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Master Thesis

Accessibility of Massive Open Online Courses (MOOCs) for Blind and Visually Impaired People

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Title in English:

Accessibility of Massive Open Online Courses (MOOCs) for Blind and Visually Impaired People

Title in Macedonian:

Достапноста на Масивни Отворени Онлајн Курсеви (MOOCs) за Слепите и Лицата со Оштетен Вид

The title in Albanian:

Qasshmëria e kurseve massive të hapura online (MOOCs) për të verbërit dhe personat me kufizime në shikim

DECLARATION

I hereby declare that this Master's thesis submitted in South East European University is my own work, and it does not contain other people's work without this being stated; and the bibliography contains all the literature that I have used in writing the thesis, and that all references refer to this bibliography.

Njomza Mripa

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Contents

ABBREVIATIONS

MOOC	Massive Open Online Course
BVI	Blind and Visually Impaired
WHO	World Health Organization
WCAG	Web Content Accessibility Guidelines
W3C	World Wide Web Consortium
ALMOOC	Albanian Massive Open Online Course
NFB	National Federation of the Blind
MEST	Ministry of Education, Science and Technology
UNESCO	United Nations Educational, Scientific and Cultural Organization
LMS	Learning Management System

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ABSTRACT

Although MOOC providers claim that MOOCs are open to anyone, considering that online users are very diverse in their abilities and disabilities, detailed investigation is required to confirm this claim. As previous research has shown, MOOCs are not accessible for people with disabilities, in particular for blind and visually impaired (BVI) people.

This thesis investigates the accessibility of MOOCs for people with disabilities, in particular for blind and visually impaired (BVI) people.

The evaluation includes assessing the accessibility of Coursera and ALMOOC for BVI by employing three different testing methods: usability testing, automatic accessibility checking and heuristic testing.

The results indicate that they fail to confirm to accessibility standards. Therefore, the findings show that ALMOOC is currently not accessible to BVI, whereas on Coursera users manage to fulfill most of the required tasks. Nevertheless, in this thesis recommendations will be presented for overcoming the encountered challenges.

Апстракт

Иако МООК провајдерите тврдат дека МООК се отворени за сите, со оглед на фактот дека интернет корисниците се многу различни во нивните способности и посебни потреби, потребна е подетална анализа за да се докаже ваквото тврдење. Досегашните истражувањата покажуваат дека МООК не се достапни за лица со посебни потреби, особено за слепите и лицата со оштетен вид.

Во овој труд се истражува достапноста на МООК за лица со хендикеп, особено за слепи и лица со оштетен вид.

Евалуацијата опфаќа проценка на достапноста на Coursera и ALMOOC за слепите лица, преку употреба на три различни методи на тестирање, и тоа: тестирање на употребливост, автоматска проверка на пристапност, и хеуристичко тестирање.

Резултатите укажуваат на тоа дека ваквите интерфејси не ги исполнуваат стандардите за пристапност. Резултатите покажуваат дека ALMOOC во моментов е недостапен за слепи лица додека пак на Coursera корисниците успеваат да ги завршат повеќето од потребните задачи. Сепак во овој труд ќе бидат дадени препораки за надминување на откриените проблеми.

ABSTRAKTI

Ofruesit e MOOC pretendojnë se MOOC janë të hapura për këdo, mirëpo duke pasur parasysh se përdoruesit në internet janë të ndryshëm në aftësitë dhe paaftësitë e tyre, kjo kërkon një hulumtim të detajizuar. Hulumtimet e bëra më parë, tregojnë se MOOC nuk janë të qasshme për njerëzit me aftësi të kufizuara, veçanërisht për personat e verbër dhe me kufizime në shikim.

Kjo tezë hulumton qasjen e MOOCs për njerëzit me aftësi të kufizuara, veçanërisht personat e verbër dhe me kufizime në shikim.

Evaluimi përfshin vlerësimin e qasshmërisë të Coursera dhe ALMOOC për këta persona, duke shfrytëzuar tri metoda të ndryshme testimi: testimi i përdorshmërisë, kontrolli automatik i qasjes dhe testimi heuristik.

Rezultatet e evaluimit tregojnë se ato dështojnë të plotësojnë standardet e qasshmërisë. Pra, rezultatet tregojnë se ALMOOC aktualisht nuk është i qasshmëm për personat e verbër dhe me kufizime në shikim, ndërsa në Coursera, përdoruesit arrijnë të përmbushin shumicën e detyrave të kërkuara. Megjithatë, përmes kësaj teze, ne do të paraqesim rekomandimet për të kapërcyer çështjet e zbuluara.

1 INTRODUCTION

Education is the process of transferring systematic knowledge, instructions, skills or habits, at a school or university [1]. The right to education is universally recognized as a human right by 'International Covenant on Economic, Social and Cultural Rights'. Hence, education shall generally be available and accessible to everyone, and every kind of discrimination shall be eliminated [2].

Education is often received by guidance of the others in brick-and-mortar institutions, but nowadays technological advancements are improving the ways in which knowledge is passed on. Many universities are offering online courses that are available to large audiences and are promising to meet learning needs of millions of people.

One type of such courses is Massive Open Online Courses (MOOCs). MOOCs are organized as short video filmed lectures and are available for students online via web. Those courses are far more convenient compared to traditional classroom courses, as students are given the freedom to choose the time, pace and place of studying. They also have the opportunity to decide what, when, where and how they want to learn.

MOOCs have become increasingly popular, and there are five major providers: Coursera[1], Udacity[2], Khan Academy[3], EdX[4] and Future Learn[5]. Coursera is the largest, offering over 1000 different courses on their platform. It is an excellent opportunity for personal and professional development, and people with disabilities should also find it easy to have access to this kind of learning.

Although the providers of those courses claim that MOOCs are open to anyone, considering that online users are very diverse in their abilities and disabilities, a detailed investigation is required to confirm this claim. In particular, this thesis investigates the accessibility of MOOCs for people with disabilities, especially for blind and visually impaired (BVI) people.

[1] www.coursera.org
[2] www.udacity.com
[3] www.khanacademy.org
[4] www.edx.org
[5] www.futurelearn.com

According to the World Health Organization, 285 million people are estimated to be visually impaired worldwide: 39 million are blind and 246 have low vision [3], and from them just a low percentage has completed higher education. Online learning, MOOCs in particular, help people to improve their personal and professional development, and it is also an opportunity for BVI to gain easier access to higher education.

1.1 RESEARCH QUESTIONS

This thesis investigates the following research questions:

1. What main accessibility problems do BVI encounter when using MOOCs?
2. What guidelines are to be followed to generate accessible MOOCs?
3. What types of courses are best suitable to be delivered to BVI using MOOCs?
4. Can we utilize existing MOOCs platforms to deliver accessible content to BVI?

1.2 RESEARCH PURPOSE

The 2013 Survey of Online Learning conducted by the Babson Survey Research Group shows that the number of higher education students taking at least one online course has now exceeded 7.1 million and thirty-three percent of higher education students now take at least one course online [4].

Even though MOOCs are still at the experimental stage, it is not too early to consider the kind of long-term impact MOOCs might have in higher education [5]. Some see MOOCs up-ending the whole model of higher education, allowing students to complete full courses of study in a non-traditional format, particularly with international students, which have made up a large part of the student body in early MOOC courses [5]. Some professionals are sceptical about the future of MOOCs; however, statistics show that their significance will obviously grow. Their accessibility for disabled people is equally important, and this thesis will evaluate MOOCs and provide further information in this regard.

Contrary to the traditional way of providing education in brick-and-mortar classes, where infrastructure does not meet the minimum requirements for BVI, MOOCs, being a new model of delivering knowledge, are quite promising for BVI as they provide them with easier access to education. In this way BVI will be able to learn on their own pace and place; no additional changes in facilities will be necessary in order to accommodate them.

In everyday life, the senses of touch hearing of BVI people are more effectively used; the same also applies to their learning process. With the help of MOOCs BVI may be able to listen to lectures as many times as they want. Likewise, difficult subjects that contain experiments may be easily transmitted to BVI. Therefore, MOOCs are better at providing auditory information to BVI.

In Kosovo there are around 30 BVI people that have finished higher education, which compared to the total number of the BVI community is quite low. The number of BVI people attending schools remains small due to: a) the impossibility to navigate unaccompanied; b) stigma associated with this community; and c) financial difficulties of their families. This is also reflected in their employment. Although it is regulated by law that each employer is obliged to employ a person with disability for every fifty (50) employees [6], this is never implemented. MOOCs will, therefore, open new perspectives for the BVI community, such as easier access to education, as well as helping them become specialized in various fields. This will eventually facilitate their integration in the community.

MOOCs are open to everyone and BVI could easily participate without additional costs. This thesis will investigate the current situation of BVI, and based on that, guidelines for designing and using MOOCs for BVI will be proposed, which will facilitate the education of this marginalized community. Guidelines for designing and using MOOCs for BVI are proposed by evaluating the accessibility of Coursera and ALMOOC. Coursera is a well-known MOOC provider and is considered a leader in providing online courses. ALMOOC is, however, the only MOOCs provider that offers courses exclusively for Albanian speaking people. It is thus meeting the needs of Albanian speaking people who lack English proficiency [7].

1.3 RESEARCH METHODOLOGY

This study uses both quantitative and qualitative research methods. The quantitative methods are used when utilizing and comparing statistics obtained from institutions in Kosovo. Additionally, the evaluation of the level of accessibility of Coursera and ALMOOC involves several quantitative methods. Qualitative methods are used for conducting interviews. In general, the following activities are conducted:

- Gathering data for the BVI community in Kosovo from different institutions, including the Ministry of Labour and Social Welfare, the Ministry of Education, Science and Technology, and Kosovo Agency of Statistics. The data collected presents the current situation of BVI in Kosovo.
- Conducting interviews with competent personnel from the school for the blind 'Xheladin Deda' in Peja. The main focus of the interviews is to better analyse the needs of students that are currently enrolled and to gather and develop requirements for subjects, which will help to better understand the learning styles of the BVI students.
- Evaluation of the level of accessibility of Coursera and ALMOOC, will show whether they are accessible to BVI. Three different methods are used:
    - Usability testing
    - Automatic accessibility
    - Heuristic evaluation
- Providing accessibility guidelines to be followed while developing MOOCs, Coursera and ALMOOC case.

The combination of these research methodologies will bring an understanding of the entire problem of accessibility issues. The results from one method might be used in another one, by examining in more depth the issues raised.

1.4 HYPOTHESIS

The following are the hypotheses of this study:

1. Existing MOOCs are not suitable to deliver accessible content to BVI.
2. Using World Wide Web Consortium (W3C) design guidelines we can redesign existing MOOCs platforms to deliver accessible content to BVI.
3. The success of delivering accessible MOOCs depends on the type of the course, i.e., not all courses can be delivered using MOOCs.

2 BACKGROUND AND LITERATURE REVIEW

2.1 OVERVIEW

MOOCs are an excellent opportunity for BVI who are not able to engage in face-to-face learning. In addition, educational institutions do not need to create accessible facilities, accessible equipment or accessible educational resources, or costly physical adaptations for this community. Furthermore, designing accessible MOOCs is both technically and financially possible [15].

As MOOCs have emerged quite recently, until now there have been no thorough studies that would examine the accessibility of this delivery model from the perspective of an individual with a disability [16]. Considering the fact that navigation problems limit the access of unaccompanied BVI to school [13], MOOCs are promising to offer a learning environment that is open to all 'able' and 'disabled' participants [17]. This thesis evaluates the accessibility requirements for MOOCs for BVI and based on the results the major obstacles will be identified, and main guidelines will be proposed, which are to be followed while developing MOOCs.

According to the conducted research, although millions of people have been benefiting from MOOCs, the main providers fail to confirm to standards. Some evaluations of existing MOOC providers have been performed, with the assistance of screen readers and Heuristic evaluation, and they have showed that Coursera courses evaluated with respect to WCAG 2.0 have failed to conform to all priority levels (A-AA-AAA) [18].

