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WEB ACCESSIBILITY OF MOOCS FOR ELDERLY STUDENTS: THE CASE OF TURKEY

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ABSTRACT

Learning, eLearning and distance education has a significant function on the elderly for advancing well-being, which has indicated in the literature. In addition to this, e-learning provides an opportunity to become unified with the rest of society to older people. In this context, older people have extensive opportunities to raise the qualified life and enable lifelong learning and inclusion in learning communities by using Massive Open Online Courses (MOOC). The number of users over age 65 has more than doubled since 2000. Currently elderly users represent less than 10 % of MOOC users. Besides, the certain outcome of younger participants aging will raise the number of older people using the Internet the next decades. In this research, it is attempted to examine whether a MOOC-platform is accessible for elderly people. For this purpose, three MOOCs selected and were evaluated. The evaluation was carried out according to the Achecker. The results of the study showed that one of the investigated MOOCs met the overall criteria. And, there is no study has been carried out on the accessibility of MOOCs for elderly users in Turkey context.

1. INTRODUCTION

All over the world, as a result of both increased life expectancy and declining birth rates led to population aging of countries. Every country is encountering population aging, but each country is at a different stage of transition (W.H.O., 2012). Generally, most of the developed countries have population aging issue earlier than other portion of the world. Recently, developed countries have nearly 60 years old or above population, which represents 20% of the total population, in spite of this, only 8% of the total population are 60 years old or above. Especially, the aged 60 or above population of Europe is envisaged to be about 37% by 2050, up from 20% in 2000 (United Nations, 2015). According to a United Nations Report (United Nations, 2015), the number of older people has tripled over the last 50 years in the world, and this number will grow exponentially in the next 50 years. It was considered that the number of people aged 60 or above to be 205 million in 1950 in the world, with just three countries (China, India, and the United States) having more than 10 million older people. According to the projections, 60 or over age group will be growing 3.5 times faster than the

total population from 2025-2030. Nonetheless, 80% of the world's older people are expected to be living in low- and middle-income countries by 2050 (W.H.O., 2012).

The conversion of population will increase the employment of older workers. In additon to this, banking, communication, education, government, access to health and shopping services are needed for independent living. Most of the older people are using the web to address to decrease the feelings of the loneliness and depression and other needs (Kowtko, 2012). Accordingly, elderly people has constituted a progressively significant group of web users. Even though the people has prejudges such as myths and stereotypes about older people, which can be true or false not being interested in using the Internet. And also, older people confront various drawbacks such as vision decline, hearing loss, decremented motor skills and cognition issues when using the web in consequence of diminishing capacities related to aging (Carter and Markel, 2001).

Multiple impairments are likely developed by older people, which affect the ability of older people to perceive, understand, navigate, interact with the Web and contribute to the Web (W3C, 2008). Web accessibility studies must address these challenges confronted by older people. Web accessibility is the attributes of a website to support the same level of effectiveness for all people, whatever their disabilities or non-disabilities (Slatin and Rush, 2003). The accessible Web is fundamentally designed to work for all people, whatever their hardware, software, language, location, or ability, "such as people using a slow Internet connection, people with temporary disabilities such as a broken arm, and people with changing abilities due to aging" (W3C, 2005). MOOCs are accepted as a valid alternative for people who have difficulties to go to school, or attend courses (Jansen and Schuwer, 2015; Alario-Hoyos et al., 2014; Hew and Cheung, 2014). MOOCs provide an opportunity to get rid of limitation of time and place. And, MOOCs have great potentials for the active learning and well-being of elderly people.

2. HISTORY OF MOOCS

To gain a better insight of MOOCs, the historical context and origins of the development of this educational innovation must be studied and examined. The history of MOOCs is not very far. Stephen Downes and George Siemens introduced the term firstly in 2008 based on "Connectivism and Connective Knowledge" distributed peer learning model. Following it, in 2011, Sebastian Thrun and Peter Norving ran the first MOOC definitely massive, the course "Introduction to Artificial Intelligence" through Stanford University, U.S. This course had 160,000 students registered. The need for architecture to support this level of massiveness led to the creation of specific MOOC platforms. A vast media coverage initiated on MOOCs in 2012. "Udacity" and "Coursera" companies founded by Daphne Koller and Andrew Ng and Udemy was established. These companies carried on providers for infrastructure and aim to participants with universities, which are to distribute the content of the courses. Similarly, Udacity reports students ages range from 13 to 80 years (https://www.udacity.com/us) and edEX´s first MOOC had students from 14 to 72 years (Breslow et al., 2013). Following it, the prestigious academic institutions MIT and Harvard University incorporated their MITx platform into EdX. The other MOOC platform Khan Academy (www.khanacademy.org), the target group of it, which is young learners from kindergarten to 12 years old with courses focused on biology, chemistry, mathematics, physics and science. A consortium 12 major UK universities constituted FutureLearn and Iversity followed them which are not US platforms but European. The courses are providing around Europe. "P2PU" (UK), "Iversity" (GER), "Open MOOC" (Spain) or "Futurelearn" (UK) are other examples, which started to provide platforms for MOOCs.

