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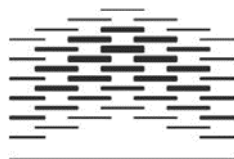
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Elderly Users Engagement with MOOC content in Context of Universal Design

Anna Nishchyk

Department of Computer Science
Faculty of Technology, Art and Design

OSLO AND AKERSHUS
UNIVERSITY COLLEGE
OF APPLIED SCIENCES

Abstract

Every day the Internet brings us a variety of new opportunities. Recently it had significant influence on the field of education by providing the possibility of online learning for all the Internet users, for free and at their own pace. The relatively new type of online education, Massive Open Online Courses (MOOCs), is becoming more and more popular every day. According to the literature MOOCs can help to make education more accessible for people with diverse abilities, but in order to make it possible, universal design principles should be used in the process of MOOCs development.

According to previous studies, MOOC courses could be very beneficial for seniors. Unfortunately, different negative factors, such as age related issues and a lack of experience, create a lot of ICT barriers for elderly people, who use Internet and computer technologies. The literature review of the current thesis showed that the issue of elderly users' engagement with MOOC content was not sufficiently addressed. This research attempts to put bigger emphases on MOOC content types in order to investigate issues faced by elderly in relation to each of the types. In order to achieve the goal, the combination of user testing observation and in-depth semi-structured interviews with 14 elderly participants were applied.

The research was performed in few steps. First, the extensive literature review was conducted. Then the methodological and practical decisions were made in order to decide, which methods and techniques should be used to achieve the goals of the research. In the next step, the user-testing and interviews were conducted. Then all the collected data were summarized, analysed and discussed in relation to literature review findings.

The results of the study show that elderly users express positive attitude towards MOOC as a way of learning new things. However, some adjustments need to be made in order to make the MOOC content universally designed, since the elderly users face a number of barrier, related to different content types, which make it harder for them to take full advantage of MOOCs. The results also describe seniors' perception of the different types of MOOC content presentation and their preferences. The set of recommendations for potential improvement of MOOC content and its presentation for senior users in universal design context was elaborated.

Acknowledgements

Looking back on the whole journey, I can definitely say that studying on the master program in Oslo and Akershus University College of Applied Science was the best periods in my life. Sometimes it was hard, but most of the time it was a great experience. So, my first thank you goes to Oslo and Akershus University College of Applied Science for giving me opportunity to study here. Writing this master thesis has been very challenging and demanding, but going through that process allowed me to develop some of my professional and personal skills, which will surely help me in the future.

I want to thank the elderly participants who agreed to spend their time and help me to conduct this research. Their contribution is priceless. I hope that the results of our collaboration will help to improve the accessibility and usability of MOOCs for them.

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In the end, I want to say that nothing will be possible if it wasn't for my parents. They are my constant inspiration throughout my life.

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List of abbreviations

ICT – Information and communication technology

IT – Information Technology

LMS – Learning Management System

MOOC – Massive open online courses

NESH – The National Committee for Research Ethics in the Social Sciences and the Humanities

NN/g – The Nielsen Norman Group

W3C – The World Wide Web Consortium

WAI – Web Accessibility Initiative

WCAG 2.0 – Web Content Accessibility Guidelines 2.0

QRCA – Qualitative Research Consultants Association

1. INTRODUCTION

In modern era, it's hard to imagine our lives without information and communication technologies, which constantly improves the quality of our everyday living and bring us a variety of new opportunities. The Internet gives us immediate access to millions of terabytes of data, opens new possibilities in every field and area, one of which is education. Getting education online is becoming more and more popular every day. One type of the currently popular online education sources is Massive Open Online Courses (MOOCs), which are free educational courses with an opportunity for everyone across the globe to join (McCartney, 2015). MOOCs are available through online platforms (websites) and basically, it is relatively new type of e-learning and distance education (Sanderson et al, 2016). Its idea closely related with a concept of lifelong learning, which, in its turn, based on idea of opportunity to learn not only at a certain age in schools or universities, but also during whole life in informal ways (Steffens, 2015). Of course, a wealth of knowledge and entertainment is only valuable if it can be accessed by its target users. MOOC can bring an opportunity to get higher education for people with different functional disabilities, but to make it possible and make education accessible universal design principles should be used in the process of MOOCs development (Sanderson et al, 2016).

The MOOC target group is very extensive; millions of different people all around the world use MOOC platforms and MOOC courses with different goals and purposes (Nawrot & Doucet, 2014). According to Sandra Sanchez-Gordon and Sergio Luján-Mora (2013) lifelong learning and e-learning in particular can be very beneficial for seniors and brings an opportunity of better integration with the rest of society. On the other hand, Trocchia and Janda (2000) consider seniors as an important and one of the fast-growing parts of the Internet users. Unfortunately, elderly users face a variety of barriers, different accessibility and usability problems, when using technology to access Internet (Arch, 2009), a lot of them caused by age related issues. In addition to them, there was identified other barriers. For example, elderly have a lack of confidence due to a lack of experience (Lee, Chen, & Hewitt, 2011). It is possible to assume that this lack of experience and computer exposure means that elders have a limited knowledge of internet and computer jargon. In support to this, there are evidences that elderly miss the necessary information because of Web terminology misunderstanding (Slone, 2003).

In order to make the first step in understanding how to help senior and give them an opportunity to take full advantage of such courses and platforms, it is important to investigate, which particular barriers elderly face during MOOC usage. This thesis is aimed at identifying these problems with the end goal of improving MOOC courses content for the elderly community in context of universal design. A lot of different studies focused in MOOC were conducted; many researchers investigated the MOOC platforms and courses from different perspectives, for example, pedagogy, accessibility, data analysis, student activities (Sanderson et al, 2016). In 2013 Sanchez-Gordon and Luján-Mora conducted a research, which focus was MOOC accessibility for seniors. The researchers studied mostly the accessibility of MOOCs platform's framework, and evaluated it against Web Content Accessibility Guidelines 2.0 (WCAG 2.0) and WAI-AGE Project recommendations without participation of real elderly users. The results of their study showed that the Coursera platform and its courses contain accessibility barriers for seniors. It also stated the importance of further research process.

Another study, which raised the issue of MOOCs accessibility for elderly is Way Kiat Bong and Weiqin Chen research (2016). The researchers evaluated the "edX: DemoX.1 Demo Course", which is an introductory course for new users on the edX platform. They combined automated testing against WCAG 2.0 principles and user testing with six elderly participants. Unfortunately, none of the senior participants of the user testing manage to complete the introductory course. The results of the research show that tested introductory course holds a bunch of barriers for seniors. In the same year Liyanagunawardena and Williams (2016) presented an extensive review on the topic of seniors' engagement with MOOC courses.   Both works claimed that there is a lack of research in the area. They also emphasized the importance of further investigations and involving of real users to the testing process.

This thesis will not focus on the framework, but on the content of the MOOC courses. It intends to identify accessibility barriers that seniors face related to content, and which may not be covered by the guidelines and recommendations. While focusing on the content, the lack of confidence and experience will be addressed. Since understanding of elements and lingo/internet-jargon can be limited amongst elderly users, it is important to gain understanding of these obstacles in order to identify possible improvements.

Overall the purpose of current thesis is to explore which challenges elderly MOOC students faced in a

MOOC content, and to raise awareness of these challenges; to investigate which barriers in the MOOC content seniors face. In order to achieve this, qualitative research with several elderly participants will be conducted.

Collected data will be analysed through qualitative analysis methods. Based on it, a suite of conclusions about seniors' perception of MOOC content will be presented. Also, a set of recommendations for potential improvement of MOOC content presentation for elderly in context of universal design will be provided.

Since the thesis related to concepts of "seniors" and "elderly", it is very important to understand, who are "seniors" and "elderly". In the framework of this thesis, these words are going to be used interchangeably. The research group of this study narrowed down to retired seniors or elderly in the pre-retirement stage, since they have less opportunity to communicate with other people and, at the same time, want to spend their free time more active nowadays. According to Gardyn research (2000) retired seniors believe that continuation of education, learning and developing of new skills are important components of their retirement. So, the research will investigate seniors, who have retired or have reached the age close to retirement age.

Problem statement

As follows from the previous discussion, nowadays the MOOC courses could be very beneficial for elderly, especially, for those who retired and want to continue their education. Because of different accessibility and usability issues they can't take full advantage of MOOC. The thesis will investigate ICT barriers of MOOCs content for senior citizens, and their perception of it in context of Universal Design, by conducting the qualitative research (qualitative surveys, observations and interviews) with elderly users' participation.

Research questions

The research aims at contributing to the filling the gap in this research area, which is caused by the lack of the empirical studies. It seeks to identify and gain understanding of ICT barriers in MOOCs for elderly users. The thesis focuses on the content of MOOC courses.

Overall MOOC courses consist of different types of content. There are several: text, images, video, audio and combination of them. First, it is important to figure out what are the known barriers that

can be experienced with each of these types of MOOC content. It brings us to the first question:

RQ1: What known ICT barriers can be experienced with each type of MOOC content?

The answer for this question depends on the existing investigations and researches, and will be found through the theoretical part of the current study – the literature review.

As mentioned above, the elderly people have special needs within the availability and usability issues context. This means that special attention should be paid to barriers in the MOOC content within the confines of senior citizens. Consequently, second research question, which will be a part of future practical investigation, is:

RQ2: Which ICT barriers elderly users could face using MOOC?

