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ACCESSIBILITY EVALUATION OF MOOCS' WEBSITES OF TURKEY

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ABSTRACT

Massive Open Online Courses are emerged by the use of developing technologies for distance learning. With the aid of these systems, millions of people have an opportunity to attend academic lectures and obtain certificate. In recent years, most of the well known universities have supported these type of studies. Thus, number of open courses have been increased. In this study, specifically in context of Turkey, three most commonly used MOOC platforms evaluated the level of accessibility of localized MOOCs using automatic accessibility checking and provide some recommendations to improve its accessibility and usability.

1. INTRODUCTION

Traditional education has been provided by instructions, which is presented in brick-and-mortar institutions, which has obstacles for blind people as identified lack of independent navigation. Road and classroom has inadequate infrastructure to provide accessible education to people with disabilities. Due to a lack of these basic school infrastructures, people with disabilities, such as the blind students often do not receive training classes for navigation. Therefore, blind people has difficulties go to class without a human escort to attend schools (Ferati et al., 2014). Recently, the proliferation of open online courses has radically changed the traditional education along with the effect of globalization. Web based technologies have a tremendous chance, but the application of these technologies also needs to surmount substantial disputes in an effort to gain advantage of them entirely (Allison et al., 2012). Online courses offered by many universities by using Massive Open Online Courses (MOOCs), which are available to large audiences and are promising to fulfil learning needs to millions of people, regardless of their geographical location or personal abilities and disabilities are classes carried in an online environment with substantial dissimilarities from earlier approaches to online education. MOOCs have essentially larger audiences than traditional online education, which have the aspects of free and open to all (Martín-Monje and Bárcena, 2015; Voss, 2013). E-learning has been enhanced by MOOCs, which give the opportunity to students to have official certificates, high-qualified instructors in renowned institution. The raising usage and penetration of e-learning and information technologies has,

unfortunately, had a negative impact on access to course materials and other resources hosted online for students with disabilities, specifically those individuals with sensory impairments (Bühler and Fisseler, 2007; Buzzi, Buzzi, & Leporini, 2009; Colace, De Santo, & Mascambruno, 2007; Evans, 2009; Evans & Douglas, 2008; Fichten et al., 2009; Fichten et al., 2009). Regarding MOOCs, the blind people has a big opportunity for who in this case are not able to enroll in face-to-face learning. On one hand, accessible facilities, accessible equipment, accessible educational resources, or costly physical adaptations aspects of educational institutions do not need to design for disabled people. On the other hand, MOOCs can be designed based on technical and financial dimensions (Rizzardini et al., 2013). MOOCs have attained a stimulating reputation, partially precisely its require that MOOCs are open to both normal and disabled people. Regardless, their openness MOOCs do not provide equal access to content or courses, as researches have indicated that most of the MOOC websites do not comply with accessibility guidelines (Al-Mouh et al., 2014; Bohnsack and Puhl, 2014). Accordingly, regardless of the MOOCs' main aim and provide education to all people must have equal accessible opportunities to all MOOCs' recourses, studies have indicated that MOOCs are not designed accessible to people with disabilities are still being deprived from taking full advantage of these services, such as the blind, which approximately comprise 15 % of the world population (Singleton and Clark, 2013; Calle-Jimenez et al., 2014; Sanchez-Gordon & Luján-Mora, 2015) or the elderly (Bong and Chen, 2016; Sanchez-Gordon and Luján-Mora, 2013). MOOCs, however, can overcome inclusion barriers if developed with accessibility in mind (Sanchez-Gordon and Luján-Mora, 2016). Implementing metadata can be improved the accessibility of websites, which is suggested by various studies (I"niesto and Rodrigo, 2015), content adaptation (Sanchez-Gordon and Luján-Mora, 2015) and following the Web Content Accessibility Guidelines (WCAG) (Chisholm et al., 2001). The WCAG are comprised of 14 guidelines, each divided into various "65 checkpoints.", that describe how developers could adapt their web content in order to make it accessible. Web accessibility can be defined as the degree and equality to which a site is accessible to the largest possible range of people. the specific conditions of people is not expresses by web accessibility but these conditions have an impact on their ability to use and access the web, the more people are able to access a website, the more accessible is the site (Carter and Marker, 2001; W3C). There are several categories of disabilities: visual, auditory, physical, motor, speech, cognitive, psychosocial, neurological disabilities among others (Burgstahler, 2002, W3C). There are permanent, temporary or situational disabilities (Farrelly, 2011). It is examined that accessibility as having learning environments that are "compatible with assistive technologies, such as narrators, scanners, enlargement, voice-activated technologies, refreshable Braille, and other devices" (Wentz, Jaeger and Lazar, 2011). According to Anastasopoulos and Baer (2014), MOOCs are enhance access to education just like any other online courses but the people who are unable to enjoy this privilege predominantly are those with visual and hearing impairments. According to World Health Organization (WHO), The estimated number of people visually impaired in the world is 285 million, 39 million blind and 246 million having low vision; 65 % of people visually impaired and 82% of all blind are 50 years and older. In context of Turkey, Turkey has an estimated of totaş population of 220.000 disabilities, out of which about 12% blind and visually impaired. The only school for the blind in Turkey is mitigating this issue by promoting inclusion on regular schools and sending teachers to blind persons' homes, although this brings a heavy load on the school, considering the low number of staff. Regarding these affairs, the education process of the blind or visual impairment people could be contributed by MOOCs, which is an infrastructure to advance facilitates.