2.2 WEB CONTENT ACCESSIBILITY GUIDELINES

In 1999 the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C) defined the first version of the Web Content Accessibility Guidelines (WCAG 1.0). WCAG 1.0 was published to promote web accessibility and to provide a comprehensive set of guidelines on how to prepare web content so that people with disabilities could use the web regardless of their needs and preferences [8]. WCAG 1.0 comprised 14 guidelines, which included 65

checkpoints (CPs) that described how developers could adapt their web content in order to make it accessible. Each checkpoint was assigned a priority level, Priority 1 through Priority 3, which indicated the importance of the CP in terms of its impact on accessibility of content to different groups of disabled users [9].

However, the impact of WCAG 1.0 on improving the accessibility of the Web remained quite low throughout the period of its use [10]. Some sites are making exaggerated claims about their accessibility, with 30% of sites overstating their level of conformance to WCAG [11]. The authors hypothesized that this may be that web commissioners do not understand the differences between automated and manual testing, and therefore attribute more importance to the former when making conformance claims [10].A study made, finds out that tools and guidelines related to accessibility are unclear to most of web site owners [12]. For BVI a satisfactory level of accessing digital information is not guaranteed even when WCAG guidelines are followed [13].

2.3 SITUATION IN KOSOVO

In Kosovo and the surrounding region, one of the main obstacles that BVI people face is lack of independent navigation. Inadequate basic road infrastructure and classroom settings make it difficult for this community to have access to education. Due to lack of those basic settings, schools do not provide training classes for navigation, as they will not be able to make use of such knowledge [13]. Therefore, going to school becomes difficult for BVI, or simply going to class, for those living on campus, and human escort becomes a necessity [13].

In Kosovo there are currently 86 BVI attending primary and high school education. However, this number is very low considering the fact that typically 3% of people with disabilities (10% of the total population) is BVI, hence the real number should be over five thousand, and the number of BVI attending schools should be higher [14]. We believe the stigma associated with this community as well as the financial difficulties these families face, contribute to leaving most of the BVI unrecorded. The only school for the blind in Kosovo is mitigating this issue by promoting inclusion in regular schools and sending teachers to BVI homes and neighbouring

schools. This in turn brings a heavy load on the school, considering the low number of staff and limited budget.

2.4 LITERATURE REVIEW

From 2008 to 2016 there is a total of 40 relevant studies done on systematic literature review on accessibility of MOOCs. Although the term MOOC first appeared in 2008, relevant MOOCs accessibility studies have been conducted since 2012, with a significant increase in 2016[19].

As seen on the graph below, during [19]:

- 2008 -2011 there were no relevant studies
- 2012-2013, there were four relevant studies
- 2014-2015, there were 9 studies per year, and
- 2016, there is a significant increase, where 18 relevant studies were conducted.

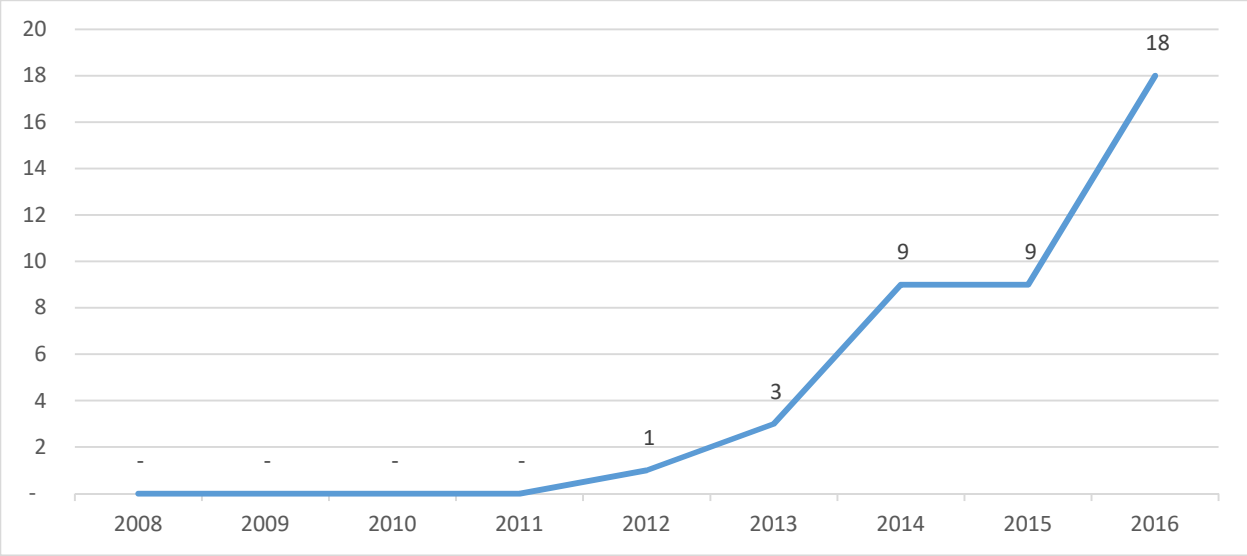

Figure 1: Number of relevant studies

The table below shows the number of relevant studies conducted based on the source, where the duplicates have been removed [19].

	2012	2013	2014	2015	2016	2012-2016
Scopus[6]	1	2	6	6	10	25
WOS[7]	1	3	7	6	8	25
DOAJ[8]	0	0	0	1	0	1
ERIC[9]	0	0	0	1	0	1
Total (with duplications)	**2**	**5**	**13**	**14**	**18**	**52**
Total (without duplications)	1	3	7	7	11	29
GS (additional studies)[10]	**0**	**0**	**2**	**2**	**7**	**11**
Total	**1**	**3**	**9**	**9**	**18**	**40**

Contribution on these studies distributed by country, show that Spain has participated in 25 studies (62.5%), Ecuador in 11 studies (27.5%), UK in eight studies (20%), USA and Germany in four studies each (10%), Norway in three studies (7.5%), Portugal in two studies (5%), and Saudi Arabia, Egypt, Austria, Italy, Guatemala, and South Africa in one study each (2.5%)[19].

All these studies show that MOOC platforms are developed by ignoring accessibility guidelines, and there is also absence of scenarios and personal descriptions. Additionally, the diversity of the audience is not taken into account, such as disabilities of the people, non-native speakers, cross-cultural barriers and needs related to the limitations of the technology available.

[6]Scopus, https://www.scopus.com/
[7]Web of Science, https://webofknowledge.com/
[8]Directory of Open Access Journals, https://doaj.org/
[9] Education Resources Information Center https://eric.ed.gov/
[10]Google Scholar, https://scholar.google.com

3 GENERAL OVERVIEW OF ONLINE LEARNING AND BVI PEOPLE

3.1 OVERVIEWOF ONLINE LEARNING

Advancements in technology have considerably supported the improvement of the education system over the past two decades, by leading to new possibilities and challenges. These developments have reshaped the traditional way of transferring systematic knowledge at a school or university. Many universities utilize electronic technologies and are offering online courses that are available to large audiences. Although many people still consider traditional brick-and-mortar schools to be the best way to study, online learning has become a great alternative. Online learning has many advantages: it provides just-in-time learning; increased access; removal of time, place and situational barriers; cost effectiveness; greater accountability; increased interaction; provision of future employment skills for students; and finally effective support of lifelong learning [19].

In general, online learning refers to learning through a computer that is connected to the Internet. In a typical online course, all the materials related to the course are available and displayed on the computer upon student's request. The course materials can be simple lessons consisting of text, graphics, audio or video parts. Some courses might have weekly quizzes and/or final assessment projects.

3.2 TYPES OF ONLINE LEARNING

Types of online learning can be differentiated just by the way how they are delivered to the audiences. Therefore, there are different terms that refer to online learning like: E-learning, Web-based training, Computer-based training, Distance Learning, MOOCs etc. All of these terms are types of online learning, some of which differ in the way they deliver the materials to the students, but most of them are just synonyms. The term online learning is the most comprehensive term referring to all types of learning via computer [20]. The other terms are defined in the following way:

- E-learning is used to refer to online learning only if the computer is connected to the Internet, intranet or extranet and learning materials are available online. Other forms of learning on CD or DVD are technically not forms of e-learning, although they are forms of online learning [20]
- Web-based training is a synonym of e-learning [20]
- Computer-based training refers to courses presented on a computer. In this type of courses, resources outside the course are not provided and the computer is not connected to a network [20]
- Distance learning refers to providing access to learning for students who are geographically distant [21]. It is an umbrella term that covers terms like correspondence education or correspondence learning [22]
- MOOCs or Massive Open Online Courses refer to courses designed as short video lectures available a large number of students (massive), accessible by anybody (open), all the materials are delivered online (online) and it represents a unit of study (course) [23]

Basic distinction between different types of online learning is made by the approach and the way how it is delivered to the audience. Hence, this thesis will evaluate in depth MOOCs only, as the newest trend in delivering online learning to students, with the main focus on accessibility for people with disabilities, specifically for blind and visually impaired (BVI) people.

3.2.1 MOOCs as a new method of delivery

3.2.1.1 General Overview

MOOCs are quite a new trend in learning methods in higher education, and the predecessor of MOOCs is online learning. The term MOOC was first used in 2008 at the University of Manitoba, Canada. The first course was 'Connectivism and Connective knowledge' and was presented to the audience of 25 fee paying participants within campus and over 2,000 non fee paying students from public [24]. Those students who paid the fee earned credits from the university,

while for the others the full course content was available through the Internet. Course participants had the freedom to choose in which platform they want to learn. This was the first course provided to the public and over the following years, many more courses where presented and published [25].

As it can be seen from the graph below, which represents the MOOCs development timeline, at the beginning MOOCs were named cMOOCs and xMOOCs. The main difference between them is the educational approach to the course. xMOOCs are an extension to a traditional campus education, where the course material is provided in video lectures and students are engaged in quizzes or testing. cMOOCs, on the other hand, supported the idea that the best way for students to learn is on networks established by active participants. Hence, in cMOOCs, technology is used to develop networks based on students' needs and wishes [25].

One of the best summaries of the MOOCs development is done by Cathy Sandeen, Vice president for education attainment and innovation, American Council on Education (ACE), where she identified three stages in MOOCs development: MOOC 1.0 era, MOOC 2.0 era and MOOC 3.0 era [26] .

The first stage, MOOC 1.0, started in 2008, when the first course was offered by the University of Manitoba. Then, in 2011 the first U.S. MOOC was offered 'Online Learning Today and Tomorrow' by the University of Illinois Springfield. These courses were the first initiatives towards MOOC, and the expansion began when top universities started offering MOOCs. And by this, starts the second era MOOC 2.0[26].

In the second of MOOC 2.0 much attention was given to high enrolments from all around the globe, and this helped in collecting data on how really students learn. During this stage courses were offered at no charge and there were no prerequisites to enrol on a course. Most of the courses provided had no academic credit worthiness and they were created mainly for lifelong learning or leisure learning [26].

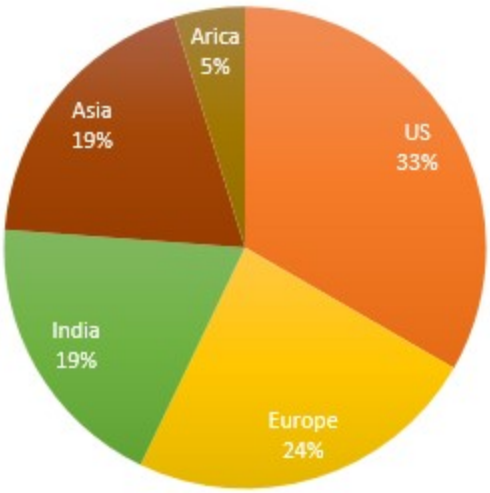

Figure 2: Distribution of enrollments on Coursera 2013

For example, in Coursera in 2013 students from all over the world were enrolled, with the roughly distribution of 35% from the US, 25% from Europe, 20% from India, 20 % from Asia and 5% from Africa, and around 80% of the enrolled students had at least a bachelor's degree [27]. This statistic explains why the completion rate is so low (9-10%), because most of the MOOC students already have a degree and are mainly interested in lifelong learning [26].

Now we are at MOOC 3.0 era, and the main focus is on institutions importing MOOCs as a component used as needed by individual institutions or academic professionals, e.g. particular content, technology or methods. Some universities integrate courses and use them as hybrid classes. In this way students learn the content of the course online, by themselves, and when they go to the classroom, with the professor and other students they discuss the course materials. By this universities try to emphasize and give more time to discussion, reducing the time when a professor merely stands and talks in front of the class.