Moreover, it is important to understand how these barriers affect seniors' perception of MOOC courses content. The concept of perception in this case includes preference, choice and attitude. Exploring seniors' perception of MOOC content will allow us to understand reasons and factors which influence their preference and choice. These findings will help us to get better insight into what plays crucial role for elderly people in the MOOCs content perception. This leads to third research question, which also will be a part of future practical investigation:

RQ3: How each MOOC content type is perceived by seniors?

The results should provide the insight into the accessibility and usability issues in MOOC courses content for seniors; describe seniors' perception of the different types of MOOC content; elaborate the conclusions and set of recommendations for potential improvement of MOOC content presentation for senior users in universal design context.

Outline of the thesis

The current Master Thesis is structured into seven chapters. Following the introduction, extensive literature review is presented in the second chapter. It describes in details the issues related to elderly users' engagement with Massive Open Online Courses and previous investigations of this topic. In chapter 3 "Methodology" the methodological aspects of the current thesis are presented. The chapter explains the methodological decisions made during research designing and describes, which methods and techniques were used to obtain the necessary data during the research. In chapter 4 "User testing

and interviews" the detailed research process is described. The chapter 5 "Results and analysis" provides main finding, that were discovered during the current research, as well as initial analysis of the data. In the next step, the results, presented in the previous chapter, were discussed in relation to literature review findings, provided in the chapter 2. The discussion including limitations of the study are presented in chapter 6. Chapter 7 "Conclusion and Future Work" emphases the main points, provides the thesis's conclusion and makes the recommendations for possible further research in the area of MOOCs.

2. LITERATURE REVIEW

In the following section of this research theoretical platform of this study will be presented. The literature review chapter represents the results of careful literature investigation on several topics. The section starts with explanation of "senior" and "elderly" concepts, continues with the information about Internet usage by elderly people and finally the reasons of ICT barriers, which seniors face, when interact with computer technologies and Internet will be presented. In the last part of this section the concept of MOOC described in more details, including MOOC content.

2.1. "Senior" and "elderly" concepts

There are a lot of different researches and sources with different estimations of who is considered as "senior" and "elderly", so it is important to define who is considered as "senior" and "elderly" within the framework of the current thesis.

In 2008 the World Wide Web Consortium (W3C)[1] conducted a literature review "Web Accessibility for Older Users", which is extensive and highly useful research in context of issues related to Internet usage by seniors. According to this review few sources stated that since life expectancy, health, and economic expectations have increased, 60 can be defined as the new retirement age from full-time work. One of the resources W3C also investigated, Word Health Organization (WHO) document 'Definition of an older or elderly person'[2], stated that "in most developed countries have accepted the chronological age of 65 years as a definition of 'elderly' or older person", but at the same time WHO states that "The United Nations has not adopted a standard criterion, but generally use 60+ years to refer to the older population".

As a part of the same review, W3C analysed research relevant to seniors' information technologies (IT) skills and age-related issues, which was conducted by the American Association of Retired Persons study (Redish & Chisnell 2004). They analysed previous studies (2000 – 2004) about usage of IT and the Internet by elderly and concluded that there are age-related issues for people from 50+ years (Redish & Chisnell 2004).

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1   https://www.w3.org/ - World Wide Web Consortium (W3C) website
2   http://www.who.int/healthinfo/survey/ageingdefnolder/en/ - Word Health Organization (WHO) document 'Definition of an older or elderly person'

According to above studies it can be concluded that in this issue a lot of different aspects matter, for example, differences in abilities, health issues, economic situation, attitude, education, and country of residence, especially when we talking about IT and Internet usage. In case of MOOC and life-long learning, opportunity to communicate with other people is also important parameter.   The research will be conducted with participation of elderly, who have retired or partially retired. In Norway admission rules, which have been introduced in January 2011, gives the opportunity to retire at age of 62 years old, if a person has enough earnings. From the age of 67 anybody can retire[3.]

2.2. Internet for elderly

A variety of studies, which focused on Internet in context of elderly users, were conducted. The researchers studied elderly users' engagement with the Internet from different angels, such as statistical researches of how many elderly people use Internet, seniors' attitude towards Web, accessibility and usability of the Web for elderly, barriers which seniors face during usage of the Internet, and other. Livingstone et al (2005) (sited in Karahasanović et al, 2009) stated that people in different age use the Internet differently. They also provided statistical information from United Kingdom which shows that 52% of people aged 55–64 use Internet, but only 15% of those, who over 65 years use it (Livingstone, Van Couvering & Thumim, 2005). Morris et al (2006) showed even worse numbers. They claimed that approximately 25% of people 55-64 years old use the Internet, and only one in nine people in category 65–74 years old use it.

According to Karahasanović et al (2009) there is the similar situation in most European countries. For example, Heim & Brandtzæg (2007) investigated that in Norway, Austria and Germany most of people who aren't using Internet and IT are 45 years and older. Another example was published in Karahasanović et al (2009). It stated that in Belgium 76% of people from 65 to 74 have never used the Internet.

2.2.1 Elderly users' exclusion

Based on all researches and information mentioned above, we can clearly see that elderly people are much less likely to use the Internet than younger people. Consequently, they do not get all the benefits and opportunities that the Internet brings to our lives. So, it becomes a source of inequality in

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3   Rett til pensjon fra Norge (Entitled to a pension from Norway) – http://www.norden.org/no/hallo-norden/norge/pensjon-fra-norge/pensjon-fra-norge

modern society.   Research of Morris et al (2006) confirms the "existence of a digital divide with age" and a fact that many senior citizens losing the benefits provided by IT and Web because of it.

Based on Valentine et al (2002), Dickinson et al (2005) concluded that inappropriate technologies strongly increase social exclusion. Also, Dickinson et al (2005) stated the importance of overcoming this exclusion. He offered to involve senior citizens in the development process of technologies as well as provide examples of suitable technologies for them.

2.2.2 What are the issues causing this situation?

In order to develop and provide suitable technologies for seniors, first of all, it is important to gather information about barriers, which elderly users could face using Internet and computer devices. The literature has shown that seniors, who use the Internet and computer technologies, tend to experience a lot of difficulties, related to their age. The research also showed that nowadays most of elderly users has a lack of experience with ICT and Internet, which, in its turn, creates a lack of confidence. Consequently, the elderly people face a number of barriers, related to these issues. As a result, the seniors could show a negative attitude towards ICT and Internet in particular. The factors, such as unfamiliarity with Web terminology and Internet jargon and difficulties with foreign languages, are also negatively influencing elderly user experience. Let's look on these issues in more details.

Age related issues

Arch et al. (2009) mentioned issues, that elderly people experience, such as reduced vision or/and hearing, reduced motor skills and some cognitive problems. Also, many issues arise during their e-learning process such, for example, disability to fully utilize web pages or to adequately perceive the information on website. Additionally, sometimes elderly users could not have a possibility to access video and audio materials, especially, if alternatives, such as alternative text, captions and subtitles, are not provided. The users' deficiency with motor skills can affect their ability to use a mouse, keyboard or other computer devices, which, as a result, can influence their ability to navigate through the websites. Also, the author mentioned cognitive issues, memory declination and another challenge, which influence the Internet usage for elderly people (Arch et al., 2009).

W3C literature review "Web Accessibility for Older Users" adheres to similar opinion. It states that a lot of seniors have age-related issues, which could influence their Internet experience. Issues related to vision, for instance, reduced contrast sensitivity and colour perception, make it difficult or even not

possible to read the text on a web page. Issues with physical abilities, for example, reduced dexterity and motor control, make it difficult or even not possible to use a computer mouse or touchpad and click relatively small targets. Hearing issues, for instance, hearing higher-pitched sounds or separating sounds, make it difficult to hear podcasts and other audio materials, especially, when there is some background music in the audio track. Cognitive ability, such as reduced short-term memory, difficulty concentrating, and being easily distracted, make it difficult to follow the information, navigate and complete different online tasks. All these issues negatively influence elderly user experience and make in difficult for elderly to take full advantage of the Internet and ICT.

The issues related to lack of experience

Some researches hold the view, that there are other barriers for elderly people, which are not related to age issues and caused by such factors as lack of experience and confidence, and, as a result, negative attitude towards ICT and Internet in particular. For example, Lee et al (2011) investigated, that elderly people have a lack of confidence, while using Web and information technologies (IT), due to a lack of their experience with it. Evidently it becomes a barrier for elderly people. Karahasanović et al (2009) states that barriers, which seniors face in ICT usage, are more depended on their attitude towards a technology and their experience with it, than with physical abilities.   Among others they refer to Eastman & Iyer research (2004) which claimed that for seniors' previous experience and attitude play significant role in their IT skills development.

According to Dickinson et al (2005) senior citizens more often are inexperienced computer users, then younger people. This leads to the fact that they tend to have negative experiences with computer technologies, which can be a reason of computer anxiety. Also, Gilly & Zeithmal (1985) (sited in Karahasanović et al, 2009) conducted the research which was focused on the usage of the new media by elderly people. The results suggested that usually seniors resist changes in their lives, and using the Internet and ICT brings a lot of changes in our everyday routine.

The issues related to foreign languages

The language issue is very important in the context of Web accessibility generally and accessibility of learning platforms in particular. It could be a problem to access a resource in foreign language, especially, if we speaking about senior citizens. This statement is supported by Onwuegbuzie et al. research (1999), which showed that seniors have high level of anxiety to foreign languages. According

to Van der Hoeven and De Bot (2012), who investigated the learning process of new French word and relearning forgotten words, elderly age group showed significantly lower results in learning new words, than younger group. Base on the above statements, it can be concluded that foreign language could be a possible barrier for seniors who use Internet.