2. DEFINITION AND HISTORY OF MOOCS

More recently, the massive open online course (MOOC), which is a new form of online course has emerged, which is a form of e-learning and distance education. The emergence of MOOCs are providing online courses to large-scale interactive participation and access via Web, where content followed up by individuals including people with disabilities and elderly, who enroll, too. In addition to the traditional lecture notes such as slides, the content of courses via videos, texts, quizzes/online tests, discussion forums, blogs and so forth is conveyed by instruction. The participants tend to be young, well educated, and employed, with a majority from developed countries have indicated in the studies. There are substantially more males than females enrolling and following up MOOCs, notably in developing countries. Students' primary aims for enrolling and following up a MOOC are promoting in their current job and fulfilling interests (Gaebel, 2013; Wang & Baker, 2015). MOOCs to promptly advance reputation accordingly mentioned above these advantages, and hence, MOOCs have been raising their number of students exponentially during the last years. MOOC is open and free of charge, whoever have Internet access and willing to learn can use it. MOOC is massive; unlimited of students can register and enroll these characteristics have defined MOOCs that differentiate them from earlier online courses (Kay et al., 2013).

Dave Cormier raised the name of MOOC in 2008 as an on behalf of an online course, in which the massive number 2,200 participants from the general public enrolled to define "Connectivism and Connective Knowledge" credit and required payment course opened for a group of 25 students; nevertheless, after some time, the number of the student, who enrolled in the mentioned course raised to 2,300, the mentioned course given by Siemens and Downes (Herman, 2012; Holdaway & Hawtin, 2013; Stokes, 2013; Parr, 2013; Parry, 2010; Yuan & Powell, 2013). Stanford Professor Sebastian Thrun opened a course on artificial intelligence in 2011, the number of 160,000 students enrolled the mentioned course. In addition, two more MOOCs were initiated by Daphne Koller and Andrew Ng. Due to the participants raised the high number, Thrun, Ng and Koller imagined a more extensive require for knowledge in the a couple weeks. "Udacity" and "Coursera" companies founded by Daphne Koller and Andrew Ng. These companies carried on providers for infrastructure and aim to participants with universities, which are to distribute the content of the courses. A vast media coverage initiated on MOOCs in 2012. In early 2013, media coverage initiated with a delay in Germany and other European countries, when other companies utilized to provide infrastructure for MOOCs and searched for participants with universities. "P2PU" (UK), "Iversity" (GER), "Open MOOC" (Spain) or "Futurelearn" (UK) can be given as some examples. The globally popular MOOCs, such as Coursera, Udacity, Khan Academy, EdX, Desire2Learn, Canvas, and FutureLearn host hundreds of courses with millions of participants. In addition to global MOOCs, localized MOOCs utilized, which is specific a language and a region. These kind of MOOCs' major aim to provide particular demands that are characteristically not related to the aspects of the global MOOCs. For example, by 2017, Coursera offered more than 2000 courses from 149 partner universities and 25 million users (https://about.coursera.org/). Two Stanford University professors constituted Coursera (www.coursera.org), which is presently a significant MOOC platform, supplying 212 different courses in such subjects as: biology, business, computer sciences, earth sciences, economics, film, food, health, medicine, music etc. Coursera has a cooperation 33 universities, which is the most famous and well regarded in the world. Udacity (www.udacity.com) has a range of topics from beginner, intermediate and to advanced courses. Topics include especially computer science courses. The prestigious academic institutions Harvard University and MIT established EdX (www.edx.org), which content well regarded courses. Khan Academy (www.khanacademy.org) is a MOOC platform, the target group of which is young learners from kindergarten to 12 years old with