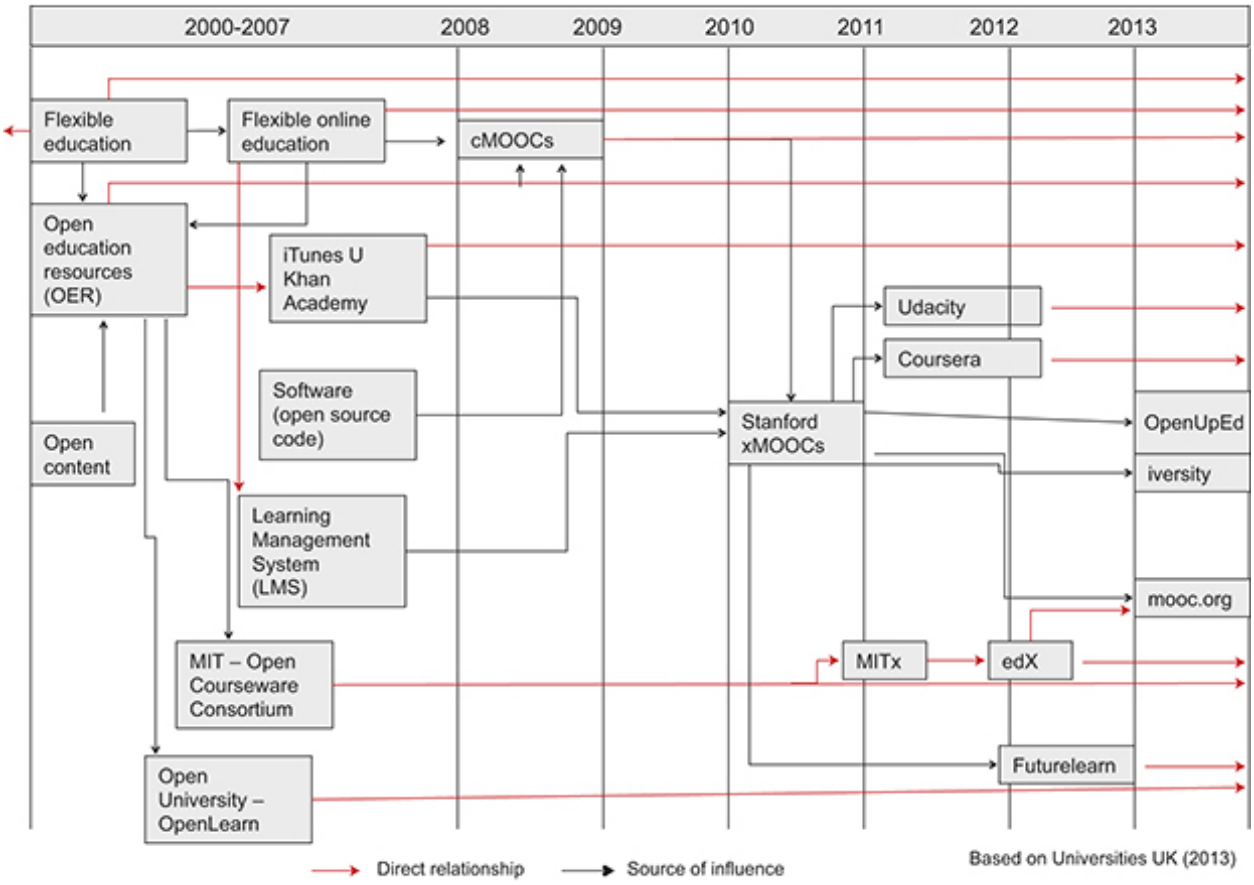

Figure 3: MOOCs timeline

Figure 3 shows the timeline of major MOOCs milestones from 2000 until 2013. As the graph shows since 2010 there has been a growth of MOOCs providers. Every day they are expanding in different areas and cooperation with different universities is increasing.

3.2.1.2 MOOCs providers

Currently, there are a lot of MOOC providers. The table below shows a list of top 20 providers [28]:

No	Provider	Number of courses
1	Coursera	1274
2	EdX	660
3	Canvas.net	279
4	FutureLearn	193
5	Independent	162
6	Miriada X	144
7	Udacity	104
8	CourseSites	81
9	Iversity	67
10	Rwaq	67
11	NovoED	63
12	Open2Study	49
13	France Universite Numerique	39
14	Gacco	35
15	openSAP	35
16	Stanford OpenEdx	32
17	NPTEL	29
18	EdCast	28
19	OpenLearning	26
20	Edraak	25

Table 1: MOOCs providers

There are more details about some of the key MOOCs providers below:

Coursera – is a for-profit company founded in 2012 by two computer science professors Andrew Ng and Daphne Koller from Stanford University. Coursera offers courses in different subjects like engineering, physics, mathematics, computer science, business, biology, social

sciences and many other subjects. With the mission “we provide universal access to the world’s best education”, they offer free courses from top universities like Stanford University, Princeton University, University of Pennsylvania etc.

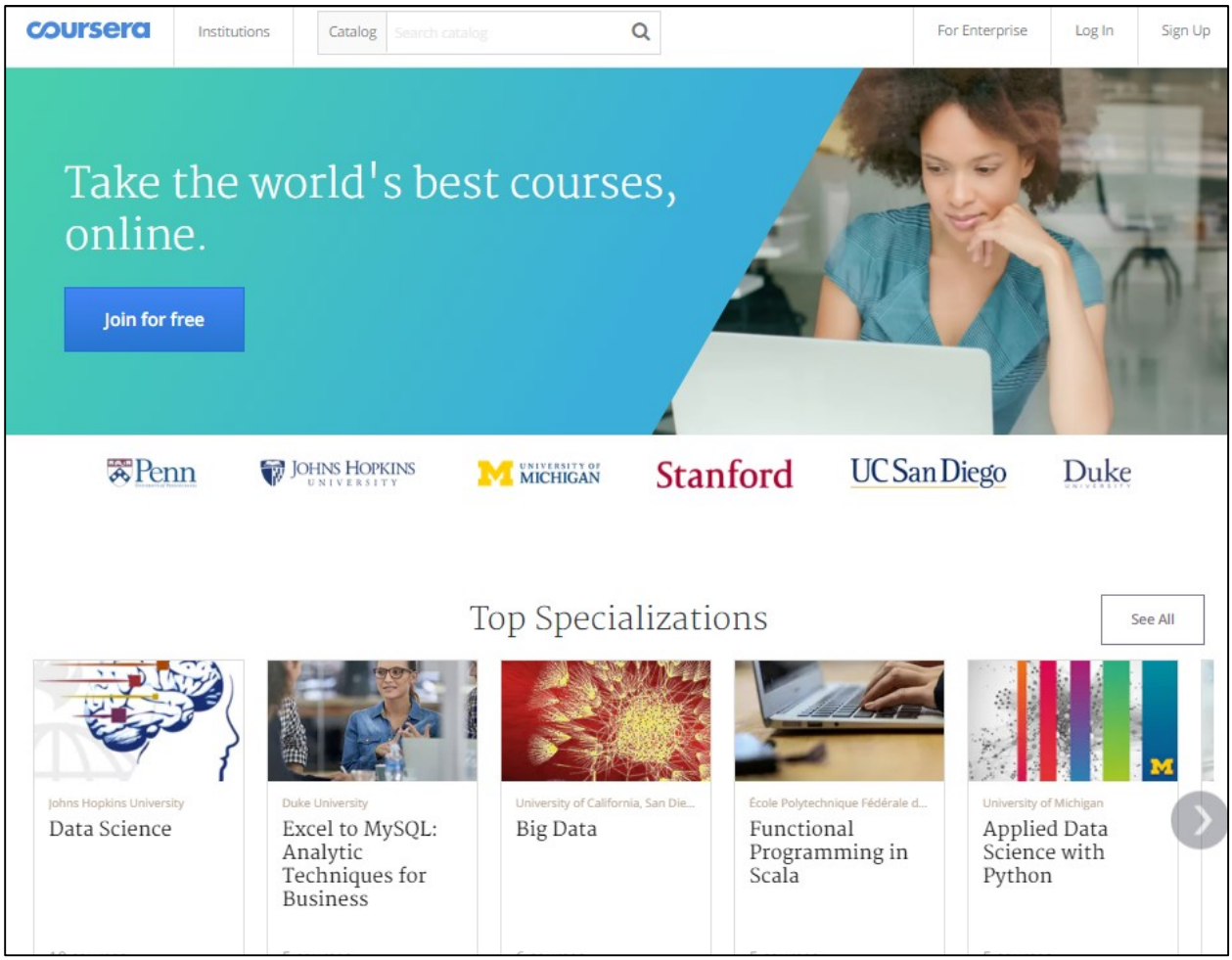

Figure 4: Coursera courses page - Apr17

edX– is a non-profit company founded in 2012 by scientists from MIT and Harvard and it is run by MIT, Harvard and Berkeley. It offers a wide range of courses in different disciplines. Their mission is “to give a world-class education to everyone, everywhere, regardless of gender,

income or social status", and it is different from other MOOC providers because edX is a non-profit organization.

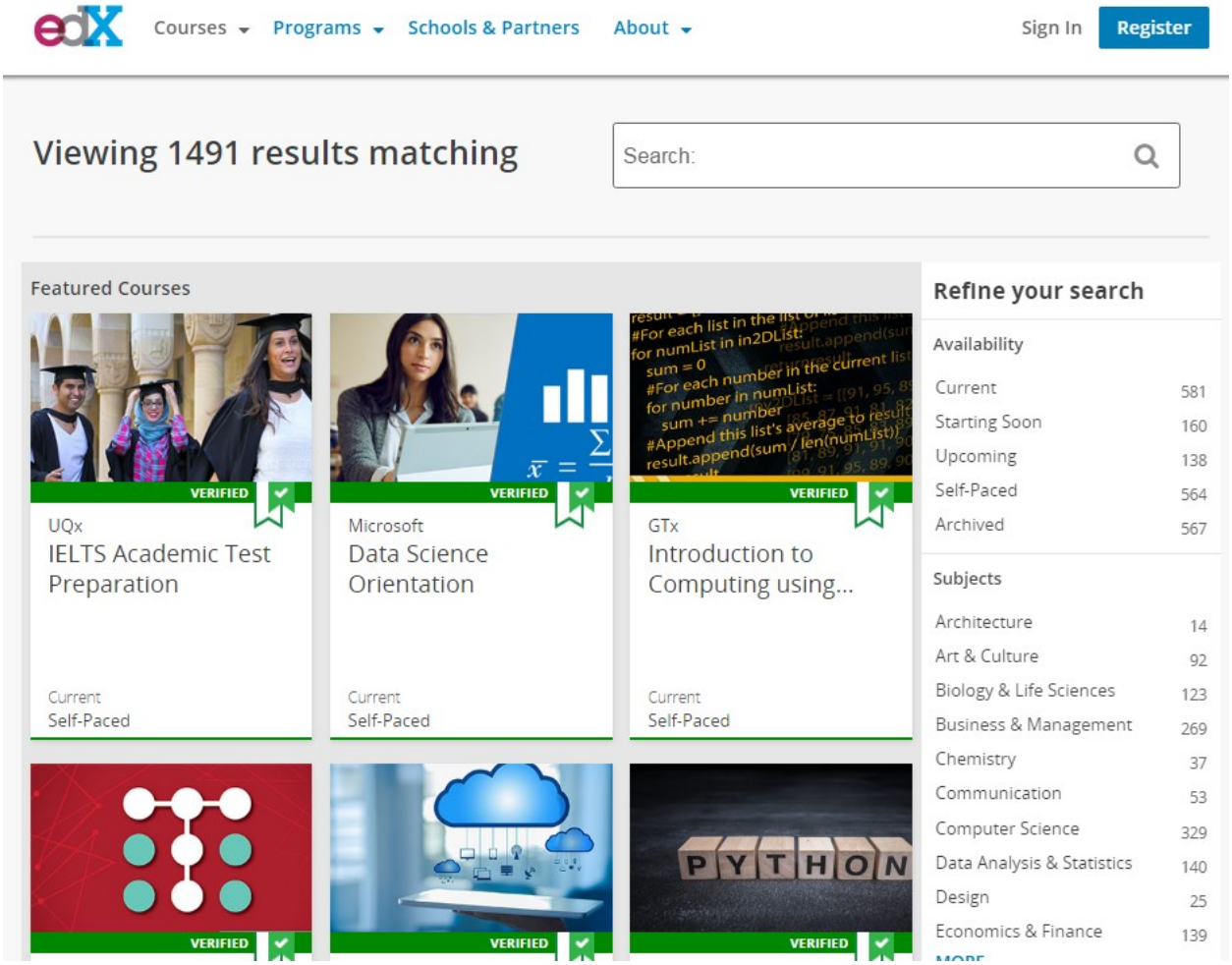

Figure 5: EdX courses page Apr17

Udacity – is a for-profit company founded in 2011 by Sebastian Thrun, David Stavens, and Mike Sokolsky. With the mission "to bring accessible, affordable, engaging, and highly effective higher education to the world", they promote that they are "building an online university by

Silicon Valley, with industry giants like Google, AT&T, Facebook, Salesforce, Cloudera etc.". The main difference with other MOOCs providers is that they offer courses mainly in computer science and related fields, and works with individual professors rather than institutions [29].