2.2.3 Benefits for elderly

Although the elderly face many different barriers while using Web, they are one of the most rapidly growing segments of new Internet users (Schofield, 1999). According to Eastman & Iyer (2004), in comparison to 1940s, most of retired people can live much longer (average 15-20) because of new medicine improvements. They can be more active and have better health in general. Moreover, nowadays retired people want to spend their free time more active. They want to learn new things and develop new skills. According to Gardyn research (2000) 37% of its participants said that they want to continue their education, because they consider it as an important component of the retirement. In this context, it is important to mention that according to Koustriava & Papadopoulos (2014), the elderly people tend to have more positive attitudes towards distance education compared with younger people, mostly because of firmer motivation, and no need of peer interaction. Based on this, it can be concluded, that seniors fit perfectly to the target group of MOOCs courses and can appreciate their benefits and advantages. The Liyanagunawardena T.R. and Williams S.A. review (2016) showed, that considerable number of elderly users is already participating in Massive Open Online Courses. In the light of the above and since the number of elderly, who use the Internet is growing very fast, it is possible to assume that elderly will take a significant part among MOOC users.

Mentioned above factors show, that in its turn e-learning, and MOOCs in particular, can be very beneficial for elderly, especially for those, who retired. It brings them an opportunity to learn new stuff and develop new skills. Moreover, the opportunity to study through MOOCs is independent of location or financial capability. All that they need are computer and Internet connection.

It is important to mention, that Eastman & Iyer (2004) claimed that the largest issue of the elderly people is loneliness. Their social isolation is also a big problem, and it can be associated with ageing (Dickinson et al, 2005).   In this context, Eastman & Iyer (2004) stated, that seniors can get many benefits and opportunities from the Internet usage. The e-learning and MOOCs could be beneficial for seniors in the case of loneliness and social isolation, since it can bring an opportunity of better

integration with the rest of society (Sandra Sanchez-Gordon and Sergio Luján-Mora, 2013). The MOOC courses also include different interactive parts, such as forums, which help to communicate with students and teaching assistants (Yang, 2014). The Eastman & Iyer research (2004) stated that different activities through the Internet can be also beneficial for people with limited mobility, including elderly. The examples of these activities can be personal communication, entertainment and information. In addition, Eastman & Iyer (2004) mentioned that elderly can increase their mental abilities and get "a psychological boost" from the Internet usage. The result of a research showed that familiarization with computers has a positive influence on seniors' well-being (Dickinson et al, 2005).

It is also important to say that one research that estimated universally designed sites found out that websites which were designed for elderly/disabled users in mind showed that the efficiency over all age groups increased, and less entry errors were made (Johnson & Kent, 2007). So, we can conclude that adaptation of web pages for elderly people could be useful and beneficial not only for them, but for all users.

2.2.4 Suggested solutions

Morris et al (2006) also indicated similar to listed above reasons, why senior citizens do not use Web and IT more often. The authors also provided few practical suggestions, how to improve this situation. The researchers proposed to increase elderly people' awareness about IT systems, computers, and Internet, in order to change their misconception about it. They underlined the importance of raising senior citizens' awareness, about practical use of these technologies, its benefits and conveniences. The results of the study showed, that training and courses are very important for elderly people in this situation. Furthermore, these training and courses should be adapted for people with low IT skills (or without any IT skills at all), and with "high levels of computer anxiety" (Morris et al, 2006). Based on the last statement, it can be assumed that all learning courses should be adapted for people with low IT skills and high levels of computer anxiety to become understandable and accessible for them.

In the case of the MOOC courses the lack of experience issue problem could probably be solved by providing the tutorials and information about how to use the MOOC and specific features. This recommendation has been mentioned in Bong W.K. and Chen W. (2016): "The tutorial for specific assignment should be placed at the respective course itself to provide context-sensitive help. The users should be able to access the tutorial when they need it, and not during the demo course as the

course content might not be usable to them".

Despite the advantages of MOOC usage for seniors there are some researches, which stated another opinion on this issue. For example, Dickinson & Gregor (2006) research claimed that the evidence supporting benefits of internet usage for elderly is inaccurate and based on perceptions about concept of "well-being." They noted that many elderlies could not retain information and will require assistance all the time. They also suggest that higher social activity may be a predictor of computer usage, in contrast to the statement made in many studies. They found that most elderly in one training session had not desire to own or use a computer after taking a training course (Dickinson & Gregor, 2006).

In another large survey, it was indicated that seniors would rather have conversations in person, because of issues associated with typing (Lee, Chen, & Hewitt, 2011). And Dickinson & Gregor (2006) research also suggested that there were minimum or no benefits of Internet usage for elderly, and concluded that sometimes there are even negative effects with social interactions in general, when elderly users would be reminded of the inequality and their separation from own families (Dickinson & Gregor, 2006).

Even though some of the researchers expressed negative opinion on the issue of Internet usage by elderly citizens, still the majority of the sources and researches stated that there is strong usefulness and benefit of the Internet and ICT for elderly citizens (Eastman & Iyer, 2004; Sandra Sanchez-Gordon and Sergio Luján-Mora, 2013; Dickinson et al, 2005 and others). Another important argument, that was mentioned above, is that retired people want to continue their education after retirement, expand their knowledge and develop new skills (Gardyn, 2000); and moreover, they have positive attitudes towards distance education (Koustriava & Papadopoulos, 2014), that allows them to take advantage of different online learning platforms, including MOOCs. So, as was mentioned before, e-learning, and MOOCs in particular, is one of the examples of information and communication technologies, which can be really beneficial for seniors.

2.3 Massive Open Online Courses

Let's look at MOOCs in more details. As was mentioned before, Massive Open Online Courses (MOOC) are educational courses, available through online platforms (websites). These platforms give an opportunity for everyone to join the educational courses through the Internet. MOOCs are free and

can have a theoretically unlimited number of registrants (McCartney, 2015). According to Sandra Sanchez-Gordon and Sergio Luján-Mora (2013) it is very beneficial for seniors and can improve quality of their leisure time by providing a lifelong learning opportunity. One of the biggest advantages of MOOC courses is: "unique learning opportunities for underprivileged people, including people with disabilities, elderly and people who live in countries with low infrastructure" (Sanderson et al, 2016).

Basically, MOOC is a new kind of distance education and e-learning (Sanderson et al, 2016). According to Masters (2011), its evolution has gone through several stages. On the first stage, typical for the 1980s and early 1990s, it was simply traditional lecture material which teacher posted into online environment (it could be online server or repository); only registered students had access to educational material. On the second stage, used mostly in 1990s, teacher started to use Virtual Learning Environment or Learning Management System (LMS), which could be externally-developed or home-grown. They also could use external web sites. In addition to traditional lectures, the chat rooms, discussion forums and wikis appeared on this stage. On the third stage LMS became more centralized and tools such as discussion forums, chat rooms, wikis, blogs, quizzes and interaction part of the course became more important. Overall "Web 2.0" tools became more important. On this stage material could be seen by non-registered students. Finally, Masters (2011) stated that MOOC is a fourth stage in this evolution of online education.

The first MOOCs have appeared relatively recently in 2008. It was called Connectivism and Connective Knowledge (in short – CCK08) and was run by George Siemens (Athabasca University, Athabasca, Alberta) and Stephen Downes (National Research Council, Ottawa, Ontario) from Canada (Masters, 2011). The course had 25 students from Extended Education at the University of Manitoba, who paid for tuition and more than 2200 students from the general public, who studied online for free[4]. Thereafter the education moves towards MOOC direction incredibly fast and number of courses increases daily. Today there are a lot of different MOOC platforms, such as Coursera, Udacity, edX, Desire2Learn, Canvas, and Future-Learn (Sanderson et al, 2016). In 2015 all MOOCs platforms together had more than 500 partners-universities, offered more than 4200 courses, and had more than 35 million students[5].

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4   Mooc creators criticise courses' lack of creativity – https://www.timeshighereducation.com/news/mooc-creators-criticise-courses-lack-of-creativity/2008180.article
5   By The Numbers: MOOCS in 2015 – https://www.class-central.com/report/moocs-2015-stats/

Usually the researchers distinguish two types of MOOC: cMOOCs and xMOOCs. cMOOC is a type of courses which based on connectivist principal (Phan et al, 2016). cMOOCs don't have basis on any educational institution, and consist of participant-driven content typically produced by social media users. xMOOC is most common type of MOOC which is closer to usual university course. This research will be focused on xMOOC, because it has structured and constant learning material. However, according to Pursel et al (2016) this classification of MOOCs are probably simplified, and it is hard to clearly distinguish the boundaries between cMOOCs and xMOOCs, since a lot of MOOCs contain elements of both types.

The MOOCs platforms provide courses on a huge variety of diverse topics. For example, Coursera has 144 partners across 28 countries and offers around 1896 different courses (and its number grows literally every day). Its courses related to arts and humanities, business and computer science, data science and life sciences, maths and logic, personal development and physical science, engineering and social sciences, and language learning[6]. Although, according to Masters (2011), MOOC courses' applicability is not tested in many different fields, for example, medical education. He also claimed that in some areas MOOC could be not so beneficial and useful. At the same time Masters (2011) stated: "medical educators should look closely at the concept of a MOOC, so that MOOCs can be properly understood and used in such a way so as to have a positive impact on medical education."