3. MOOCs in TURKEY

In Turkey, There are two different approaches for MOOCs production initiatives. And the development of MOOCs are still in infancy stage due to inadequate supplement. There are two state universities and two private universities and one profit initiative that provide MOOCs. The first initiative to provide MOOCs have constructed with 8 courses mainly in social sciences and humanities and more than 2000 learners in its custom developed MOOC infrastructure by Anadolu University named as AKADEMA (http://akadema.anadolu.edu.tr/) in 2013. Next, Erzurum Ataturk University has established Moodle-based MOOC infrastructure named as ATADEMİX (atademix.atauni.edu.tr). The University has already provided 14 courses in Turkish and is currently running another course too. Afterward, a private higher education Yaşar University has transferred some of its online courses as self-paced MOOCs and offered to all. Currently they are offering 17 courses without any certification (hayatboyu.yasar.edu.tr). In addition to this, another private higher education Koç University has transformed some of Coursera courses into Turkish, and later Koc University utilized and provided a course in Turkish in Coursera in 2014. Furthermore, a profit initiative Turkcell has sponsored to reveal 3 courses in EdX. Also, along with a couple profit initiatives intended to utilize a Coursera-like environment in Turkey, intitled as UniversitePlus (https://www.universiteplus.com/). Currently, four different universities and profit initiatives have collaborated to provide 46 courses.

4. RELATED WORK

In author's initial literature review, the author has observed there has been limited research focused on accessibility within MOOCs in the context of elderly users. To date, no study focused on the accessibility of MOOCs' websites of Turkey in context of elderly participants.

Coursera courses have been evaluated based on two perspectives: users and experts. Courses have been tested by using the assistance of screen readers for user perspectives. The results indicated that Coursera still had accessibility issues to screen readers' users, thus failed to comply WCAG 2.0 guidelines. Heuristic evaluation utilized to assess ten courses and the results of the study indicated that the courses' have a failure to comply to all priority levels (A, AA and AAA) for expert perspectives (Al-Mouh et al., 2014). The same year, Bohnsack and Puhl (2014) examined the MOOC providers, instead of assessing courses. The researchers adopted W3C guidelines and recommendations for accessibility, while examining user testing with blind test person based on Udacity, Coursera, edX, OpenCourseWorld and Iversity. The results of the study indicated that the only the accessible MOOC platform found to be edX for blind users. An another a case study was carried out to assess the level of accessibility of two MOOC providers: UNED COMA (Universidad Nacional de Educacion a Distancia) and UAb iMOOC (Universidade Aberta) (Iniesto et al., 2014). The accessibility of the tested pages has been given a score between 1 and 10 by using eXaminator, while a designer as a disability simulator was used to examine the web pages were accessible and usable to users with certain disabilities such as blind and reduced vision. None of the assessed MOOC platforms was found accessible and usable to the users. 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.

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. The same year, Sanchez-Gordon and Luján-Mora (2013a) proposed MOOCs (Massive Open

Online Courses) as creditable courses in engineering programs at the National Polytechnic School of Ecuador.

There are only two researches have been found focusing on MOOC accessibility for the elderly Sanchez-Gordon and Luján-Mora (2013b) examined the accessibility evaluation of five courses from Coursera for elderly users. Authors performed two methods; the identification of web accessibility requirements based on principles in WCAG 2.0 and WAI-AGE and heuristic testing. Like other researches' results, all five examined courses have accessibility issues. Furthermore, the authors also asserted that WCAG 2.0 success criteria are inadequate as an accessibility requirement for the elderly people. The second research Bong and Chen (2016) a case study was conducted to assess the accessibility of the demo courses of edX for the elderly. The results of automated and user testing indicated that MOOC has different accessibility issues.