courses focused on biology, chemistry, mathematics, physics and science. FutureLearn (www.futurelearn.com) is the recent significant performer attracting how MOOCs are consistently transforming. A consortium 12 major UK universities constituted FutureLearn. The Open University has substantial experience in distance and online education. In this context, free access courses have been provided by the pioneer Europe-wide institutions as a several endeavours. Except the Open University UK, The European open universities were comparatively non-participating about the MOOCs' infrastructural advancements. Regardless how, as time progress more MOOSs go into action, which was Futurelearn in 2012 (Gaebel, 2013).

Recently, MOOCs' have drawn much attention of both researchers and educators in Turkey. In terms of Turkey. The first initiative to propose MOOCs was constructed in 2013 by Anadolu University. However, due to inadequate registration and lack of support these courses could not utilized. Afterward, in 2014, Koc University originated a project to transform some of Coursera courses into Turkish, and later Koc University designed and provided a course in Turkish in Coursera in 2014. At the end of 2014, Erzurum Ataturk University and Anadolu University revealed their MOOC infrastructures and contributions. Ataturk University's MOOCs infrastructure arised AtademiX, which is based on the Moodle infrastructure. AtademiX has 15 courses. A few months before the launch of AtademiX, Anadolu University has established, whih was intitled as AKEDEMA MOOC platform and courses. The development of AKEDEMA was based-on SharePoint infrastructure. Currently, AKEDEMA has 58 courses, which was created Turkish students' cultural and learning characteristics with no fees. Along with these two initiatives, there is couple more initiatives asserted MOOCs infrastructures, such as Turkcell Academy's by oneself learning courses (with the cooperation of MIT and Khan Academy), Turkish Academy of Sciences, and the Scientific and Technological Research Council of Turkey introduced the OpenCourseWare Project, which won 5000 $ grants (Aydin, 2017). Liyanagunawardena et al. (2013) reviewed the published MOOC litarature (2008-2012), and the results of the study revealed that most of the papers centered only on introducing MOOCs and the discussion of challenges of MOOCs.

3. BACKGROUND AND RELATED WORK

In our initial literature review, we have observed there has been limited research focused on accessibility within MOOCs. To date, no research focused on the accessibility of MOOCs' websites of Turkey. Researchers have initiated to pay attention to the accessibility of MOOC platforms and courses with the increasing popularity of MOOCs. The majority of research published so far focus on the accessibility of courses. It is still early stage of such research. For instance, Johnson and Ruppert (2002) assessed accessibility of Blackboard 4, Blackboard 5, Prometheus 4, and WebCT 3.0 using W3C/WAI guidelines. The results of the study indicated that analyzed four LMSs need to comply with Priority 1 of the W3C/WAI guidelines. In addition, Guenaga, Burger and Oliver (2004) investigated the accessibility of LMSs' tools. The results of the study revealed that there is no LMS tool that comply with WCAG guidelines and specifications. Fichten et al. (2009) examined the accessibility of e-learning materials for university students with visual impairments with two studies the results of the study indicated that blind students are more affected by the exclusionary design practices than students with low vision. Burgstahler, Corrigan and McCarter (2005), asserted due to inaccessible design of MOOCs, some people with disabilities (visual impairments) can not access (graphic and video content) the MOOCs. Rizzardini, Chang, Gütl and Amado-Salvatierra (2013) evaluated the MOOC. Researchers reported the barriers they found in the MOOC. Unavailability of 'alt' images, access keys and non-existent sound controls barriers have been examined as barriers.