Even though most of the MOOC courses have completely free access, some platforms have "premium" services. The most popular of them is certification. It means that users must pay, if they want to receive documented approval that they have finished the course. The platforms such Coursera, Udacity, edX, and Udemy have certification fee. Coursera also has other "premium" services, for example, secure assessments, human tutoring. Udacity provides "premium" services like job match services, creating students' resumes. Some of them designed for the users, and some for teachers who want provide own course (Yuan & Powell, 2013).

According to Sanderson et al (2016) a MOOC-committee appointed by the Norwegian government stated MOOC can bring an opportunity to get higher education for people with various disabilities, but in order to make education accessible universal design principles should be addressed in the MOOCs design and development.

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6   Hundreds of Specializations and courses in business, computer science, data science, and more –
     https://en.coursera.org/browse?languages=en

2.3.1 Investigations of MOOCs

Since popularity of MOOCs has been increased, many researches started to investigate MOOC platforms and courses from different angles (Sanderson et al, 2016). The Sanderson et al (2016) summed up that MOOC courses have been studied from many different perspectives, for example, pedagogy, accessibility, data analysis, student activities; the Sanderson et al study (2016) focused of accessibility of the MOOC platform from instructors' perspectives. Some researchers focused on the MOOC platforms. MOOC platforms such as Udacity, Coursera, edX, OpenCourseWorld and Iversit were evaluated based on observation of blind users. UNEDCOMA and UAb iMOOC were also evaluated; unfortunately results showed that none of them are fully accessible and understandable to the users (Sanderson et al, 2016).

Several studied were focused on MOOC courses, rather than MOOC platforms. For example, Coursera courses were evaluated from the angel of users with screen readers and experts. Geo-MOOC courses were tested with three automated tools. All the researches and tests showed that there are some accessibility issues with each of courses mentioned above (Sanderson et al, 2016). Still, according to Masters (2011), there are a lot of different angle, in which MOOCs should be investigated in the future, especially because nowadays MOOCs are used a lot and permanently.

Sanchez-Gordon and Luján-Mora conducted research (2013) to ascertain, which accessibility challenges elderly MOOC students faced, and to raise awareness of these challenges. They focused on the framework (particularly, home pages of courses, evaluation sections and discussion forums) of 5 Coursera courses and tried to identify barriers by using manual evaluation based on WCAG 2.0 principles and WAI-AGE Project recommendations. The results of their study showed that the Coursera platform and its courses contain accessibility barriers for seniors. For example, the authors found that it's not possible to resize check-boxes and radio-buttons, some of the links don't change colours after clicking on them etc. The researchers conclude that MOOCs accessibility issues should be further investigated. They also stated the importance of further investigation in this area and including elderly users to the future research process.

In 2016 Bong W.K. and Chen W. study investigated accessibility of "edX: DemoX.1 Demo Course" for elderly users, by performing the automated testing (using WCAG 2 principles) and conducting the user testing with 6 seniors in total. The research showed accessibility barriers for elderly users in the

introductory course and claimed the importance of further investigations of that topic, particularly involving real users and including bigger quantity of elderly participants as well as testing more courses and platforms.

In 2016 Liyanagunawardena T.R. and Williams S.A. conducted the review on elderly learners' engagement with MOOCs. The results of this review showed that considerable number of elderly people are already taking some Massive Open Online Courses. The same as Sanchez-Gordon and Luján-Mora (2013) and Bong W.K. and Chen W (2016), Liyanagunawardena T.R. and Williams S.A. (2016) also emphasize a lack of research in this area. "We hope this assertion of the wide gap in research on elderly learners in MOOCs will pave the way for more research in this area" (Liyanagunawardena T.R. and Williams S.A., 2016). In the review, they also mentioned that question about the topics, which would be interesting to seniors, has been not well studied, however the researchers claimed that there is a possibility that certain topics will arouse interest of elderly learners.

2.3.2 MOOC content

MOOC courses use different advantages of both types of education: traditional and online education. Though the concept of MOOC courses takes advantages of the new technologies that allows to have far more interactivities and better delivery of the content, then in case of traditional education methods (Altbach, 2014). MOOCs consist of different type of studying material. MOOC has more traditional course materials such as readings, lectures, different kinds of assignments, and problem sets. It also has videos, audio, images and interactive user forums which help to communicate with students and teaching assistants (Yang, 2014).

According to Guo P. J. et al (2014) among others types of content, videos is playing very important role for learning experience in the most MOOC courses provided by the platforms, such as Coursera, edX, and Udacity; during MOOC education process students spent a lot of their time watching videos. There are different types of video materials used in MOOC courses: classroom lecture, "talking head" shot of an instructor at a desk, digital tablet drawing format, and PowerPoint slide presentations (Guo et al, 2014). "These online courses are mostly organized as sequences of instructor-produced videos interspersed with other resources such as assessment problems and interactive demos." (Guo et al, 2014). This means that special attention should be paid to accessibility and comprehensibility of the video material of MOOC courses, its content and navigation mechanisms. Although, there are no

evidence that elderly users also prefer video material or use it with the same frequency as users in general. Also, despite all the advantages, it was investigated that a lot of MOOC students, who mostly used video materials tent to skip important part of courses such as assessment problems, discussions as well as various other interactive components (Guo et al, 2014).

2.3.3 Investigations of users' engagement with MOOC content

There are little research investigating the users' engagement with different types of the MOOC content. Most of the found studies are focused on motivation of the students, for example, Pursel et al (2016) investigated the variables of motivation and behaviour to better understand them and evaluate their influence on MOOC completion. Another study (Phan et al, 2016) investigated the influence of patterns of the students' participation (for example, active engagement), the motivation and background knowledge on their performance in MOOCs.

According to Guo et al (2014), their research was the first study, which investigated how the video presentation and other features affect student engagement in educational videos, particularly MOOC videos. Besides the videos types of presentation formats categorization, the researchers presented the valuable for MOOC authors findings. For example, they stated, that "video length was by far the most significant indicator of engagement" and "shortest videos (0–3 minutes) had the highest engagement and much less variance than all other groups" (Guo et al, 2014). They also found out that some types of video presentation are more engaging, than other. For instance: "informal talking-head videos are more engaging, that Khan-style tablet drawings are more engaging, that even high-quality pre-recorded classroom lectures might not make for engaging online videos, and that students engage differently with lecture and tutorial videos" (Guo et al, 2014).

In terms of Universal Design, the understandability and coherence is very important for all types of the MOOC content. In this context, another issue comes up. The Web terminology and jargon occur on the different web pages and services, including MOOCs. As was mentioned before, Slone (2003) provide information that most of the inexperienced users in different age, including elderly, miss the necessary data or information, because of the lack of understanding of the Web terminology. Dickinson et al (2005) confirmed this statement and claimed that inexperienced users tend to have difficulty with computer and Internet terminology; it makes another barrier for seniors, who, as was mentioned before, more often are inexperienced computer users. Dickinson et al (2005) also stated that in

context of accessibility the used terminology should be understandable and coherent for user group. Since seniors are part of MOOC courses target group, then it can be concluded that used language should be understandable and coherent for them, in order to be universally for all users.

Zaphiris et al (2007) stated that elderly Internet users can have a low understanding of complex language. Also, Hill et al, 2008 stated that elderly people tend to have difficulties with understanding and coherence of technical jargon, which makes perception of the Web and IT technologies as technically complicated and complex. Based on these statements, it can be concluded that special attention also should be paid to simplicity and comprehensibility the language used in MOOCs navigation and learning materials.

The Slone research (2003) also stated that people over 50 years usually have more problems related to syntax and search results understanding than younger users. They usually made more errors related to syntax. It is also important that, according to Slone (2003), senior citizens usually had less understanding of Boolean logic, which is often used in different educational courses. Additionally, elderly usually used less complicated tools, than younger people with similar experience did (Slone, 2003).

According to Bong W.K. and Chen W. research (2016) there is another issue related to the text MOOC content could be expected. The results of their research showed that some text pieces were too technical for the seniors. The participants seem to prefer video materials and quizzes.

There is another issue which can reduce the understanding and coherence of MOOC courses' content. It is the foreign language issue. As was mentioned before, elderly people demonstrate high level of anxiety to foreign language and experience difficulties in learning new languages. The fact is that, according to Altbach (2014), the biggest part of MOOCs courses is American or from other Western countries, so most of the courses' content is in English. In 2014 80% of all MOOC courses were in English, although in 2015 this percentage decreased to 75%[7]. So it could be an accessibility issue for non-English speakers.

Nevertheless, there are courses in other languages at the big platforms, such as Coursera, which offers courses in 16 different languages. A lot of courses are in Spanish and French[8]. Also, there are more

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7   By The Numbers: MOOCS in 2015 – https://www.class-central.com/report/moocs-2015-stats/
8   By The Numbers: MOOCS in 2015 – https://www.class-central.com/report/moocs-2015-stats/

local MOOC platforms in different languages, for example, Russian Universarium (orig. Универсариум), Eduson and Uniweb consequently in Russian[9]. In Norway, there is "mooc.no" – the MOOC platform which provides MOOC courses run by Norwegian universities and colleges, a lot of them in Norwegian[10]. Also, there is "FUN" – French MOOC platform with courses offered in French, supported by French government[11]. Still non-English courses cover only 25% of MOOCs available online.