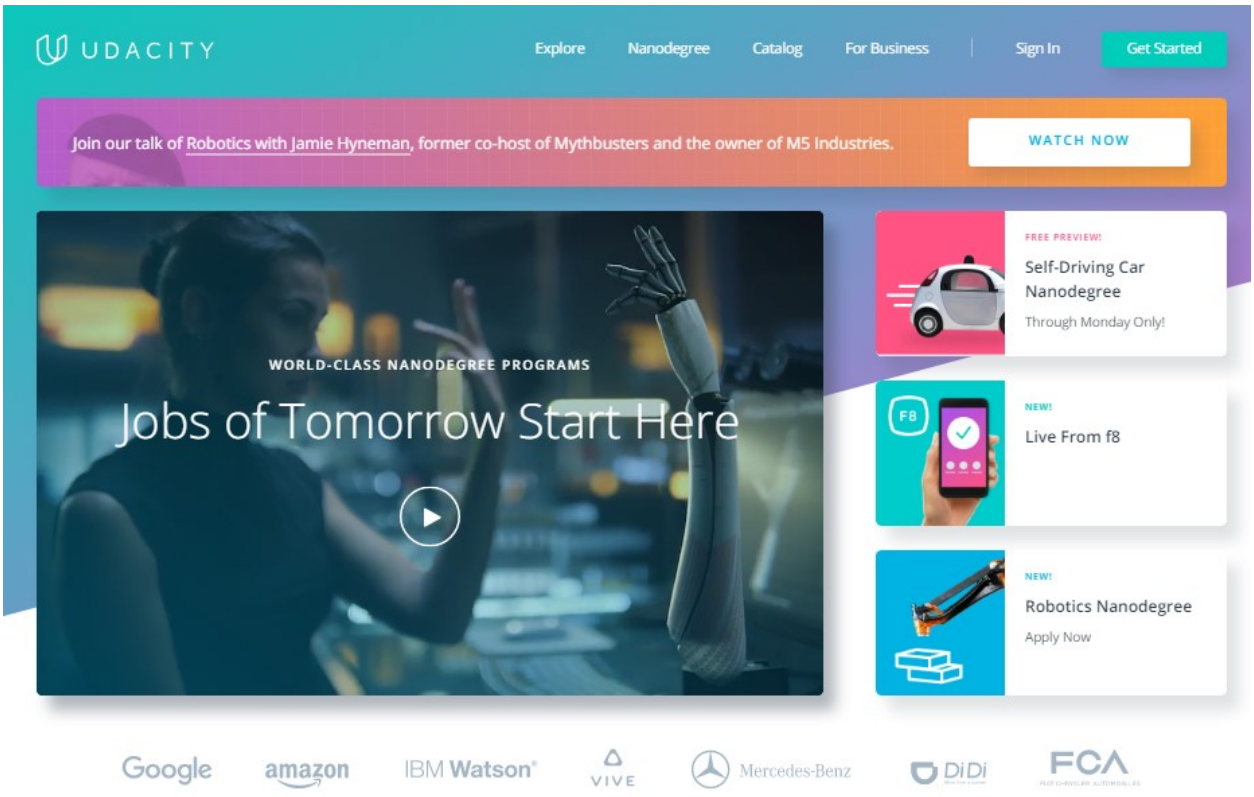

Figure 6: Udacity courses page Apr17

Khan Academy– is a non-profit company that started in 2006, by Salman Khan, as an online library of short videos that he made to help his cousins in math. Khan Academy received significant financial backing from Bill & Melinda Gates Foundation, Google, and other individuals. The content is geared toward secondary level –education students, and offers wide range of courses in more than 23 languages. [29]

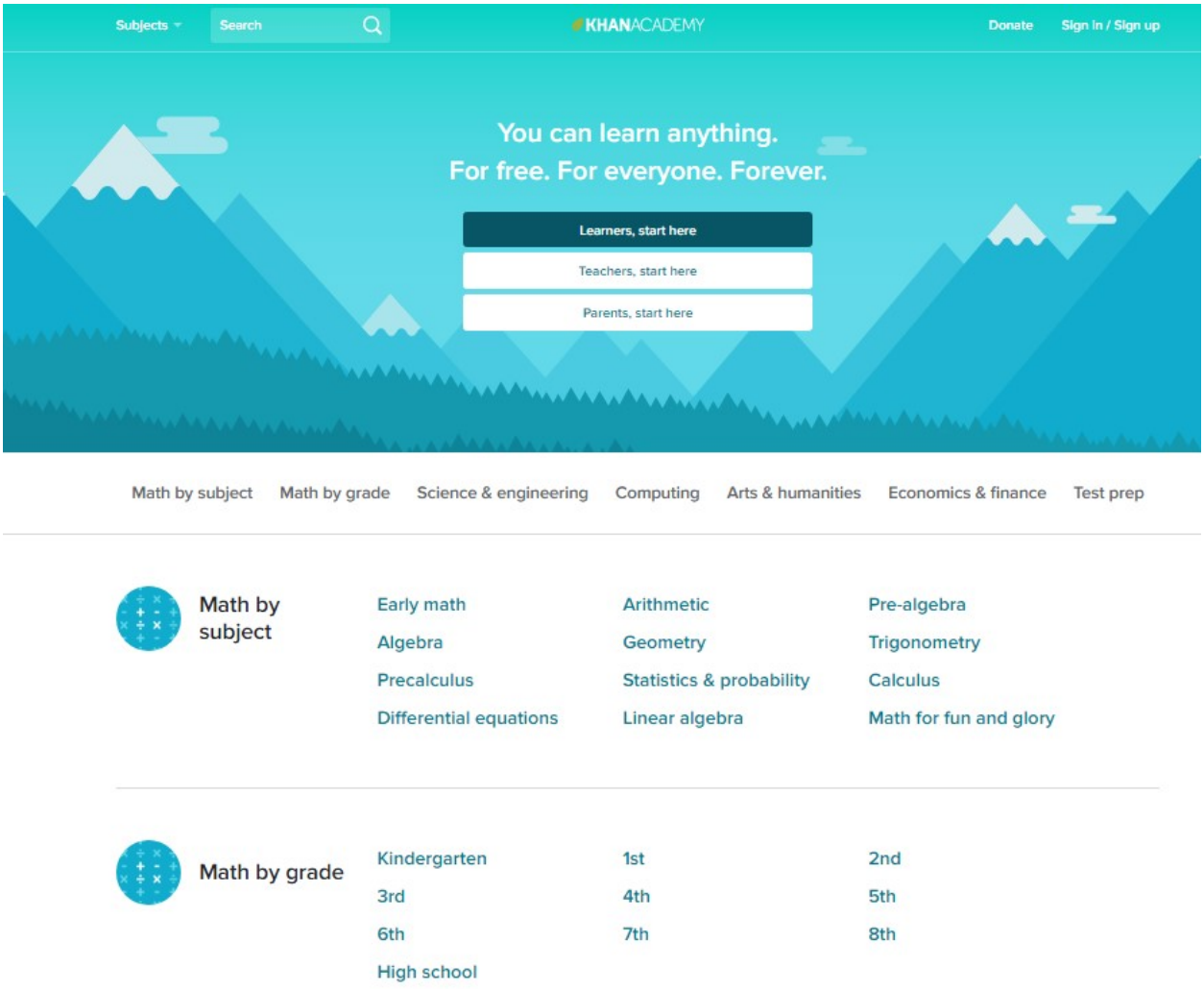

Figure 7: Khan Academy courses page Apr17

Udemy–is a for-profit company created in 2007 by Eren Bali, which allows instructors to build their online courses on different topics. Their mission is "to help anyone learn anything", and it is not necessary for instructors to have academic affiliation in order to teach any course.

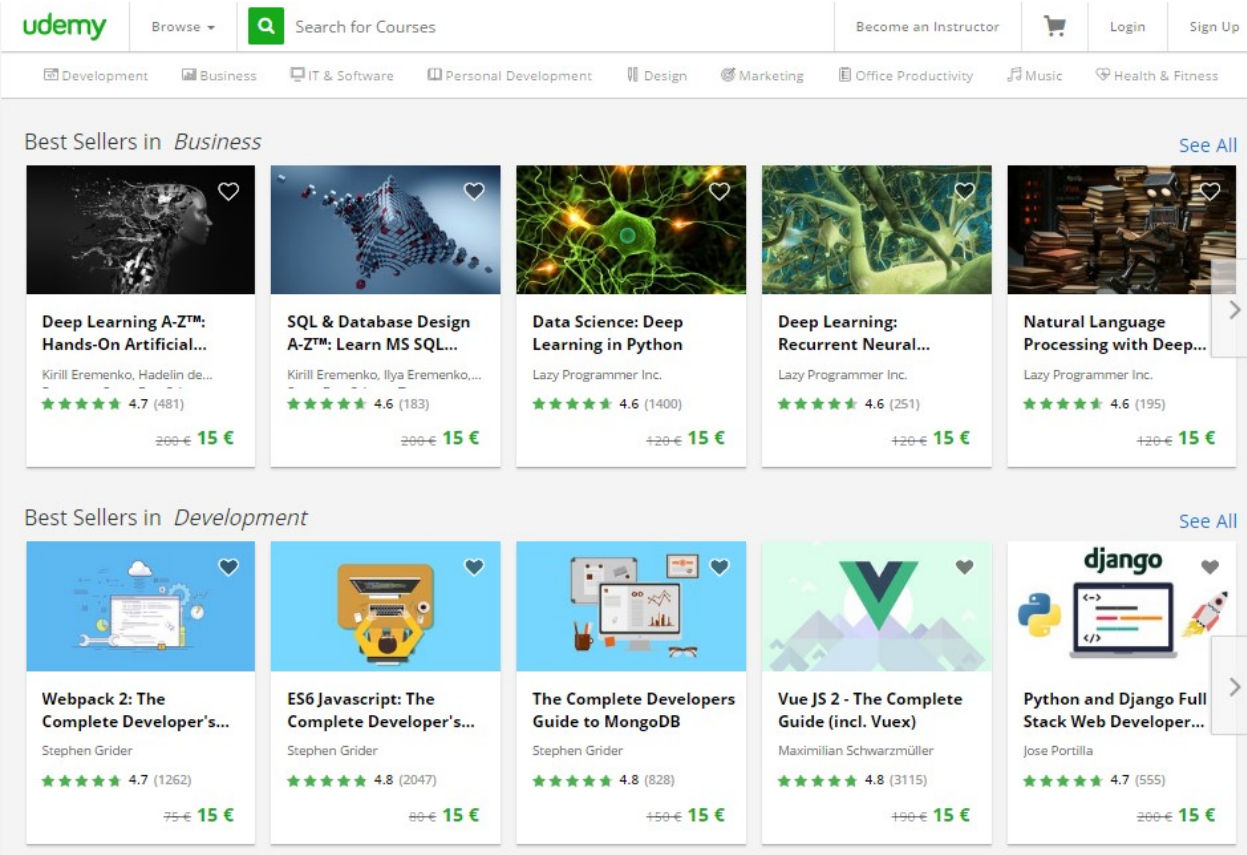

Figure 8: Udemy course page - Apr17

3.2.1.3 Summary of MOOCs

Until now, MOOCs and their derivatives have played an important role in changing the traditional way of teaching and learning, from providing course materials to large audiences for free of charge, to importing MOOCs in universities' curricula to provide easier and more accessible learning methodologies.