Sanchez-Gordon and Luján-Mora (2013) conducted heuristic testing to identify the potential accessibility problems for elderly students with using selected five Coursera courses. The results revealed that all the courses have accessibility issues. The same year, the same researchers, Sanchez-Gordon and Luján-Mora (2013) proposed MOOCs (Massive Open Online Courses) as creditable courses in engineering programs at the National Polytechnic School of Ecuador. Sanchez-Gordon & Luján-Mora (2014), asserted thta content and platform two interrelated aspects of accessibility. The same year, Seale (2014) proves that the accessibility of MOOCs has not been considered as a vital issue. Watling (2011: 491), identifies three ways in which digital exclusion can take place; that is through "high set-up costs, inadequate technical support and exclusive design practices". Equally, Bohnsack and Puhl (2014), report that their study on MOOC accessibility reveals that there is incorrect web design. The same year, Sanchez-Gordon and Luján-Mora (2014) proposed personal and non-personal disabilities, which is two kind of web accessibility necessities.

Another example is the study conducted by Al-Mouh et al. (2014) analyzed the accessibility of Coursera courses from the aspects of users and experts. For users aspect, researchers tested a set of essential tasks using screen readers. For experts aspect, 10 courses conducted heuristic assessment. The results of the study revealed that the courses failed to comply with WCAG 2.0 guidelines. Moreover, Calle-Jimenez et al. (2014) evaluated a Geo-MOOC course using three automated tools. The results of the study indicated that one of the tools depicted more accessibility errors. Bohnsack and Puhl (2014) investigated Udacity, Coursera, edX, OpenCourseWorld and Iversity using user testing with blind users, rather than W3C guidelines. The results of this study indicated that none of these MOOCs were accessible for people with visual impairments, particularly blind people. Iniesto et al. (2014) examined the accessibility of UNED COMA and UAb iMOOC. The findings revealed that none of the analyzed infrastructures have not accessible and understandable contents.

Kelle et al., (2015) utilized a new participatory design for learning, developed in the context of a transnational initiative for creating Massive Open Online Courses (MOOCs) on Accessible Design for ICT. Rodrigo and Iniesto (2015) said that the access to MOOC platforms still present barriers, there is also a lack of accessibility on the learning resources, the communicating tools and even personalized user interfaces.

More recently, Iniesto et al., (2016) conducted a study to investigate the perceptions of managers, platform software developers and designers, and MOOC accessibility researchers. The results indicated the the awareness that MOOCs can be valuable for disabled learners, and indicate that legislation acts as a driver for accessibility.

Some similar studies on accessibility of MOOC web sites were also conducted by Baker et al. (2012), Dias and Diniz (2013), Santos et al. (2014), Iniesto and Rodrigo (2014), Pascual et al. (2014), Yousef et al. (2015), Sanchez-Gordon et al. (2015), Draffan et al. (2015), Sanchez-Gordon and Luja´n-Mora (2015), Sanchez-Gordon and Luja´n-Mora (2016), Van Rooij and Zirkle (2016), Iniesto et al. (2016), Sanchez-Gordon et al. (2016), Gupta and Fatima (2016), Sanderson et al. (2016), Bong and Chen (2016), Coughlan et al. (2016), Ferati et al. (2016), Ferna´ndez et al. (2016), Martı´n et al. (2016), Rodriguez-Ascaso et al. (2016), Iniesto and Rodrigo (2016), Ngubane-Mokiwa (2016), Osuna and Tejera (2016), Park et al. (2016) and give suggestions for improvements.

4. WEB ACCESSIBILITY

Web accessibility means that people with some type of disability or the elderly can use the web. Web accessibility refers to web design that will allow people to perceive, understand, navigate and interact with the Web, contributing with content (Acosta et al., 2018; Luján-Mora, 2013). WCAG 2.0 were developed by the World Wide Web Consortium

(W3C) and is a set the recommendations for making Web content more accessible. It includes 4 principles (perceivable, operable, understandable and robust), 12 guidelines, 61 criteria and 3 levels of conformity which includes A (less demanding but the most important), AA and AAA (more demanding, but the least important). The guidelines provide basic goals for making content accessible. Compliance criteria (sufficient and recommended) have techniques that are applied to the content and technology being used, as described in (W3C, 2008).

5. ACCESSIBILITY ANALYSIS

For the analysis of compliance with accessibility guidelines in Turkey MOOCs, the AChecker tool was utilized. The analysis was carried out for 3-level priority accessibility checkpoints based on WCAG 2.0. The average numbers or errors of the evaluation results are given in Table 1. The lowest and highest average numbers of accessibility issues at conformance level A were observed in the MOOCs websites of M2 (15 errors) and M1 (63 errors). The average number of errors at conformance level AA was lower for all MOOCs. Again, the lowest number of errors was found in the MOOCs websites of M3 (zero error in average) and the highest was observed in Turkish MOOC websites of M2 (26 errors). And also, in the MOOC websites of Turkey, zero error were found at conformance level AAA, which was the lower average number among all three MOOC websites.