There is limited research related to users' interaction with the MOOC discussion forums. Bong W.K. and Chen W. (2016) investigated, that elderly users do not consider the discussion as important part of the MOOC courses. The researchers provided few possible reasons for these results. They correlated it with the fact that seniors are not active users of the social media websites and elderly people desire to keep their activities at educational websites private. The researchers also assumed that: "It is likely that they did not fully understand the purpose of the discussion; therefore, they did not see the importance of it in the course" (Bong and Chen, 2016).

The issues of elderly users' interaction with the MOOC quizzes was not sufficiently investigated. The results of Sandra Sanchez-Gordon and Sergio Luján-Mora research (2013) showed that tested during their research MOOC course contained the accessibility issues related to the quiz in the course. More specifically, the researchers investigated, that it was not possible to change a size of radio-buttons and check-boxes in the quiz. The authors of the research also concluded that indicated accessibility issues need a further investigation. One more issue related to the quizzes was identified by Bong W.K. and Chen W. (2016). They found out that a multiple-choice question had two right answers instead of one. The authors stated that this situation "caused confusion to the elderly participants".

2.4 Universal Design: accessibility and usability

The current thesis investigating the elderly users' engagement with MOOC content in context of universal design, so it is important to understand the meaning of the concept. According to The World Wide Web Consortium (W3C)'s Web Accessibility Initiative (WAI) website[12], the concepts of accessibility, usability, and universal design are closely related. The information on the website also

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9 Исследование русскоязычных МООС-платформ от Центра образовательных разработок бизнес-школы СКОЛКОВО (The research of Russian Mooc platforms from Moscow School of Management SKOLKOVO) – http://www.skolkovo.ru/public/ru/research/news-research/item/4057-2014-03-20-rusonline/
10 Om mooc.no (About mooc.no) – http://www.mooc.no/om/
11 About FUN - FUN-MOOC – https://www.fun-mooc.fr/about
12 https://www.w3.org/WAI/intro/usable – The World Wide Web Consortium (W3C)'s Web Accessibility Initiative (WAI) website

states that when the authors design and develop websites or applications, it is most effective to address these concepts together.

The definition of the Universal Design, provided by W3C says:

> "Universal design, and design for all involves designing products, such as websites, to be **usable** by everyone to the greatest extent possible, without the need for adaptation. Inclusion addresses a broad range of issues including **access** to and quality of hardware, software, and Internet connectivity; computer literacy and skills; economic situation; education; geographic location; and language — as well as age and disability." (The World Wide Web Consortium and Web Accessibility Initiative website)

So, the concept of universal design overlap the concept of **usability**.

Although usually the accessibility addressing the needs of users with disabilities, according to the website, it could be also beneficial in case of users with low literacy or users, who are not fluent in the language, people with low bandwidth connections or using older technologies, new and infrequent users and mobile users. Since the people with disabilities are generally included in the scope of universal design, so the universal design also overlap the concept of **accessibility**.

Considering the information above, in order to investigate users' engagement with MOOCs in context of Universal Design, both accessibility and usability types of issues should be addressed.

2.5 Summary

Overall, after careful investigation through the literature related to Massive Open Online Courses, it can be concluded that despite the existence of the variety conducted researches, related to different aspects of the MOOC courses, the issue of MOOC content accessibility, perception, and comprehensibility was not sufficiently investigated. Also, this issue was not addressed in the context of the elderly users, who are valuable segment of MOOCs target group.

It was investigated that aside from age related issues, seniors face other barriers during their usage of Internet and ICT. They have a lack of confidence, lack of experience, possible foreign language barrier, lack of understanding of computer terminology and jargon. These issues can influence elderly usage of MOOC courses. It also can be assumed that there are other, unexpected accessibility and usability

barriers in the MOOC courses content for elderly citizens, which can appear during MOOCs user testing with real senior participants. The elderly preferences of MOOC content type and possible barriers in MOOC content for senior are not identified. All these issues will be further addressed in current thesis, to provide the insight into them, with the end goal of improving Massive Open Online Courses content accessibility and usability for the senior community.

3. METHODOLOGY

In the following section of this research methodological platform of this study will be presented. The methodology chapter represents an overview on methodological assumptions, underlying the thesis and describes, which methods and techniques were used to obtain all the necessary data during the current research. The section starts with explanation of research design, continues with description of research approach chosen for this study together with data collection methods, finally data analysis methods and quality of the research discussion presented. In the last part of this section special attention is given to the ethical considerations as they also play very important role in the research process.

3.1 Research design

The purpose of the research design is organizing activities within the research, for example, data collection. The choosing of the type of the research design depends on the aims of the research (Easterby-Smith, 2008). There are different types of research design: explorative, descriptive and causal (Gummesson, 2000). In the case of the current thesis the explorative design suits better, since it is a "valuable means of finding out 'what is happening; to seek new insights; to ask questions and to assess phenomena in a new light" (Saunders et al., 2009, p.139). Also, Saunders et al. (2009) states that explorative study is useful in case if the researcher want to clarify the understanding of a problem, in our case – understanding on elderly users' engagement with MOOC content in context of Universal Design and elderly users' perception on MOOC content. Usually explorative design includes: investigating the literature and interview with "experts" in the subject (Saunders et al., 2009). In case of accessibility and usability issues, users are the "experts" of the studied issue.

But literature review is not something what you do only before the writing process. It should be an ongoing process. Thus, reviewing the literature was an important process of continuous acquisition of needed data throughout the whole research.

3.2 Understanding the philosophy of science

While reviewing the literature, it is necessary to take into consideration general philosophical issues and to define your philosophical position. It contributes in clarifying the research design. There are

three major epistemological approaches to the social science research: positivism, relativism and social constructivism. The most suitable approach for this research is social constructivism, "because it focuses on the ways that people make sense of the world, though sharing experience with others via the medium of language" (Easterby-Smith, 2008, p.58). The main premise of this paradigm consists in the idea that "'reality' is determined by people rather than by objective and external factors…researcher should appreciate the different constructions and meanings that people place upon their experience." (Easterby-Smith, 2008, p.59). The following are implications of the social constructionism (Easterby-Smith, 2008):

- The observer is a part of what is being observed;

- Human interests are the main drivers of the science;

- Explanations aim to increase general understanding of the situation;

- Research progresses through gathering rich data from which ideas are induced;

- Concepts should incorporate stakeholder perspectives;

- Units of analysis may include the complexity of 'whole' situations;

- Generalization through theoretical abstractions;

- Sampling requires small number of cases chosen for specific reasons;

The current research rests upon main premise and implications. This approach could be referred as one of the interpretative research methods (Easterby-Smith, 2008). Thus, it could be argued, that within such approach main attention is centred on people's personal perception, their thoughts and interpretations. One of the main objectives of this research was to understand perception of elderly users of MOOC content which makes social constructivism a logical approach.

3.3 Qualitative approach

Next step of the research design was choosing the research approach. According to Nielsen Norman group article (Rohrer, 2014), qualitative research methods are more suitable in case, when the goal is answering for the question like "Why?" and "How to fix a problem?", and it is better to use quantitative research methods, when there is a need to answer questions such as "How many?" and

"How much?". Based on the initial goal and objectives of the current thesis the qualitative research approach was chosen.

The decision was also made, based on the following statements. "Qualitative research is an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem" (Creswell, 1998, p. 15). According to Creswell (1998) the researcher, who conducts the qualitative research, builds a holistic picture of the studied subject, analyses words, reports detailed views of participants, and conducts the research in a natural setting. Qualitative approach allows the researcher to collect data, that expressed though words and based on meanings (Saunders et al., 2009).

According to Mack et al (2005) the advantage of qualitative technique is that it gives the possibility to provide complex textual information about participants' experience of a researched subject. Qualitative approach describes the "human" side of an issue, which often may be represented as views, opinions, beliefs, emotions so on.

The overall objective of the current thesis is the investigation of accessibility and usability barriers of MOOCs content for elderly users, and their perception of this content. According to Qualitative Research Consultants Association (QRCA)[13] the use of qualitative methods is reasonable in the situations when the goal of the research is, inter alia: to investigate a product or service, its strengths and weaknesses; to explore demographic and customer groups, to study the usability of websites or other interactive products or services; to understand perceptions of a product.

Furthermore, the expected results of the research should provide the insight into the accessibility and usability of MOOCs content for seniors; describe seniors' perception of the different types of MOOC content; and elaborate the conclusions and set of recommendations for potential accessibility and usability improvement of MOOC content for senior users. According to QRCA qualitative approach will help to achieve these results, since it helps, for example, to understand the feelings, values, and perceptions, identify customer needs, generate ideas for product improvements.3.3 Data collection methodology.

There are various data collection techniques, which could be used in the qualitative research. For example, interviews, observation, documentary analysis and questionnaires. The use of a combination

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13   http://www.qrca.org/?page=whentouseqr – Qualitative Research Consultants Association (QRCA) website

of different qualitative methods seemed most appropriate, because it can create the opportunity to identify barriers from various angles. According to Lazar et al. (2010), the combination of interview with observation can help the researcher to understand the relation between participants' actions and words, and help to avoid the missing of some important data.

3.3.1 Literature Review and Documentary Analysis

The answer for the first question "What known accessibility issues can be experienced with each type of MOOC content?" depends on the existing investigations and researches, and will be found through theoretical part of current study – literature review. Critical review of literature is a crucial step in the research process. According to Hair et al. (2007) it can help in developing and expanding research ideas. Since needed information also can be found through reviewing the related websites it partially includes the documentary analysis to our methods. This type of the research involves data, which can be obtain through investigating of existing documents, without involving real users for conducting observation or interviews with them.