As said, "*Just three years ago, MOOCs were an idea. Today they are an industry. Millions of students from around the globe have enrolled; thousands of courses have been offered; hundreds of universities have lined up to participate*" [30]. MOOCs are promising to fulfil learning needs and wishes of students all around the globe. Also, for the BVI community it is very promising because without additional and expensive changes in infrastructure they will be able to have easy access to courses provided online by top universities.

3.3 SUMMARY OF ONLINE LEARNING

It is evident that technology has changed the way we think, learn and perform our daily routine duties. For hundreds of years there were hardly any changes at schools. They remained basically the same, despite technological advancements. However, with the introduction of online learning people started to learn new things just for the sake of learning.

There are no admission criteria for studying online in general and for MOOCs in particular. In order to be admitted to a university one needs to show a certain level of intelligence and meet certain requirements, including having some knowledge about the field you want to study. There is a reason for this, and there should also be a social norm that certain things ought to be free and open to everyone, like open software, or the right to accessible education. Nevertheless, people continue paying for going to colleges, because they need a diploma in order to find a job. MOOCs are a way of trying something unconventional, since not everyone has the chance to study at top universities, due to financial difficulties or other limitations. Hence, online learning seems to have bright future.

3.4 OVERVIEW OF BVI WORLDWIDE

According to data provided by the World Health Organization (WHO), 285 million people are estimated to be visually impaired worldwide, from them 39 million are blind and 246 have low vision [3]. The majority, around 90%, live in low income countries [3].

From 1990 to 2002 the number of blind people increased by 8.5%.In 1990 it was estimated to be 3.5 million, while in 2002 it was 3.8 million. The increase in people with low vision is slightly more significant, (around 80%) though. In 1990 it was estimated to be 10 million, and in 2002 it was 18 million. This increase is linked to ageing of population, leading to an increase in population over 60 years [31].

Distribution of global estimate of visual impairment by region, published by WHO in 2002, is as follows [31]:

	African Region	Region of the Americas	Eastern Mediterranean Region	European Region	South-East Asia Region	Western Pacific Region
Population	672.238	852.551	502.823	877.886	1590.832	1717.536
No. of blind People	6.782	2.419	4.026	2.732	11.587	9.312
No. with low vision	19.996	13.116	12.444	12.789	33.496	32.481
No. with visual impairment	**26.778**	**15.535**	**16.469**	**15.521**	**45.083**	**41.793**

Table 2: Visual Impairment by Region published by WHO in 2002

In the U.S. distribution by the level of education of blind and visually impaired people in ages 21-64 in 2012 were as follows [32]:

Less than high school graduation	26.70%
High school diploma	32.30%
Some college education	29.10%
Bachelor's degree or higher	11.90%

Table 3: BVI distribution by level of education in U.S.- 2012

Unfortunately, only 37.74% of blind and visually impaired working age adults were employed in 2012. Employment statistics for the U.S. blind and visually impaired people in 2012 were [32]:

Employed	37.74%
Unemployed (in the labour force)	7.64%
Unemployed (not in the labour force)	54.62%

Table 4: BVI distribution by employment status in U.S - 2012

As the research done by the National Federation of the Blind (NFB) [33] shows education attainment is positively correlated to the employment of this community. Employment rate of graduates is twice as high as rate of high school graduates, and their earnings are also higher.

These figures represent only data about blind and visually impaired people in the U.S., where accommodation at schools and infrastructure settings are far better than in any other country. In other developed and high income countries statistics about BVI community are more or less the same. Low income countries, however, have no reliable statistics provided and it leaves much to be desired regarding the BVI community.

3.5 OVERVIEW OF BVI IN KOSOVO

3.5.1 Statistics about BVI in Kosovo

In Kosovo it is estimated that there are currently around 5,400 BVI people. The estimation is done by using a formula that says typically 10% of the total population are people with disabilities, and from them 3% are BVI [14] (1.8 Mio – total population *10% - people with disabilities * 3% - BVI), according to latest data from the 2011 census. Hence, these figures are estimates only, as there are no officially published statistics about BVI in Kosovo.

Statistics about the number of pupils attending primary and secondary school in Kosovo in 2013/2014 are [34]:

Total number of pupils	403,342
Total number of pupils with special needs	1,239
Total number of BVI pupils	86

Table 5: Number of pupils attending primary and secondary school in Kosovo – 2013/2014

Regarding higher education, it is estimated that around 30 BVI people have finished higher education, which compared to the total number of BVI people in Kosovo is just 0.6%.

As it has previously been mentioned, attaining education is positively related with employment for the BVI community; such low figures indicate that the majority of this community is unemployed.

Despite the fact that it is regulated by law that BVI people shall be enabled to access education in public schools, it still remains quite challenging to fulfil their basic needs. A lot of investments

and changes have to be done in infrastructure and classroom settings in order for BVI people to access education unaccompanied. Therefore, MOOCs are promising to open new perspectives for this community, without any expensive changes in infrastructure and classroom settings.

3.5.2 Strategies of educational institutions in Kosovo

In the past education for people with special needs was segregation-oriented, by creating schools for people with special needs, as is the case with the School for the Blind 'Xheladin Deda' in Kosovo. This kind of educational system is seen as inappropriate and discriminating from a human rights perspective, but also regarding the effectiveness of this practice [35].

Consequently, inclusion has evolved and it is seen from UNESCO as "a dynamic approach of responding positively to pupil diversity and of seeing individual differences not as problems, but as opportunities for enriching learning." [35].

Furthermore, UNESCO states that "Education for All means ensuring that all children have access to basic education of good quality. This implies creating an environment in schools and in basic education programmes in which children are both able and enabled to learn. Such an environment must be inclusive of children, effective with children, friendly and welcoming to children, healthy and protective for children and gender sensitive. The development of such child-friendly learning environments is an essential part of the overall efforts by countries around the world to increase access to, and improve the quality of their schools." [35].

This strategy has been embraced by the Ministry of Education, Science and Technology (MEST) in Kosovo, and its implementation is under way. This strategy is a new approach in education, where all the children learn together in the nearest school. The aim of the MEST strategy is not only placement of children at school, but also organizing and providing effective support to children's individual needs. With the implementation of this strategy schools for special needs in Kosovo have to transform in resource centres, which will support inclusion of children with special needs in regular schools.

In Kosovo there are currently five resource centres:

- Perparimi – Pristina – Specialised for children with intellectual disability and development

- Lef Nosi – Prizren – Specialised for children with intellectual disability and development Xheladin Dedain - Peja – Specialised for blind and visually impaired children
- NënaTerezë – Prizren - Specialised for children with hearing disabilities
- NënaTerezë–Mitrovica - Specialised for children with intellectual disability and development

In order to implement the inclusion strategy special classes attached to regular schools were created. Creation of these classes is done to support and prepare children with special needs before attending regular schools. In 2004 in Kosovo there were 73 special classes attached to regular schools. These classes are created as needed in schools close to the places where people with disabilities live. Since there are only five resource centres, some families face financial difficulties in sending their children there. For this reason, special classes are created in the nearest school.

The school for the blind 'Xheladin Deda' (which is now called a resource centre) is one of the few schools for special needs that have been implementing the inclusion strategy in the neighbouring region.

3.5.3 School for the blind 'Xheladin Deda' in Kosovo

The school for the blind 'Xheladin Deda' was established in 1982, and it offers learning and advisory services for blind and visually impaired people in Albanian language. It is the first and only school that offers this kind of services in Kosovo. It is located in Peja, a western part of Kosovo. Pupils attending the school are mainly from Kosovo. However, pupils from Macedonia also attend this school, due to the fact that in Macedonia there is no specialized school for BVI in Albanian language.

The school also has a dormitory, where pupils stay from Monday morning to Friday evening. In order for pupils to spend more time with their families and to make it easier for the families to send their children to school, on Mondays lessons begin in the afternoon, while on Friday they end by midday. Previously, pupils stayed at school for two weeks in a row, but this practice did not prove very useful, hence it was changed to a weekly stay. This change had a positive impact

on pupils, because after spending more time with their families, pupils were more relaxed and thus more socialized. Teaching is done in the same way as it is in regular schools, one lessons lasts 40 minutes, and in the afternoon pupils have different activities. After 19:00 pupils are normally free to do leisure activities and bedtime is at 22:00 [14]. Currently, there are around 40 pupils attending this school, distributed in different classes.

Figure 9: School for the blind "Xheladin Deda"

The above mentioned strategies have been implemented in this school, but the staff is still experiencing some difficulties. According to the school principal, Mr. Xhavit Kastrati, one of the main issues faced by these institutions is financial difficulties. In 2014 approximately 1.8 Million Euros from the MEST budget were allocated to those 5 resource centres, and only 90,000 Euros were allocated to his school. This sum is rather low compared to the expenses they have.

Additionally, this school has engaged teachers that travel to different towns throughout Kosovo, where they have special classes in order to support pupils with special needs. Due to the limited budget the number of those teachers remains rather low.

Another barrier that continues to prevent the successful implementation of the inclusion strategy is that there is no commitment of the teachers in special classes attached to regular schools. This is so because the institutional approach towards these teachers is unclear,

therefore, children are not integrated into regular classes and they continue to receive lessons in special classes.

3.5.4 Interview with the principal of the school for the blind "Xheladin Deda"

School for the blind "Xheladin Deda" is the only institution providing this kind of services in Kosovo, hence gathering information from the school personnel is of utmost importance. A comprehensive analysis of the current situation of the BVI community included an interview with the school principal, Mr. Xhavit Kastrati. Mr.Kastrati is well-informed about BVI people in general, about strategies for BVI provided by different ministries, as well as challenges faced in day-to-day work and needs of BVI pupils in particular.

The interview lasted two hours and different topics about BVI community were discussed. The interview mainly focused on better understanding of the a) current situation of the BVI community; b) learning needs of BVI students and c) main challenges faced by this community.

Mr. Kastrati emphasized the importance of overall awareness regarding BVI people, including families, community and institutions. The following reasons were identified as the main ones for the low number of BVI people attending schools: the stigma associated with this community; financial difficulties of their families; institutional ambiguities about specialized schools; classes attached to regular schools; the inclusion strategy; not committed teachers in special classes; and lastly, lack of financial support from the government.

Details of the interview are provided in the Appendix A.

3.6 SUMMARY OF BVI IN KOSOVO

Even in developed countries like the U.S. the number of BVI people with high school education remains low, due to inaccessible learning environments. In Kosovo and the surrounding region, this situation is even worse.

In Kosovo, the main reasons for the low participation of this community in the education process are as follows:

- Inadequate basic road infrastructure and classroom settings
- Impossibility to navigate unaccompanied
- Stigma associated with this community
- Financial difficulties of their families

Despite the tremendous efforts put at a governmental level to support people with special needs, including introduction of new strategies such as inclusion, travelling teachers, and special classes attached to regular schools, the engagement of this community in education still leaves much to be desired.

Low participation in education has a direct impact on employment, and the majority of this community remains unemployed.

Due to all the above mentioned issues, MOOCs are seen as a quick, easy and cost effective solution. Therefore, making them accessible for BVI people will be a great opportunity to ease the access to higher education for these people, and for their personal and professional development.

4 EVALUATION OF ACCESSIBILITY OF MOOCS FOR BVI

4.1 OVERVIEW

Nowadays, online learning is becoming more and more popular, as it is considered a good possibility to improve education. Unfortunately, there is scarce research on the accessibility of Learning Management Systems (LMS). Its findings show that LMSs are continually improving, but they still need more work in order to comply with Priority 1 of the W3C/WAI guidelines. However, no thorough studies have been conducted on evaluation of accessibility of MOOCs for BVI [18].

This thesis will present the accessibility evaluation of the leading MOOCs provider Coursera[18] and localized MOOCs specific to Albanian speakers [7]. The findings from the evaluation of accessibility have been gathered through three different methods: usability testing, automatic accessibility checking and heuristic evaluation.

4.2 EVALUATION OF ACCESSIBILITY OF COURSERA

4.2.1 Coursera Overview

Coursera was founded in 2013 and is a for-profit company. Coursera offers courses in different subjects to more than 25 million learners. In April, 2017 Coursera had 149 partners from 29 different countries, more than 2,000 courses provided, more than 180 specializations and 4 degrees.

