, the working area, the role, educational background, specialization, and the interest level* of the participants to see the heterogeneity needed to create active discussions with people who have the potential to use the shared definition. According to their findings, the definition below was the most popular one. The strong points of this definition are the wide coverage and the active role of users. The engineers and all work areas opted for this definition.

“Web accessibility means that people with disabilities can use the web. More specifically, Web accessibility means that people with disabilities can perceive, understand, navigate, and interact with the web, and they can contribute to the web.” (W3C WAI)

Another popular definition, according to the study, is given below. This is one that received the lowest number of negative comments and was the most popular in the US. This definition was accepted mostly by people who are in the field of business, psychology, and design. Most importantly, this definition targets all users.

“Technology is accessible if it can be used as effectively by people with disabilities as by those without.” (Section 508 – Access Board of the US Federal Government)

The researchers concluded that the best definition should focus on contributing, being achievable and realistic, should not be ambiguous or vague, and be understood by everyone.

In a recent study conducted by Giannoumi et al. (2017), the relationship between web accessibility and Technological Protection Measures (TPM), which is led by multilevel governance and social regulations, was analyzed. Academic literature focused on web accessibility and copyright laws for persons with cognitive disabilities like developmental and intellectual disabilities, traumatic brain injury, dyslexia, and autism, was reviewed. The researchers stated that mostly people with sensory and physical disabilities are the subject of web accessibility studies. However, the relationship between people with cognitive disabilities and the obstacles they face is affected by social, cultural, and political norms. It was concluded that the laws and regulations that protect TPM should not be an obstacle for people with cognitive disabilities in using their rights to utilize the web. The laws should ensure pointed legal protection for every individual to create, use, and share accessible formats.

Iniesto et al. (2017) highlighted that more and more learners with disabilities prefer distance education. Accordingly, the researchers investigated the perspective of learners and providers regarding the accessibility of Massive Open Online Courses (MOOCs). It is alleged that the accessible MOOCs have a flexible learning format. A common view among provider-interviewees was that there is a lack of identifying the needs of disabled people when creating content for MOOCs. Compared to other learners, disabled learners are more interested in MOOCs to see if they can manage online higher education. Therefore, disabled learners' preferences should be considered in practices.

Rodriguez et al. (2017) first provided some information about the Open Educational Resources (OER) and the Open Course Ware (OCW) regarding the ease of accessing those anywhere, anytime. The study underscored both the universal knowledge by citing UNESCO and sharing course materials online by citing MIT. Afterward, the researchers presented a framework to enhance the accessibility of OCW sites by referencing the regulation ISO/IEC 13407 and the Web Content Accessibility Guidelines 2.0 (WCAG). The three levels of success criteria regarding accessibility are: all non-text content has an alternate text with an equivalent purpose, the visual presentation of text, and images of text that have a contrast ratio of 7:1 with the exception of large, incidental text or logos.

The prominent aim in making accessible websites for everyone including people with special needs is to increase the usability rate. Similarly, Aizpurua, Harper, and Vigo (2016) examined the correlation between web accessibility and usability concerning user experience. The researchers designated four websites using for accessible checkers: AChecker, EvalAccess, TAW, and WAVE. They categorized the designated websites and performed the study with 11 participants, who are legally blind and using screen readers to utilize the web, by asking questions about familiarity with the web, frequency of access to the web, and demographics of the participants. It is noteworthy that the design of the website's menu and hyperlinks have an effect on the perception of the website. The more accessible the website is, the more motivated users would be to navigate on the website and revisit it.

Conclusion

Throughout the history of technology, people have increased their expectations of technology. Today, websites that have multimedia elements, interactive features, and a higher level of accessibility are named "well-designed websites." Researchers have placed emphasis on the importance of a well-designed website for all users (Aizpurua, Harper, & Vigo, 2016; Coiro & Fogleman, 2011; Wall, 2007). There are many significant points that educators and designers should give importance to interaction, special needs, collaboration, pedagogy, and accessibility. Otherwise, the sites are useless, nobody searches them, and no one learns anything.

Planning how to design a high-quality educational website according to general standards of multimedia learning is complicated and strenuous. The visual design of the sites should be appropriate, and navigation must be precise. Less complex texts should be used to guarantee balance in design concerning cognitive load as stated in the study of cognitive theory by Choi & Bakken (2010). In light of the evidence presented in this paper, well-designed educational websites are needed. However, this is troublesome because it is vital to design the site to appeal to as many as possible. In addition, designers should seriously consider accessibility because they may find themselves in difficult situations due to legal regulations as Vigo et al. (2007) mentioned in the study about quantitative accessibility measurements.

When we consider all these aspects and the findings of the studies, websites can be used as sources of information, tools for assessments, and platforms to produce and share products (Liu, 2017; Ekici & Delen, 2016; El-Seoud et al., 2013). A well-designed educational website would be helpful for all learners getting their educational degrees, for teachers to assess students' understanding, and for academics who want to determine what other people think about education. For students, educators, and designers, it is never too late to use educational websites wisely to enhance learning and also not to create websites for particular groups of people but everyone.

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