MOOCs have different types of studying material: more traditional course materials such as readings, lectures, different kinds of assignments, and videos, audio, images and interactive user forums (Yang, 2014). These types of materials are used not only at MOOCs, but also as part of other websites and technologies.   During the literature review of the current thesis the information about accessibility issues, which can be experienced with different types of MOOC content was found.

According to Guo, P. J. et al (2014) among others types of content, videos is playing very important role for learning experience in the most MOOC courses. According to W3C[14] the video without captions and transcripts can create an accessibility barrier for seniors. On the other hand, according to Sanchez-Gordon & Luján-Mora (2013) videos' captions and visual text can create visual dispersion and cognitive overload, which in its turn can be a reason of minor learning among people who need captions. The possible ageing issues can affect the ability to view a video or to hear an audio.

According to Slone (2003) Web terminology also can be a barrier for elderly, since they could miss the necessary data or information because of lack of understanding of it. This research also stated that people over 50 years usually have more problems related to syntax and search results understanding

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14 https://www.w3.org/WAI/intro/wcag – The World Wide Web Consortium website, information about Web Content Accessibility Guidelines

than younger users. Hill et al (2008) stated that senior users tent to have difficulties with understanding and coherence of technical jargon. Another barrier is the foreign language issue, since according to Altbach (2014), most of the MOOC content is in English and, according to Onwuegbuzie et al. (1999), seniors have high level of anxiety to foreign language.

More information has been presented in the literature review of the thesis. The results of literature review and documentary analysis will be discussed in the Discussion part of the thesis, and the conclusions will be presented in the Conclusion part.

3.3.2 Observation

In order to answer research question 2 "*Which type of the MOOC content holds most of accessibility barriers for seniors?*" and research question 3 "*How each MOOC content type is perceived by seniors?*" the observation of research participants, while utilizing a Demo course with various content will be performed. This type of the data collection can be useful, when it is important to investigate, what users do and how well they manage to do it under certain circumstances[15].

"Data obtained through participant observation serve as a check against participants' subjective reporting of what they believe and do" (Mack, 2005, p. 14). According to Mack (2005), due to different reasons, the behaviour of participants can often contradict with what they say. "Given the frequency of this very human inconsistency, observation can be a powerful check against what people report about themselves during interviews and focus groups" Mack (2005, p. 13)

There are different types of the observation. In our case, **participant observation** will be used. According to Saunders et al. (2009) participant observation is qualitative and derives from the work of social anthropology early in the twentieth century. Its emphasis is on discovering the meanings that people attach to their actions.

The researcher, which use the participant observation, should approach the participants in their common environment, rather than asking the participant to come to the researcher; it is important to make careful, objective notes about what you see (Mack, 2005). In the case of the current research, the notes will be taken and the screen recording of participants' actions will be performed.

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15 http://www.skillsyouneed.com/learn/dissertation-methodology.html - SkillsYouNeed web-service. Writing your Dissertation: Methodology

3.3.3 Interviews

Despite all the advantages of the observation methods, according to Lazar et al (2010) the observer can filter some information, which he or she don't expect and observe only these things or actions that he or she expect from the observed process. In this case, interview can help to find the issues that were not catched through observation process.

Qualitative interviewing is based on conversation, with the emphasis on researchers asking questions and listening, and respondents answering. There are three different types of the interviews: fully structured, semi-structured and unstructured (Lazar et al, 2010). Last two are often referred to as 'qualitative research interviews', while **fully structured interviews** referred as "quantitative research interviews" (King, 2004).

In **semi-structured interviews** the researcher will have a list of themes and questions to be covered, although these may vary from interview to interview. **Unstructured interviews** are informal. They are used to explore in depth a general area in which you are interested. There is no predetermined list of questions to work through, but you should understand clear idea about the aspect or aspects that you want to explore. There is an opportunity for interviewee to talk freely about events, behaviour and beliefs in relation to the topic area (Saunders et al., 2009). Despite all the advantages, the unstructured interviews require skilled interviewer with a previous experience. According to Doody and Noonan (2013) unstructured interviews are not suitable for the inexperienced researchers, who could ask the participants inappropriate questions, which, in its turn, could lead to biased results. The authors also mentioned that the participants of unstructured interviews could talk about irrelevant topics. It would make the coding and analysing the data difficult for the researcher.

On the other hand, the fully structured interviews are fairly inflexible. According to Mack (2005) during quantitative methods such as surveys and questionnaires or fully structured interview, researchers can ask all the participants fully identical questions in the same order and the response categories are "closed-ended" or fixed. "The advantage of this inflexibility is that it allows for meaningful comparison of responses across participants and study sites. However, it requires a thorough understanding of the important questions to ask, the best way to ask them, and the range of possible responses" (Mack, 2005, p. 3)

In the case of current thesis, both pretesting interviews and post-testing interviews will be semi-

structured, since this type of interview seems the most reasonable for the goals of the conducting research. Both pretesting interviews and post-testing interviews based on semi-structured interview questions (Appendix 2).

Pretesting interviews will help to gather information about users, their experience with computer technologies, Internet, their attitude towards e-learning and MOOCs, the issues they have experienced using the Internet. Post -interviews will give the opportunity to learn, how each type of MOOC content (i.e.: text, video, quizzes or discussions) perceived by elderly users and why; which type of MOOC video presentation format is more engaging for elderly. Particular attention will be paid to instances where users encounter problems. Participants in this portion of the study will be asked specific questions about problematic incidents that occur, in a follow-up interview. During the post interview, a critical component of the process will be to ask users not only to identify frustrations, but more importantly have them suggest an alternative, preferable design.

3.3.4. Choosing participants

Choosing participants for research is a very important step. Different factors, such as a level of familiarity with MOOCs or level of computer proficiency have the potential to skew or negate the results of the research. For example, during the observation part, users which have taken MOOC courses before would be expected to navigate through them much more easier and faster, then inexperienced user. And conversely, users that have little or no experience with MOOCs will pull results strongly in the opposite direction. Also, it can be assumed that the level of English proficiency will also influence the results.

The elderly participants of current research could have different level of experience using a computer, as well as their level of familiarity with MOOC courses can be different. In this case, it is expected that it will be possible to find accessibility and usability barriers, which new or less experienced users with low IT skills can face in MOOC content and barriers, which even more experienced users can face. The participants should be active people, who want to learn new stuff and improve themselves.

3.3 Data analysis

In the next step, all collected data were analysed through qualitative analysis method – content analysis. According to Lazar et al. (2010) the content analysis is a systematic technique which is used

for compressing data into fewer content categories by using explicit rules of coding; the data could be represented as text, audio or video files. Also, according to Lazar et al. (2010) this type of analysis is usually in-depth analysis, which can help to find theoretical interpretations, which in its turn could help to generate new knowledge. The technique, which is used to conduct content analysis, is "coding". It involves the interaction with data and making comparisons between data (Lazar et al., 2010).

3.4 Ethical considerations

When conducting research, it is necessary to consider several number of ethical issues. These considerations include people, who are participating in the research, research practice and how findings from the research would be used. There are guidelines established by The National Committee for Research Ethics in the Social Sciences and the Humanities (NESH) for how research should be conducted. Ethical issues will appear throughout the whole research process, thus it is of most importance to develop and maintain a good research practice, because it promotes ethical reflection and a better understanding of the ethical dilemmas. According to Ringdal (2001) there are three kinds of ethical concerns: those connected to the research process; those connected to privacy protection; and those related to the use of research results, including the researcher's social responsibility.

Ethical issues of design stage should be considered starting from data collection stage and through the analysis and reporting stages of the research process. Matthews & Ross (2010) stated that there are basic areas, which needs to be considered before we start the research. The ethical issues here especially relate to the choice of methods, in particular the privacy of the people, who will be affected by the research and the how we get access to them. This issue will be considered with the utmost respect in order to make sure this is handled in a best way possible. It is crucial to avoid subjective selectivity in the data collection stage, to make sure that the collected data is accurate and full. Researcher's perception of reality and understanding of it can affect research itself. This requires us to reflect on how this can influence the choice of topics, data sources and assessment of possible interpretations. Therefore, it is necessary to explain the choice of methods and analytical perspectives to minimize the influence of these unwanted factors.   There is also a matter of preventing the results of the research presented in a misleading manner, and making sure not to be selective regarding which data to report. Eventually, the research material from this study will be made available to other

researchers for verification and re-use.

The basic norm, concerning individual privacy, is that the researcher should work based on fundamental respect for human dignity (Ringdal, 2001). In NESH (2012) principals concerning the protection of people are defined. These are concerned with informed consent and confidentiality of informants. The basis of informed consent is making sure that the people who are going to take part in the research understand what they are agreeing to take part in (Matthews & Ross, 2010). People who are subject of research must all receive the information necessary to form a reasonable understanding of the research field, the consequences of participating in the research project and the purpose of the research. So, within the framework of this research it is necessary to make sure to receive full consent and deliver necessary information to the participants of this study. It is also important to mention that participation is voluntarily and that participants have the right to withdraw at any time during research. Confidentiality and anonymity is another important issue to consider. Informants have the right to choose whether their personal information could be available to other people, and that any information they provide about them will be treated confidentially. Information about identifiable individuals will be properly stored and the information will not be stored longer than is necessary to carry out the purpose of the research. Social research is in general value laden, which means that results and research questions have clear value laden implications (Ringdal, 2001). This means that social science can easily become a conflict of interest as the research could be utilized by particular interest or political actors. However, science should strive to be part neutral (Ringdal, 2001), as impartiality is an important aspect of doing scientific research. The topic of this research has not been influenced by any political or other types of external pressure.