4.2.2 Usability testing

4.2.2.1 Participants and Procedure

Three individuals were involved in this experiment. All of them are fluent in English and have experience in using computers. Two individuals have been totally blind since they were born. The third one is an accessibility and IT expert who is not blind but was blind-folded. The experiment aimed at testing how BVI can complete a specific task on MOOCs by using screen

readers and identify problems they face. Each participant was given a list of tasks to complete at Coursera. In this experiment, participants conducted the test on computers running Microsoft Windows 7, Mac OS X 10.8.5 and iOS7, and on the following browsers: Internet Explorer, Mozilla Firefox and Safari. Screen readers used NVDA for browsers and a preinstalled VoiceOver on MAC's. Participants were required to do tasks as: sign up, enrol on a course, go to class, watch video lectures, contribute to discussion forums and sign out. [18].

4.2.2.2 Findings

Although participants were able to complete the tasks, they identified the following problems [18]:

1. No assistance was available for the BVI in the text input control;
2. Pages refresh and new pages open with no notification;
3. Instructions for registering in a new course were difficult to understand by the participants;
4. Text alternatives did not include a well described text or were read incorrectly by the screen reader;
5. When there is an error, no messages are given for correction or termination;
6. There was no alt text in the images linked to other websites;
7. Using keyboard was difficult to reach some functions;
8. Using heading inappropriately conflicted with screen readers;
9. No compatibility with mobile browsers.

4.2.3 Automatic accessibility checking

4.2.3.1 Procedure

To obtain technical evaluation insights of the Coursera interface, we conducted an automatic checking using the WAVE web accessibility tool provided as a chrome extension. We randomly selected lectures and pages from four courses, Python for Everybody, Data Science Specialization, Business English Communication Skills and Business and Financial Modelling and

also home pages. For each course, we evaluated the Course Description page, the pages of lectures containing the videos, Discussion Forums, Quiz and the Grade page. Details of the evaluation are shown in the table below.

Course	Physics							English						
Level	6th Grade			12th Grade				5th Grade			Who is?			
Error Description \ *Webpage*	Course Description	Lecture 2	Lecture 10	Course Description	Lecture 2	Lecture 5	Quiz	Course Description	Lecture 2	Lecture 10	Course Description	Lecture 2	Lecture 7	Quiz
Missing Alternative Text	2	15	14	2	15	14	13	2	16	14	2	6	6	13
Missing Form Label	12	14	14	12	14	14	9	12	14	14	12	14	14	9
Document Language Missing	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Empty Heading	1	-	-	1	-	-	-	1	-	-	1	-	-	-
Empty Button	1	6	6	1	6	6	6	1	6	10	1	6	6	6
Empty Link	5	8	8	6	8	8	7	6	10	10	6	10	10	7
Empty Table Header	4	-	-	4	-	-	-	4	-	-	4	-	-	-
Total Number of Errors	**26**	**44**	**43**	**27**	**44**	**43**	**36**	**27**	**47**	**49**	**27**	**37**	**37**	**36**

Table 6: Number of errors found on Coursera– 2017

4.2.3.2 Findings

It can be noted that all errors indicate that accessibility issues are similar throughout the entire Coursera interface.

4.2.4 Heuristic testing

4.2.4.1 Procedure

For this evaluation, we selected 10 different Coursera courses offered in English from different universities and in different subjects. Two evaluators checked each course in order to confirm its compliance with WCAG 2.0 guidelines. They used a checklist which inspects 105 accessibility problematic issues within 12 guidelines, which are classified under four main principles: perceivable, operable, understandable, and robust, as listed in the table below. Each guideline has a set of Success Criteria (SC) or requirements to be fulfilled with different priority levels: lowest A to the highest AAA [18].

Perceivable	Text alternatives for non-text content
	Captions and other alternatives for multimedia
	Content can be presented in different ways
	Content is easier to see and hear
Operable	Functionality is available from a keyboard

	Users have enough time to read and use the content
	Content does not cause seizures
	Users can easily navigate, find content, and determine where they are
Understandable	Text is readable and understandable
	Content appears and operates in predictable ways
	Users are helped to avoid and correct mistakes
Robust	Content is compatible with current and future user tools

Table 7: WCAG 2.0 - 12 guidelines [8]

4.2.4.2 Findings

The results of this heuristic evaluation showed that all the courses failed to conform to all priority levels (A-AA-AAA). The table below shows the number of open issues in each course along with the level of conformity for each priority level. The level of conformity of level A was the highest among other levels (70%-84%), showing that the minimum level of conformance is highly achieved compared to other levels. Level AAA is the lowest in conformance with a rate between (56%-69%), since it depends on the conformance of level A and AA [18].

Course / University	A	AA	AAA	Open issues
Online Games: Literature, New Media, and Narrative / Vanderbilt University	78%	78%	56%	30
Plagues, Witches, and War: The Worlds of Historical Fiction / University of Virginia	76%	69.6%	59%	32
Design: Creation of Artifacts in Society / University of Pennsylvania	82%	74%	68.75%	25
Bioelectricity: A Quantitative Approach / Duke University	78%	74%	62.5%	29
Synapses, Neurons and Brains / Hebrew University of Jerusalem	82%	74%	68.75%	25
Drug Discovery, Development & Commercialization / University of California, San Diego	78%	82.6%	68.75%	25
Experimental Genome Science / University of Pennsylvania	78%	74%	59%	30
Neural Networks for Machine Learning / University of Torronto	84%	78%	69%	23
Blended Learning: Personalizing Education for Students / New Teacher Center	70%	74%	59%	34
Writing in the Sciences / Stanford University	80%	74%	62.5%	28
Average	79%	75%	63%	28.1

Table 8: Number of Open Issues in Coursera Courses

In addition, it should be emphasized that most of the required tasks were fulfilled; there were, however, several accessibility problems that users faced while using Coursera Interface.

4.2.5 Summary

Evaluation of the key and leading MOOC provider, Coursera, was performed from three different aspects: usability testing, automatic accessibility checking and heuristic testing. These evaluations have shown that Coursera still have limitations regarding accessibility to BVI. Also, it failed to conform to WCAG 2.0 guidelines [18].

Nevertheless, it should be highlighted that most of the required tasks were fulfilled; there were, however, some accessibility problems faced while using Coursera Interface. Identified problems occurred due to unclear text instructions for registering; missing text in the images linked to other websites, and most of the errors found show that accessibility issues are similar throughout the entire Coursera interface.

4.3 EVALUATION OF ACCESSIBILITY OF ALMOOC

4.3.1 ALMOOC Overview

ALMOOC is a non-profit organisation that provides education to over 60,000 Albanian-speaking students for free. It offers courses in different subjects through the cloud based learning platform by EDUonGO. ALMOOC's vision is 'making free online education available to Albanians around the world' [36].

Currently, ALMOOC offers courses in the following subjects: English, Coding, Mathematics, Physics, Chemistry and Information Technology. It has more than 60,000 students; 312,000 completed tests; 26,000 completed projects and 110,000 discussions [36]. All the course materials are in Albanian.

Figure 10: ALMOOC 2017

Distribution of courses by subjects is as follows:

Subject	**Number of courses**
English	27
Coding	28
Mathematics	8
Physics	7
Chemistry	6
Information Technology	3

Table 9: Distribution of courses by subject in ALMOOC - 2016

Some courses are designed in a way that within a course more lessons are provided. For example, in the English subject there is a total of 27 courses, and 4 of them have 67 lessons each.

In order to enter the course you first need to sign up with an email. After you sign up you are able to watch the lessons, participate in discussions, take quizzes or view your grades. Depending on the instructor's preferences for organization of course materials, there are typically short video lectures for each lesson, as can be seen in the following screen shot:

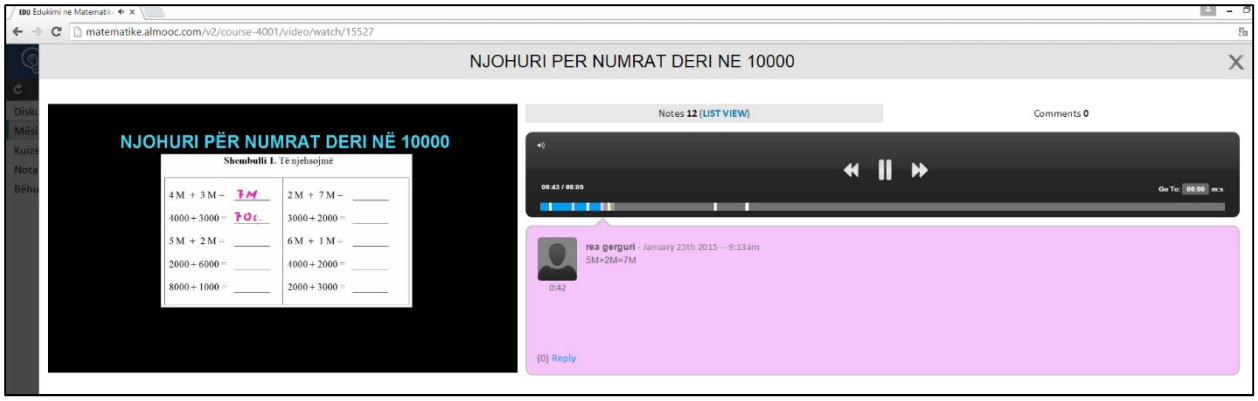

Figure 11: ALMOOC math course

Currently, ALMOOC is the only MOOCs provider that offers courses exclusively for Albanian speaking people.

4.3.2 Usability testing

4.3.2.1 Participants and Procedure

Two blind individuals participated in evaluating the accessibility of ALMOOC. Both of them have been totally blind since they were born. The first person has a master's degree education and works as a lecturer at a public university and has experience in using computers with screen readers to browse information on the web. The second person has a bachelor's degree and works as a journalist at a public broadcasting news agency. He rarely uses a computer and mainly relies on using his smart phone with its built-in screen reader. None of the participants had previously taken any online course before. Both participants were tested on a computer running Windows 7, using the Internet Explorer browser and JAWS screen reader. Participants were required to perform the following tasks:

- Select a course randomly
- Register for a course
- Watch two video lectures
- Take a quiz within the selected course, and
- Contribute to class discussion and chat [7].

4.3.2.2 Findings

The usability testing of ALMOOC was very difficult and the second participant gave up at the beginning of the testing. However, the first participant made it through most of the predefined tasks [7].

Some of the main issues and positive aspects include [7]:

- Initially, the participant had difficulties registering for the course, as he could not locate the appropriate link. He succeeded only on the third attempt.
- The participant could successfully play lecture videos and listen to their content, but diagrams and images in the video were not accessible, for instance, when the instructor was explaining a concept and was referring to a diagram on the white board.
- Although the video playing speed was appropriate, a need for speed control was addressed by the participant.
- Navigating from a video to another video within a lecture was easy, however, going forward and backward within the video was difficult.
- Navigation from one lecture to another was easy.
- Access to a Quiz section as well as selecting and submitting answers was easy, but it was difficult to navigate from one question to another due to unlabeled buttons.
- The participant had problems accessing the Discussion page.
- The participant successfully navigated to the Chat section, he could read people's comments and provide his own comment.
- Because of lack of appropriate labeling, the participant was unsuccessful in logging out of ALMOOC.
- The textual content across all pages during the entire session was accessible.
- Although the ALMOOC interface is in the Albanian language, many labels were still in English, which confused the participant.

These findings show that most of the drawbacks are related to missing or inappropriate labeling of links or buttons. These make the objects invisible for the screen readers and consequently unidentifiable and inaccessible for the participant [7].

4.3.3 Automatic accessibility checking

4.3.3.1 Procedure

Automatic accessibility checking was performed by using the WAVE [11]web accessibility tool provided as a chrome extension. Two courses were selected to conduct the automatic accessibility checking, Physics and English. For each course, we randomly selected lectures and pages, and we evaluated the Course Description page, Video Lectures page, and the Quiz page [7].