Liyanagunawardena and Williams (2016) examined to show the level of participation of elderly learners in MOOCs by using data for 10 University of Reading courses on the FutureLearn platform. The results indicated that the 10 courses had a considerable proportion of elderly learners participating in them.

5. GUIDELINES FOR ACCESSIBILITY

WCAG (Web Content Accessibility Guidelines) (W3C, 2008) documented a set of principles, guidelines, success criteria, benefits, and examples. These range of recommendations are for making the web content accessible even for a person with disability. Accessibility intends the providing the way to overcome the barriers faced by the persons in grabbing any information. For example, providing keyboard access as an alternative for persons with motor disability. Providing alt text to the images for the persons who are visually impaired. Along with many assistive technologies help the persons with disabilities in accessing the web content. And also, increases the potentiality of the users, including older persons in accessing the web content. WCAG 2.0 standard focuses on four major accessibility principles abbreviated in the word (POUR) with twelve guidelines that comprise a series of 61 Success Criteria (SC). There four major principles are perceivable (4 guidelines), operable (4 guidelines), understandable (3 guidelines) and robust (1 guideline) (see Table 1).

WCAG 2.0 levels of conformance are divided into: Level-A (minimum level of conformance with minimum level of accessibility), Level-AA (intermediate level of conformance with enhanced level of accessibility) and Level AAA (high level of conformance with additional accessibility enhancements).

Table 1. Overview of WCAG 2.0 principles and guidelines

Perceivable (users must be able to perceive the information being presented)
Provide text alternatives for non-text content
Provide captions and alternatives for audio and video content
Make content adaptable, and make it available to assistive technologies
Use sufficient contrast to make things easy to see and hear
Operable (users must be able to operate the interface)
Make all functionality keyboard accessible
Give users enough time to read and use content
Do not use content that causes seizures
Help users navigate and find content
Understandable (users must be able to understand the information as well as the operation of the user interface)
Make text readable and understandable
Make content appear and operate in predictable ways
Help users avoid and correct mistakes
Robust (users must be able to access the content as Technologies advance)
Maximize compatibility with current and future technologies

Source: W3C.org

6. RESULT AND DISCUSSION

For the analysis of compliance with accessibility guidelines of MOOCs in Turkey, the AChecker tool was examined to assess manually for WCAG 2.0 conformance Level A, AA and AAA. Table 2 depicts the number of parsing errors in the different MOOCs. . Researcher did not have permission for using the titles of MOOC in the study. The titles of MOOC has been used as M1, M2 and M3. Most parsing errors have appeared at the conformance level A, with 249 (M1) and 82 (M3) issues, respectively. As depicted in Table 1, there is known problem and likely problems at WCAG 2.0 level A, Level AA and Level AAA.

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Table 2. The number of accessibility errors by MOOCs

	Guidelines					
	WCAG 2.0 Level A		WCAG 2.0 Level AA		WCAG 2.0 Level AAA	
	Known problem	Likely problem	Known problem	Likely problem	Known problem	Likely problem
M1	249	0	18	0	49	0
M2	0	0	0	0	0	0
M3	82	2	69	6	100	6

In brief, of the 3 MOOC websites from Turkey, only one satisfied the accessibility conformance level A, level AA and level AAA. It was found that the most failed success criteria include: SC 1.1.1 (missing appropriate Alt Text). In MOOC websites (M1), 79% of all the errors were due to violating this criterion. In M3 MOOC websites, this error constituted errors of (21%, respectively) named F30, F20, F3, F31, F38, F71, F72, F65, F67 and F13. Among the MOOC websites, the violation of criterion 1.4.4 resize text was 5% (M1) and 28% (M3) it corresponds to the level AA and it has two common failures documented, named F80 and F69 and some of the failed success criteria include: SC 1.4.6 (Contrast) (16% of all errors) at M1.

In the website of M3 websites, this error was observed 100 times, which constituted 40% of all errors, respectively. The visual presentation of text and images of text has a contrast ratio of at least 7:1, which is named F24 and F83. SC 1.3.1 (Information, structure, and relationships conveyed through presentation can be programmatically determined or are available in text) M1 websites (3 times of all errors) and M3 websites (3 times of all errors), respectively, which is named F2, F17, F33, F34, F42, F43, F46, F48, F62, F68 and F87 (Table 3).