3.5 Quality of research

Explorative research is such research type where it is difficult to estimate the level of quality. Many aspects should be taken into consideration. Even though there are a lot of criteria it is possible to highlight two, which could be considered as main ones: validity and reliability. The validity and reliability of qualitative data, to a great extent, depends on the methodological skills, sensitivity, and integrity of the researcher. It takes much more than just ask question in order to provide skillful interviewing (Patton, 1990). If collected data was not relevant to the topic or not accurate enough, that can hinder validity and reliability of the research and eventually make it useless.

3.5.1 Reliability of the research

"Reliability refers to the extent to which your data collection techniques or analysis procedures will yield consistent findings" (Easterby-Smith et al. 2008; cited in Saunders et al., 2009, p 156). That makes it necessary to be sure that needed information is reliable. Respondents which participated in this research are typical elderly users in the age group which varies from 60 years to 71, with various experience with computers. Even though they do not have any severe disabilities which could be considered as serious barrier for Internet usage. After interviewing respondents, all interviews were transcribed and sent back to the them, via e-mail for approval and then sent back. Some corrections were made.

All interviews were conducted during personal meeting which increased reliability of the received information through better engagement of the respondents in exploratory discussion. Issue of difficulty taking notes was eliminated by usage of voice recorder, which allowed to spend more time analysing answers without necessity of taking detailed notes. Project is supplied with quotations of the interviewees.

3.5.2 Validity of the research

"Validity is concerned with whether the findings are really about what they appear to be about" (Saunders et al., 2009, p.157). In this respect collected data is derived from feelings of elderly people, which do not require them to be specialist in any particular topic beforehand. There are several types of validity. In of the taxonomies validity is divided into two types: internal validity and external validity. Internal validity, which concerned whether or not what has been identified as the cause actually produces the effects (Johnson & Duberley, 2000), it is an important measure in quantitative studies, but not in qualitative. In respect to external validity, which is concerned with extent to which the research findings can be extrapolated beyond the immediate research sample (Johnson & Duberley, 2000), research concentrated on the case of elderly people with different backgrounds and experiences to cover as much as possible different representatives in this quite wide social group.

Right interpretation of the received information from the respondents could be considered as one of the crucial factors among others. Right interpretation was one of the most challenging tasks. While working with words, sometimes it is possible to use not the most appropriate words, which can lead the reader to misunderstanding. Thus, during research, the challenge of correct interpretation was

met taking into consideration that English is not a native language for both researcher and interviewees.

3.7 Summary

In this part of the research main methodological choices were presented, specified data collection methods and ethical considerations. Research design can be described as explorative. Qualitative approach was chosen for this research. Qualitative interviewing is a major source for obtaining data. In total, 14 semi-structured interviews were conducted, with 14 different respondents. In order to provide reliable research with high level of validity different techniques were used. Further analysing and reporting was a matter of looking on the received empirical findings through the 'prism' of elaborated theory, presented in the literature review section, and then logical presentation of the findings.

4. USER TESTING AND INTERVIEWS

In this chapter the practical details of the research are listed. Chapter is structured the following way: First, the information about consent form. Then where research took place and what equipment was used. Following part is about procedure itself – how participant chose courses and who tested what and tasks. In the final part of this section, post-testing interview process and participants background (including demographics aspects, course descriptions, content type descriptions and data analysis process) are presented.

4.1 The consent form

The observation and interviews involve real users to the research process. Before conducting the user testing and interviews parts, the potential participants should read and sign a consent form. According to Lazar J. et al (2010) the consent form should contain two obligatory part. First, it must provide clear, understandable purpose of the research and all important information about it (for example, potential risks) in comprehensive and accessible form. The reason of it is that participants should be able to make "truly meaningful decision" about their participation in the research.

The second obligatory part is the potential participant's agreement to take part in the research, in other words – consent. It should be voluntary and "free from any implied or implicit coercion" (Lazar et al, 2010, p. 381), and the person should clearly understand that he/she free to decide not to take part in the study, without any unpleasant consequences from researcher's side.

According to Lazar J. et al (2010) the consent form usually contains following several sections: title and purpose, description of procedures, duration of the process, potential risks, benefits of the participation, alternatives to the participation, information about confidentiality of the participation, participant's rights, contact information of the researchers and any supplemental information or other.

Based on the information above the consent from was written (see Appendix 1). Since the current research is part of the Master Thesis, the information about the supervisor, as the responsible person was also included in the consent form.

4.2 Setup of the user testing

Most of the sessions of the user testing (13 out of 14) were performed on the "Toshiba" laptop with Windows 10 as operating system, using "Google Chrome" browser to access the tested platforms and courses. The session with Participant 4 was performed on his own laptop "Lenovo" with Windows 7 as operating system using "Internet Explorer" browser to access the tested platforms and courses.

All the sessions of the user testing and interviews were conducted at participant's places, since it was more comfortable and conveniently for them. During all the sessions CamStudio[16] software was used to record screen activities.

4.3 Procedure

Unfortunately, due to limited amount of time, the participants were not able to test a lot of different courses. It was not also possible to go through a course from beginning to end, because of a timeline, which a user needs to finish the MOOC course. Some MOOC courses have a timeline of few weeks; some courses can take few months to finish. For example, according to the description the length of "The Art of Poetry" course from edX platform is 6 weeks, the length of "Shakespeare: On the Page and in Performance" from the same platform is 12 weeks; Intro to Descriptive Statistics from Udacity platform takes approximately 2 months. According to the Udacity website, the "Android Development for Beginners"[17] course can take approximately 4 weeks, and the "Intro to Java Programming" can take approximately 4 months. According to Stanford Continuing Studies[18] website, there are courses with a timeline of 6-10 weeks and 1-5 weeks. There are also workshops which can take from 1 to 4 days. Unfortunately, the current research has strict time limitations, since it is part of Master Thesis, consequently the participants' observation during long period would be challenging and demanding. However, the main reason, why the courses were not tested from start to end, is that none of the potential participants agreed to take part in a such long study for free.

Because of the same limitations it was not possible to test all 6 courses with all the 14 participants, since testing all 6 courses could take up to 6 hours and all the elderly participants agreed to only one test session. Thus, decision was made that each participant could choose 2 courses, based on their preferences and interests and go through a part of each course (few chosen steps of a course). Their

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16 http://camstudio.org/ - Free Streaming Video Software
17 https://www.udacity.com/course/android-development-for-beginners--ud837 - Udacity website, "Android Development for Beginners" course
18 http://continuingstudies.stanford.edu/ - Stanford Continuing Studies website

interest in the topic helps to eliminate negative attitude, which could arise in case the course wouldn't interesting for the participant. Consequently, it is make the result more reliable. The information of which course was chosen and tested by which participant are presented in table 1.

Table 4-1. The participants' choice of courses

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14
Course 1	yes		yes	yes					yes					yes
Course 2					yes		yes	yes	yes					yes
Course 3		yes	yes	yes		yes					yes		yes	
Course 4						yes				yes		yes	yes	
Course 5	yes	yes					yes							
Course 6					yes			yes		yes	yes	yes		

4.3.1. User testing process

During the testing process, the elderly participants went through the given tasks in each course, for instance: to finish a given number of steps in course, to watch videos, to operate the video player (to turn off/on subtitles and to change the speed of the video), to read text materials, to answer quizzes' questions and to participate into courses' discussions. The full set of tasks with more detailed description is listed in table 2.

Table 4-2. The list of tasks given to participants during user testing of the MOOC courses.

Course	Tasks
Coursera, "Dog Emotion and Cognition"	**(approximately 30 min)** *Please follow the course and:* *1. Watch the first video.* *1.1 During the first video: could you please make the video slower/faster?* *2. Watch the second video.* *2.1 During the second video: Could you please turn on/off subtitles?* *3. Answer two quiz questions after the second video.*
Udacity, "Intro to Descriptive Statistics"	**(approximately 25 min)** *Please follow the first lesson of the course and:*

	1. Watch the "Lauren's Intro Video". 2. Watch the next video "Believe results" and answer the question, which you will hear. 3. Watch the video "Measure Memory" and answer the following open question. 4. Watch the next two videos. 4.1. During the first video: Could you please turn on/off subtitles? 4.2. During the second video: Could you please make the video slower/faster? 5. Read the instructions and watch the following video.
edX, Birds 101: Introduction to Pet Birds	**(approximately 40 min)** Please follow the course and: 1. Watch the first video. 1.1 During the first video: could you please make the video slower/faster? 2. Answer the following 7 quiz questions. 3. Watch the second video. 3.1 During the second video: Could you please turn on/off subtitles? 3. Answer the following 22 quiz questions.
FutureLearn, Rome: a Virtual Tour of the Ancient City	**(approximately 40 min)** Please follow the course and: 1. Read the into information and try to participate in the following discussion. 2. Watch the video and read the text on the next step. 2.1 During the video: could you please make the video slower/faster? 3. Carefully read the instructions. 4. Read what's the next video is about 5. Watch the next video. 5.1 During the video: Could you please turn on/off subtitles? 6. Read the article.
edX, Shakespeare: On the Page and in Performance	**(approximately 35 min)** Please follow the Week 2 of the course and: 1. Watch the first two videos. 1.1 During the first video: could you please make the video slower/faster? 1.2 During the second video: Could you please turn on/off subtitles?