4.3.3.2 Findings

Findings show that ALMOOC interface contains a high number of accessibility errors. The majority of errors are associated with missing form labels and missing alternative text and empty links, as shown on the table below [7]:

Course	Physics							English						
Level	6th Grade			12th Grade				5th Grade			Who is?			
Error Description \ *Webpage*	Course Description	Lecture 2	Lecture 10	Course Description	Lecture 2	Lecture 5	Quiz	Course Description	Lecture 2	Lecture 10	Course Description	Lecture 2	Lecture 7	Quiz
Missing Alternative Text	2	15	14	2	15	14	13	2	16	14	2	6	6	13
Missing Form Label	12	14	14	12	14	14	9	12	14	14	12	14	14	9
Document Language Missing	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Empty Heading	1	-	-	1	-	-	-	1	-	-	1	-	-	-
Empty Button	1	6	6	1	6	6	6	1	6	10	1	6	6	6
Empty Link	5	8	8	6	8	8	7	6	10	10	6	10	10	7
Empty Table Header	4	-	-	4	-	-	-	4	-	-	4	-	-	-
Total Number of Errors	**26**	**44**	**43**	**27**	**44**	**43**	**36**	**27**	**47**	**49**	**27**	**37**	**37**	**36**

Table 10: Number of errors found on ALMOOC - 2016

[11]wave.webaim.org

The similarity of errors found, in terms of numbers and type, shows that accessibility issues persist throughout the entire ALMOOC interface. This also indicates that the issues are mainly related to the architectural structure of the site, rather than the content offered in individual web pages [7].

4.3.4 Heuristic testing

4.3.4.1 Procedure

For Heuristic evaluation, we recruited three evaluators by randomly selecting a course and lectures from ALMOOC interface. Evaluators have independently evaluated the ALMOOC interface following the nine IBM web accessibility heuristics[12] and made notes about the problems discovered, as listed on the table below. Various screen readers were used, such as: Non-visual Access Desktop (NVDA)[13], WebAnywhere[14], and ChromeVox[15][7].

IBM web accessibility heuristics
Provide meaningful and relevant alternatives to non-text elements
Support consistent and correctly tagged navigation
Allow complete and efficient keyboard usage
Respect users' browser settings
Ensure appropriate use of standard and proprietary controls
Do not rely on color alone to code and distinguish
Allow users control of potential distractions
Allow users to understand and control time restraints
Make certain the Web site is content compatible with assistive technologies

Table 11: IBM web Accessibility heuristics

4.3.4.2 Findings

The results from the heuristic evaluation show numerous issues that break the web accessibility guidelines and therefore make the ALMOOC website difficult to access. A list of encountered problems is shown in the table below:

[12] www.iwc.oxfordjournals.org/content/16/3/507/T1.expansion.html
[13] www.nvaccess.org
[14] www.webanywhere.cs.washington.edu/wa.php
[15] www.chromevox.com

Heuristic	Cumulative findings
1. Provide meaningful and relevant alternatives to non-text elements	– Images and videos lack alternative description. – Inaccessibility of videos with sentences on the board or slides that are not completely read by the instructor and it is expected that student will read them. Or, the instructor refers to a diagram or image on the board or slide without describing its details. – Lack of alternative description of video controls, e.g., play, stop. – Video lectures lack subtitles.
2. Support consistent and correctly tagged navigation	– Partially tagged headings. – No access to homepage from the video lecture page. – No links to enable users skip to main content. – No way to go to the next lecture without exiting the current lecture first.
3. Allow complete and efficient keyboard usage	– Not possible.
4. Respect users' browser settings	– Changing preferred colors on a website not possible. – Page layout is responsive to text changes, e.g. text increase and decrease. – No control to increase the text only.
5. Ensure appropriate use of standard and proprietary controls	– Good, only some control labels appearing in English, instead of Albanian.
6. Do not rely on color alone to code and distinguish	– Generally, the site has good contrast. – When quiz answers are submitted, the results are indicated only using colours: red for incorrect and green for correct answers.
7. Allow users control of potential distractions	– Not possible to change the speed of video lectures. – Forward and Backward controls do not move through the video, instead enable moving through notes or comments students have posted at different times of the lecture.
8. Allow users to understand and control time restraints	– The webpage never expires.
9. Make certain the Web site is content compatible with assistive technologies	– No tab order for easy navigation using screen readers. – Hidden controls and content that are not visible on the page (and not meant for the user), are read by the screen reader. – In case of a pop up content, the screen reader reads the content of the page behind. – Many empty elements.

Table 12: Cumulative findings from three evaluators using the IBM web accessibility heuristics

4.3.5 Summary

Evaluation of the platform intended for Albanian-speaking community, ALMOOC, was performed from three different aspects: usability testing, automatic accessibility checking and

heuristic testing. These evaluations show that ALMOOC has many accessibility issues and it is difficult to be used by BVI. Identified problems are related to inappropriate labelling of objects, missing alternative descriptions of images and videos. These issues make the objects invisible to screen readers and consequently unidentifiable and inaccessible to the participant [7].

5 DISCUSSION AND RECOMMENDATIONS

Findings from usability testing show that in order to access the ALMOOC interface, BVI people should have very good experience in using computers with screen readers, otherwise they will give up. Positive aspects show that it is easy to start a lecture and listen to its content; navigation between the lectures is easy; quiz section is easily accessible; and in the discussion part it is easy to follow comments and participate. However, the first step in taking a course remains a problem, as it is very difficult to register for the course. In this case the evaluator managed to register on the third attempt. Other issues are related to difficulty in accessing diagrams/images inside videos, finding correct answers on quizzes, moving forward/backward in the videos [7].

Results from automatic accessibility checking show that the ALMOOC interface has the same errors throughout the entire interface. This indicates that accessibility issues are related to the architectural structure of the site [7].

Similar errors also occurred in the heuristic evaluation, which renders the page difficult to access for BVI people [7].

All three different evaluation methods indicate that the architecture of ALMOOC interface is not designed and developed in line with accessibility guidelines and BVI find it difficult to access it.

In this study we evaluated the accessibility of MOOCs by showing that existing MOOCs are not suitable to deliver accessible content to BVI. Therefore hypothesis 1 has been confirmed because when MOOCs interfaces are developed BVI people are not taken into consideration and main problems are due to inappropriate labelling of objects, missing or unclear alternative descriptions for images and videos.

Evaluations show that by using W3C design guidelines we can redesign existing MOOCs platforms to deliver accessible content to BVI. Moreover, there are different aspects that ought to be considered, mainly related to the approach of the course author. Course authors should try to explain everything that is presented in video lecture and not rely on students' ability to

see themselves. To conclude, hypothesis 2hasbeen partially confirmed because by following these well-known guidelines we can improve accessibility of the existing MOOCs platforms, but not make them fully accessible for BVI people.

Additionally, the success of delivering accessible MOOCs depends on the type of the course. i.e., not all courses can be delivered using MOOCs, because BVI people rely on explanation provided by the course author and it is sometimes difficult for an alternative description to be provided. Courses on subjects like Chemistry, Physics or Biology are the most applicable; especially the part of the experiments where BVI people would better understand how they work, for instance, an experiment from a Chemistry subject on the reaction of two elements.Therefore, hypothesis 3 has been confirmed.

Based on the results from the three different evaluations, several recommendations shall be provided in order to address ALMMOC accessibility issues for BVI people.

Since ALMOOC interface is designed and developed in a way that is uses templates to create courses, when the underlying system is re-engineered by following accessibility guidelines, it will reduce difficulties faced by BVI when using it.

Another important part is course content. In this regard we advise course authors to take BVI people into consideration when developing a course. Authors should explain everything they present on the slides and not rely on students being able to see it themselves. Also, they should provide alternative descriptions for images [7].

6 CONCLUSION, LIMITATIONS AND FUTURE WORK

In this thesis we presented findings from an evaluation of the accessibility level of Coursera and ALMOOC for blind and visually impaired people. For both platforms we applied three different evaluation methods: usability testing, automatic accessibility checking and a heuristic test. The findings indicate that both platforms failed to conform to WCAG 2.0 guidelines and errors in all three different methods are similar. On Coursera, BVI users were able to fulfil most of the required tasks, while on ALMOOC, findings have shown that the platform has many accessibility issues and it is quite difficult to be used by BVI.

Regarding, accessibility of ALMOOC for BVI we suggest that a general template be made, which will be accessible to BVI, thus increasing accessibility of every course generated [7].

For MOOCs to be accessible to BVI, we recommend course authors to develop video lectures in a way that the information presented is broken into small and easily understandable pieces, and of course all elements like links, tables or images should have descriptive alternatives. [18]

However, what remains a challenge on both platforms is making video lecture contents more accessible, by explaining everything presented on the video and not rely on students' sight. This involves encouraging instructors to have blind people in mind when creating their video lectures [7].

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APPENDIX A

Interview with Mr. Xhavit Kastrati, principal of the school for the blind 'Xheladin Deda'

1. What is the number of people with disabilities in Kosovo?

The number of people with disabilties is estimated to be around 9-10% of the population. In Kosovo it is estimated to be 180,000.

2. What is the number of BVI people in Kosovo?

*The number of BVI is estimated to be 3% of all people with disabilities. Hence, in Kosovo, it is estimated that there are around 5,400 BVI people. The estimation is done by using a formula according to which typically 10% of the total population are people with disabilities, and from them 3% are BVI (1.8 Mio – total population *10% - people with disabilities * 3% - BVI). However, according to Mr.Kastrati, in Kosovo there are around 2,700 BVI people.*

3. What is the number of BVI people in Kosovo, distributed on the level of impairment?

N/A

4. What is the number of BVI people in Kosovo, distributed by level of impairment?

N/A

5. What is the number of BVI people in Kosovo, distributed by age?

N/A

6. What is the number of BVI people in Kosovo, distributed by education level?

Unfortunately, there are no official statistics on this issue.

Also, this school does not have anyprecise figures of BVI pupils attending/finished school, because there are also sighted pupils attending this school, due to socializing with BVI pupils.

Anyway, the number of BVI that finished university is around 20.

7. Is there a strategy provided by the Ministry of Education, Science and Technology (MEST) for the education of BVI?

Yes, there is a strategy published by MEST and it is available on the MEST web page.

8. Is there a strategy provided by the Ministry of Labor and Social Welfare (MLSW) for training, professional rehabilitation and employment of BVI?

Yes, the school for the blind "Xheladin Deda" has signed a memorandum of cooperation with MSLW, specificly with Vocational Training Centers (VTC). The VTC in Peja, provides information technology courses by assigning a traininer and the school provides the classes.

9. Is there a strategy provided by the Ministry of Infrastructure (MI) for addressing the needs of BVI in schools or universities?

Yes, the Ministry of Infrastructure has drafted Administrative Instructions on Accessibility to Public Facilities for people with disabilities, published in December, 2012.

10. What is the number of employed BVI?

N/A

11. What is the number of employed BVI, distributed by sector?

N/A

12. What is the strategy of MEST for the education of BVI?

MEST has a strategy for inclusion, but the inclusion of BVI has not been specifically defined.

13. How has the inclusion strategy been perceived by BVI?

Regarding the inclusion strategy, Kosovo is quite ahead compared to other neighbouring countries. But that is true just for the school for the blind "Xheladin Deda, beacuse other schools for special needs have not implemented it.

14. What does "special classes attached to regular schools" refer to?

In order to implement the inclusion strategy, special classes attached to regular schools were created. Creation of these classes is done to support and prepare children with special needs before attending regular schools. These classes are created upon demand in schools near the

places where people with disabilities live. Since some families face financial difficulties in sending their children to schools for people with disabilties special classes are created in the nearest school. In this way such classes help and prepare children with special needs to attend regular schools.

15. What is the main challenge of the strategy "special classes attached to regular schools" for BVI, and also for teachers?

According to Mr. Kastrati, this project has failed due of lack of commitment of the teachers. Lack of commitment is related to the unclear status of these teachers on an institutional level. These teachers have pupils with special needs that will later be integrated into regular classes and therefore they will not have pupils to teach anymore. Consequently, they continue to keep these kids in the "special classes attached to regular schools" and the transition from a special to a regular class never happens.

Currently, in "special classes" there are:

- *2 pupils in the nursery school*
- *3 pupils in regular primary school*
- *2 pupils in regular high school*

16. Is your school planning to offer or support online education?

School for the blind "Xheladin Deda', is planning on supporting online courses.

They have the information technology class and teachers are trained to use computers. They have 10 computers altogether.

Additionally, teachers from this school offer trainings on "usage of electronic devices for BVI". This training is accredited by MEST and they also offer trainings the teaching staff. BVI pupils or family members are also expected to attend this kind of training.