Table 3. Accessibility checkpoints violated by MOOC websites by MOOCS

Checkpoints	M1	M2	M3
Conformance Level A			
1.1.1	243	-	53
1.3.1	3	-	3
2.4.4	-	-	23
3.3.2	2	-	2
4.1.1	1	-	1
Conformance Level AA			
1.4.4	15	-	69
2.4.6	3	-	-
Conformance Level AAA			
1.4.6	49	-	100

Table 4 depicts the categories of web accessibility. These categories reflect the different needs of elderly users, the findings are based on WAI-AGE and, as depicted in their descriptions (W3C, 2010). Table 5 shows the four web accessibility requirements by category for older users. The identification of four requirements have been organized correspond to success criteria from WCAG 2.0 by this study (W3C, 2008). Each success criterion has a three level of conformance (A, AA or AAA) and common errors. These errors are considered failures of the success criterion and need to be avoided. Failed success criteria in Level AA include: SC 1.4.4 (Resize text). It has two common errors documented, named F80 and F69 (W3C, 2009).

Table 4. Web Accessibility Categories

No.	Category	Description
1	Text size	Large text appropriate in the body text, form fields and user interface due to reduced vision for older users.
2	Text style and text layout	The visual presentation of text style has an impact on reading to text whether easy or hard how hard for older users based on vision decline.
3	Color and contrast	Most of the older people has color perception and contrast sensitivity problems.
4	Multimedia	Low background sound appropriate due to reduced hearing. Transcripts and captions appropriate due to reduced vision.
5	Text-to-speech	Visual impaired people need text-to-speech software.

Source: Sanchez-Gordon and Luján-Mora (2013b:4)

7. CONCLUSION AND FUTURE WORK

In this work it has reported that the accessibility of the three MOOCs websites for elderly people. These results will lead to a first approximation of the web accessibility issues of MOOCs for elderly participants in context of Turkey. The automated testing evaluated the conformance of the MOOC websites to WCAG 2.0 at level A, AA and AAA. Author performed automated accessibility testing using only AChecker. In the future, we plan to utilize more automated accessibility testing using different evaluation tools in order to compare the results among evaluation tools and thus increase the reliability of the data (Vigo et al., 2013). For future work, the author plan to focus on user testings and test them with elderly users selected from the same group of MOOC websites and then present the results in a comparative format. Heuristic evaluation will also utilize in addition to validate the results from automated testing. It is therefore important for MOOC providers to make their courses interesting and accessible to the elderly users. For future work, the author plan to focus on user testings and test them with disabled users and elderly users selected from the same group of MOOC websites and then present the results in a comparative format. We see the potential of MOOCs where elderly can benefit from learning something new and usable at their own pace. By conducting the study, we hope to inspire more research focusing on accessibility of MOOCs and platforms and contribute to making them more accessible to the elderly users.

This preliminary paper, three of the well-know MOOCs environments, Atademix, Akadema and Turkcell Academy, were analyzed and compared in terms of their accessibility of elderly users. WCAG 2.0 sucess criteria fails to include some accessibility requirements for elderly users. Similar to most of the previous studies, the majority of MOOC websites in the current study did not meet the accessibility criteria. An analysis of the distribution of these

errors showed that the vast majority of the errors resulted from the violation of text size, color and contrast, text-to-speech and the presentation of text.

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 and colors should also be distincable. The recommendations target courses' authors as well as MOOCs platforms. Bigger font size in the body text, form fields and user interface controls, lower background sound and stronger color contrast for perception and constrast sensitivity customization features should be provided to address the elderly users' needs.

Table 5. Web Accessibility Requirements and Common Failures

No.	Requirement	Description	Level	Common Failures
		Text Size		
1	1.4.4	Text can be resized without assistive technology up to 200 percent without loss of content or functionality.	AA	F80, F69
		Color and Contrast		
2	1.4.6	Contrast (enhanced). The visual presentation of text and images of text has a contrast ratio of at least 7:1	AAA	F24, F83
		Text-to-speech		
3	1.1.1	All non-text content that is presented to the user has a text alternative that serves the equivalent purpose.	A	F30,F20, F3, F31, F38, F71, F72, F65, F67, F13
4	1.3.1	Presentation can be programmatically determined or are available according to information, structure and relationships in text	A	F2, F17, F33, F34, F42, F43, F46, F48, F62, F68, F87

Source: Adapted from Sanchez-Gordon and Luján-Mora (2013b:5)

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