In the vast majority of the MOOC websites, checkpoint 1.1.1 was violated at conformance level A. That is, developers failed to provide text equivalent for non-text objects. In the M1, 91% of all the errors were due to violating this criterion. In M2 and M3 MOOC websites, this error constituted of the all errors (15 and 23%, respectively). Among the MOOC websites, the most violated criterion was 2.4.4 concerning the link purpose (31% of all errors) in M3. In the websites of M1 and M2 MOOCs, this error was observed 0 and 0 times. Turkish developers were found to pay more attention to this criterion.

Another criterion that was often violated was checkpoint 1.4.4 (conformance level AA) suggesting that web pages should be readable at least at 200% zoom at various viewport dimensions. This criterion was most violated by the websites of M3 MOOC websites (58 times and 39% of all errors). In the websites of M1 and M2 MOOC websites, this error was found 15 and 37 times, respectively, constituting 6 and 21% of all errors in the respective MOOC websites.

Table 1. Average number of accessibility errors by MOOCs

MOOCS	Average Number of errors by conformance level		
	A	AA	AAA
M1	63	9	-
M2	15	26	-
M3	19	-	-

Table 2. Accessibility checkpoints violated by MOOC websites by MOOCS

Checkpoints	M1	M2	M3
Conformance Level A			
1.1.1	243	27	37
1.3.1	3	26	3
2.4.4	0	0	46
3.3.2	2	4	4
4.1.1	1	1	1
Conformance Level AA			
1.4.3	0	37	0
1.4.4	15	37	58
2.4.6	3	2	0
Conformance Level AAA			
1.4.6	0	43	0

6. DISCUSSION, RECOMMENDATION AND CONCLUSION

Considering that young people are the most frequent users of the Internet, it is more important that MOOC websites have accessibility features. A MOOC website should be considered as an interface that introduces the institution to prospective students and as an effective tool for providing the existing students with access to the courses offered by the MOOC websites throughout their education. Therefore, these websites should have accessibility features to ensure that all the target groups receive an equal level of courses. In the study presented in this paper, three of the well-know MOOCs environments, Atademix, Akadema and Turkcell Academy, were analyzed and compared in terms of their accessibility. Author has resolved that MOOC websites still have limitations regarding accessibility to screen readers' users. Also, it failed to conform to WCAG 2.0 guidelines. Based on the outcomes of author's evaluation, author suggest a set of recommendations to enhance MOOCs accessibility and reduce the difficulty faced by visually impaired when using its courses. The recommendations target courses' authors as well as MOOCs platforms. The following suggestions are given: Information presented needs to be divided into small and easily understandable pieces using appropriate layout elements, such as headings. Text alternatives must be available for any non-text content, whether an audio or text description. Form input labels in quizzes and assignments should have descriptive labels for easier understanding by visual disabled. In exams, authors should indicate fill-in blanks in a question instead of using multiple underscores (__), otherwise the screen-reader will not notify the user about them. Links, tables and images are among content elements that need to have descriptive alternatives. On the other hand, the following are recommendations for MOOC platforms to take into consideration for more accessible content: The MOOC platform should provide an authoring tool to ensure that the content is compatible with A, AA, or AAA levels of WCAG 2.0 guidelines. The student should be able to customize some interface features regarding auto-saving, colors, font size, etc. MOOC websites should have Input Assistance tools for visual disabled persons. MOOC websites should have search options in headings, lists, and tables.

Similar to most of the previous studies, the majority of MOOC websites in the current study did not meet the accessibility criteria. The results of the accessibility analysis showed

that no MOOC websites attained conformance level A. However, only two, M1 and M3, satisfied accessibility conformance levels AAA. An analysis of the distribution of these errors showed that the vast majority of the errors resulted from the violation of success criteria about non-text objects and resizing texts.

This study presented the current situation regarding the accessibility of the MOOC websites in three websites. It contributes to the accessibility researches. For future work, the author plan to focus on user testings and test them with disabled users selected from the same group of MOOC websites and then present the results in a comparative format.

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