17. Which subjects would be more applicable to be online for BVI?

The most applicable subjects for online learning are Chemistry, Physics or Biology, especially the part of the experiments where the BVI pupils would better understand how they work, for example, an experiment from Chemistry on reaction of two elements.

18. What is the level of English proficiency of pupils attending your school?

Unfortunately, pupils attending this school lack English proficiency. We have tried many times, but pupils are not interested in learning the language.

19. What is the level of computer literacy of pupils attending your school?

Unlike learning English langage, pupils are quite interested in using computers, and they are well prepared. The level is around 70%.

20. Could you explain the current situation of BVI and what the main challenges are?

School for the blind 'Xheladin Deda', was established in 1982, and it offers learning and advising services for blind and visually impaired people in Albanian language. It is the first and the only school that offers these kinds of services in Kosovo. It is located in Peja, a western part of Kosovo. Pupils attending the school are mainly from Kosovo. However, there are also pupils from Macedonia attending this school, due to the fact that in Macedonia there is no specialized school for BVI in Albanian language.

The school also has a dormitory, where pupils stay from Monday morning to Friday evening. In order for pupils to spend more time with their families and to make it easier for the families to send their children to school, on Mondays the lessons begin in the afternoon, while on Fridays they end by midday. Previously, pupils used to stay at school for two weeks in a row, but this practice did not prove to be very useful, hence it has been changed to a weekly stay. This change has had a positive impact on pupils, because after spending more time with their families, pupils felt more relaxed and thus more socialized. Teaching is done in the same way as it is in regular schools, one lessons lasts 40 minutes, and in the afternoon pupils have different activities. After 19:00 pupils are usually free to do leisure activities and bedtime is at 22:00. Currently, there are around 40 pupils attending this school, distributed in different classes.

According to the school principal, Mr.Xhavit Kastrati, one of the main issues is the financial difficulties faced by these institutions. In 2014, the budget allocated from MEST for those 5 resource centres was around 1.8 Million Euros, and a mere 90 thousand Euros were allotted to his school. This sum is rather low compared to the expenses they have.

Additionally, this school engages teachers that travel in different towns around Kosovo, where they have special classes in order to support pupils with special needs. However, due to the limited budget the number of those teachers remains pretty low.

Another issue is that there is no commitment of the teachers in special classes attached to the regular schools. It is because the institutional approach towards these teachers is unclear. Therefore, they are only trying to keep their workplace safe.

Documents related to proof reading:

DECLARATION LETTER

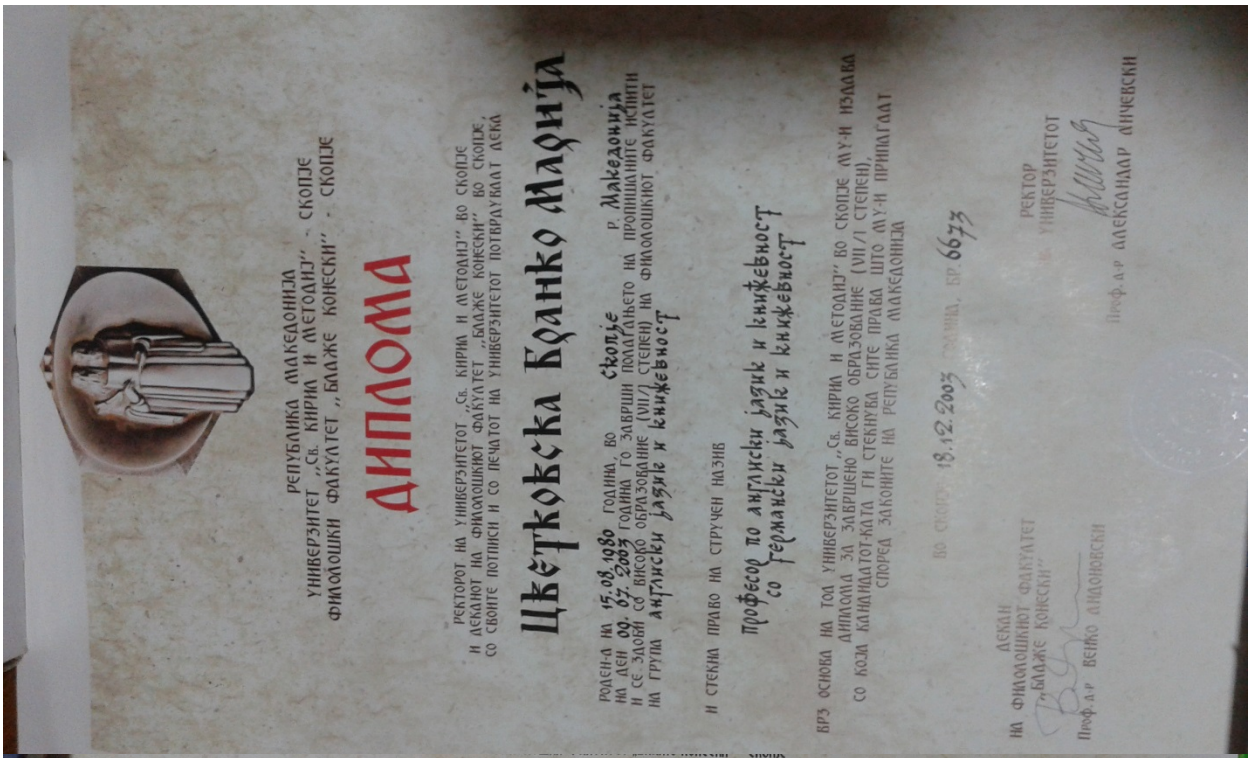
I, ***Marija Stevkovska***, born on 15.08.1980 in Skopje, with residential address at ul. Pandil Shishkov no.30/3, 1000 Skopje, R. Macedonia, authorized court translator from Macedonian into English and German, and vice versa, hereby certify that I have proofread the master thesis entitled: "*Accessibility of Massive Open Online Courses (MOOCs) for Blind and Visually Impaired People*", written by the candidate ***Njomza Mripa***, approved by the mentor ***Dr. Mexhid Ferati***, at the master program of Business Informatics, at the Faculty of Contemporary Sciences and Technology, South-East European University, Tetovo, R. Macedonia.

Date: 03.05.2017

Proofreader:

Marija Stevkovska, MA

Signature:



РЕПУБЛИКА МАКЕДОНИЈА
УНИВЕРЗИТЕТ „Св. КИРИЛ И МЕТОДИЈ" - СКОПЈЕ
ФИЛОЛОШКИ ФАКУЛТЕТ „БЛАЖЕ КОНЕСКИ" - СКОПЈЕ

ДИПЛОМА

РЕКТОРОТ НА УНИВЕРЗИТЕТОТ „Св. КИРИЛ И МЕТОДИЈ" ВО СКОПЈЕ
И ДЕКАНОТ НА ФИЛОЛОШКИОТ ФАКУЛТЕТ „БЛАЖЕ КОНЕСКИ" ВО СКОПЈЕ,
СО СВОИТЕ ПОТПИСИ И СО ПЕЧАТОТ НА УНИВЕРЗИТЕТОТ ПОТВРДУВААТ ДЕКА

Цветковска Бранко Марија

РОДЕН-А НА 15.08.1980 ГОДИНА ВО Скопје Р. Македонија
НА ДЕН 00.07.2003 ГОДИНА ГО ЗАВРШИ ПОДАТОЧНОТО НА ПРОПИШАНИТЕ ИСПИТИ
И СЕ ЗДОБИ СО ВИСОКО ОБРАЗОВАНИЕ (VII/1 СТЕПЕН) НА ФИЛОЛОШКИОТ ФАКУЛТЕТ
НА ГРУПА англиски јазик и книжевност

И СТЕКНА ПРАВО НА СТРУЧЕН НАЗИВ

професор по англиски јазик и книжевност
со германски јазик и книжевност

ВРЗ ОСНОВА НА ТОА УНИВЕРЗИТЕТОТ „Св. КИРИЛ И МЕТОДИЈ" ВО СКОПЈЕ ИУ-И ИЗДАДЕ
ДИПЛОМА ЗА ЗАВРШЕНО ВИСОКО ОБРАЗОВАНИЕ (VII/1 СТЕПЕН),
СО КОЈА КАНДИДАТОТ-КАТА ГИ СТЕКНУВА СИТЕ ПРАВА ШТО ИУ-И ПРИПАЃААТ
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ВО СКОПЈЕ 18.12.2003 ГОДИНА, БР. 6673

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ОСНОВАН НА ВИСОКООБРАЗОВНАТА УСТАНОВА
ВЛАДА НА НАРОДНА РЕПУБЛИКА МАКЕДОНИЈА

БРОЈ И ДАТУМ НА РЕШЕНИЕТО ЗА ПОЧЕТОК СО РАБОТА
ИЗДАДЕНО ОД МИНИСТЕРСТВОТО ЗА ОБРАЗОВАНИЕ И НАУКА
338 ОД 18.VI 1946 ГОД.

ДИПЛОМА

ЗА ЗАВРШЕН ВТОР ЦИКЛУС НА СТУДИИ

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(НАЗИВ НА СТУДИСКАТА ПРОГРАМА И НАСОКА)

ВКУПНО ЕКТС 60 КРЕДИТИ И ПРОСЕЧНА ОЦЕНКА 10.00 И СЕ СТЕКНА СО НАУЧЕН НАЗИВ

МАГИСТЕР ПО ФИЛОЛОШКИ НАУКИ ВО ОБЛАСТА НАУКА ЗА ЈАЗИК (MA in Linguistics)
(НАУЧЕН НАЗИВ) (НАУЧЕН НАЗИВ ЗА МЕЃУНАРОДНА УПОТРЕБА)

СЕРИСКИ БРОЈ 01225

БРОЈ И ДАТУМ НА ДИПЛОМАТА ОД ГЛАВНАТА КНИГА
НА ДИПЛОМИРАНИ СТУДЕНТИ НА ВТОР ЦИКЛУС НА СТУДИИ
7, 5.XII.2012

МЕСТО И ДАТУМ НА ИЗДАВАЊЕ НА ДИПЛОМАТА
Скопје, 15.III.2013

ДЕКАН
Проф. д-р СЛАВИЦА ВЕЛЕВА

РЕКТОР
Проф. д-р ВЕЛИМИР СТОЈКОВСКИ

Република Македонија
МИНИСТЕРСТВО ЗА ПРАВДА
Бр. 07- 6877/2008-2
26.11.2008 година
С к о п ј е

Врз основа на член 85 и 87 од Законот за судовите ("Службен весник на РМ бр. 58/06), донесувам

Р Е Ш Е Н И Е

МАРИЈА СТЕВКОВСКА, со стан на ул" Пандил Шишков " број 30/3 од Скопје, СЕ ПОСТАВУВА за постојан судски преведувач од македонски на германски и англиски јазик и обратно во Основниот суд Скопје I Скопје.

Решението стапува во сила со денот на неговото донесување.

О б р а з л о ж е н и е

Марија Цветковска од Скопје со решение број 08/1-3875/2003-3 од 31.01.2008 година е поставена за постојан судски преведувач од македонски на германски и англиски јазик и обратно во Основниот суд Скопје I Скопје.

Со молба број 07- 6877/2008-2 од 24.11.2008 година именуваната побара да и се изврши промена на нејзиното презиме на Стевковска , за што на увид достави извод од матичната книга на венчаните број 1911-03/873 од 12.06.2004 година.

Со оглед на изложеното, се одлучи како во диспозитивот на ова решение.

МИНИСТЕР ЗА ПРАВДА,
Михајло Маневски

ДОСТАВЕНО ДО:
-именуваната,
-Основниот суд Скопје I Скопје
-архивата

Република Македонија
МИНИСТЕРСТВО ЗА ПРАВДА
Бр.07- 6877 /2008-2
26.01.2009 година
С к о п ј е

ДО МАРИЈА СТЕВКОВСКА
ул" Пандил Шишков" број 30/3

С К О П Ј Е

Министерството за правда во прилог ви го доставува решението број 07- 6877 /2008-2 од 26.11.2008 година со кое Ви е извршена промена на презимето од Цветковска на Стевковска.

Прилог: решение

РАКОВОДИТЕЛ НА СЕКТОР
ЗА МЕЃУНАРОДНА ПРАВНА ПОМОШ,
Верка Цветановска

/мд