	3. Answer the 2 quiz questions. *3. Watch the following two video.* *4. Participate in the discussion.* *4.1 Think what is your associations with Romeo and Juliet?* *4.2 Post a comment to describe your thoughts. If you want to add a picture, feel free to look for it in Google*
edX, The Art of Poetry	**(approximately 25 min)** *Please follow the course and:* *1. Watch the videos and read the text under each of them.* *1.1 During the video: could you please make the video slower/faster?* *2. Read the following instructions.* *3. Answer 2 quiz questions.* *4. Watch the next video and read the text under it.* *4.1 1.2 During the video: Could you please turn on/off subtitles?* *5. Answer 2 quiz questions.* *6. Answer the question in the next quiz.*

As was mentioned before, the participants' interaction with the tested courses (all the screen activities and mouse movement) during the testing with all the participants were recorded, using software CamStudio[19], which is an open source screen recorder, available for free. As well as it was observed and notes were taken on all the issues experienced by participants during the process of user testing.

4.3.2 The post-testing interviews

The post-testing interviews were conducted in order to gain understanding about issues, identified during user testing and to clarify the participants' overall experience with the tested courses. The post-testing interview was divided into three parts. As was mentioned before, all the participants tested two courses each. After testing of each of two course, the participants were asked questions related to the course and their attitude towards it. Most of the questions were the same for each tested course, but also there were specific questions, based on the present course's content and features. For example, the questions about Power Point Slides, which were present in only two out of six tested courses.

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19   http://camstudio.org/ - Free Streaming Video Software

At the end of the session they also were asked about their general attitude towards tested courses, their preferences, and the comparison of two of them. All the questions are open-ended, in order to make the interview more flexible in order to motivate participant for more feedbacks (Lazar et al., 2010). "This freedom invites the respondent to answer in depth, exploring any aspect of the issue that may be of interest." (Lazar et al., 2010). The interview guide is attached as Appendix 2.

4.4 Participants

In order to understand the experience of older users with MOOC content, the user testing of the selected courses (see Table 1) with fourteen elderly participants (P1 to P14) were conducted. Since the research is anonymous, no names will be mentioned in the thesis.

Table 4-3. Demographic information of the participants.

	Age	Gender	Occupation
P1	68	M	Retired
P2	61	F	Medical sector
P3	69	F	Retired
P4	63	M	Partially retired/ accountant
P5	71	F	Retired
P6	64	F	Retired
P7	60	F	School teacher
P8	67	M	Retired
P9	65	F	Retired
P10	65	M	Retired
P11	67	F	Retired
P12	69	M	Retired
P13	64	F	Retired
P14	67	M	Retired

The pretesting interviews with participants were conducted in order to collect demographic

information about the users, e.g. their age, gender, background (Table 3). The participants' age ranges from 60 to 71 years old, which corresponds to older category of Web users' segmentation (Bailey, 2004). Six of the participants are men and eight are women. Most of the elderly participants (eleven persons out of fourteen) are retired. Also, during pretesting interviews, the information about participants' experience with computers, Internet, their attitude towards e-learning and MOOCs and their English proficiency were collected (Table 4).

Table 4-4. The information about participants' experience with ICT and MOOCs and their English proficiency.

	Your years of experience with computer technologies (approximate amount)	How often do you use Internet	What do you usually use Internet for	Your experience with e-learning and MOOCs	English proficiency
P1	9 years	few times a week	Previously very limited set of programs at work, now—Skype	No experience	Intermediate
P2	7 years	every day	E-banking, email, Skype	No experience	Pre-Intermediate
P3	6 years	not often (once a week)	Skype, informational websites as https://www.norge.no/	No experience	Intermediate
P4	8 years	almost every day	E-banking, email, Skype, searching for information, facebook (very little)	No experience	Intermediate
P5	2 years	few times a week	Skype	No experience	Elementary – Pre-Intermediate

			E-banking, email, Skype, searching for information, informational websites,		
P6	10 years	almost every day	entertainment	Used Wikipedia	Intermediate
P7	12 years	every day	E-banking, email, Skype, searching for information, facebook (very little)	Used Wikipedia and watched educational video on YouTube	Upper-Intermediate
P8	4 years	few times a week	informational websites as https://www.norge.no/	No experience	Elementary – Pre-Intermediate
P9	7 years	almost every day	Skype, email	No experience	Intermediate
P10	6 years	almost every day	Skype	No experience	Intermediate
P11	5 years	few times a week	Skype	No experience	Elementary – Pre-Intermediate
P12	Just started	few times a week	Skype	No experience	Intermediate
P13	8 years	almost every day	E-banking, email, Skype	No experience	Intermediate
P14	3 years	few times a week	Skype, informational websites as https://www.norge.no/	No experience	Intermediate

The participants' experience with computer technologies and Internet differs from many years of experience (with different types of software and tasks) to new Internet users, who just started to learn, how to use computer and Internet and "have tried to use very few programs". The elderly participants also have significant difference in computer usage frequency. None of them have been familiar with

MOOC courses before. Most of them also have not used Internet for educational purposes before, except P6 and P7, who have used some informational websites, as Wikipedia, for educational purposes. Also, P7 has watched educational video on YouTube. In addition, most of them have average (Intermediate) level of English language proficiency, except P5, P8 and P11 who have less than average English level. That caused some difficulties with MOOC usage as well, as with interviewing process. Also, the data about users' age related issues was collected. All the participants said that they have not experienced difficulties using ICT, related to their age. Most of the participants are wearing glasses, when using computer or other screens, but they have not used any assistive technologies (screen-readers, magnifier so on). They also don't have any serious issues related to hearing. The participants also did not have difficulties related to their motor skills, as well as any cognitive issues. However, most of them emphasized, that they had difficulties using new for them technologies.

4.5 Courses

Many different courses from various MOOC platforms were reviewed in order to find courses suitable for the testing. The topics that possibly could arouse interest and hold the attention of elderly participants were chosen. Liyanagunawardena T.R. and Williams S.A. (2016) stated that question of which topics of MOOC courses could be interesting for elderly students is not sufficiently investigated. However, the authors claimed that, based on their research, it is possible to assume, that certain topics could arouse special interest of senior students. They described the results of their data analysis, which showed that proportionally a lot of elderly students registered for courses related to specific interests, for example, travel, history, nature, poetry. So, the authors claimed that it is possible to assume that these topics could be interesting for elderly. Also, the seniors demonstrated the interest in courses related to health issues. The authors (Liyanagunawardena & Williams, 2016) also mentioned the topics, which will be less interesting for elderly, for example courses, which explore management topics, academic writing and learning English.

Based on recommendations above and availability of the courses, the topics were chosen. In the process of searching and investigation, some of the courses looked relevant and suitable for the current research. However, a number of them was closed and had opening date much later, than it was needed for the testing. In some cases, the date was not even announced. One of these courses

was "Heart Health: A Beginner's Guide to Cardiovascular Disease"[20] from FutureLearn platform, which meets the recommendations from Liyanagunawardena T.R. and Williams S.A. (2016) review (the topic is related to health issues), but it was not available at the time.

Some of the courses were not included to the testing, due to ethical concerns. For instance, "Exploring Cancer Medicines" course[21] from the FutureLearn platform[22] (designed by the University of Leeds[23].) has a very sensitive, delicate topic, which may cause bad associations, rejection and unwillingness to continue further learning process.

On the other hand, one of the courses (Intro to Descriptive Statistics) was selected, despite the fact that there was a possibility that the course will not arouse interest and hold the attention of elderly participants. The reason was that the course represents one of the most popular MOOC platforms (Udacity), as well as important type of the video presentation form, so decision was made to include the course to the testing process.

For the investigation of existing MOOC platforms, the information from related articles were used (Liyanagunawardena T.R. and Williams S.A., 2016; Sanchez-Gordon and Luján-Mora (2013). Based on video type, course prerequisites, and the courses' platforms, six different MOOC courses, which represent different types of MOOC content presentation, were selected for the research (Table 5). All selected courses are at introductory level, which means no prerequisite knowledge is needed for starting the course (no prerequisites mentioned in the courses' description). For example, the course "Dog Emotion and Cognition" has the following citation in the description: "The class is designed to be interesting and fun for all backgrounds. Whether you are a scientist of someone who has never take a science class you will have the background you need."
Here is more detailed description of all the selected courses.

Table 4-5. Tested courses.

	Topic	Course name	Platform

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20 https://www.futurelearn.com/courses/heart-health – "Heart Health: A Beginner's Guide to Cardiovascular Disease", FutureLearn platform
21 https://www.futurelearn.com/courses/exploring-cancer-medicines/ - "Exploring Cancer Medicines" course from the FutureLearn platform
22 https://www.futurelearn.com/ - the FutureLearn MOOC platform
23 http://www.leeds.ac.uk/ - the University of Leeds website

1	Literature (poetry)	Shakespeare: On the Page and in Performance	edX
2	Literature (poetry)	The Art of Poetry	edX
3	Nature (dogs)	Dog Emotion and Cognition	Coursera
4	Nature (birds)	Birds 101: Introduction to Pet Birds	edX
5	Data (Descriptive Statistics)	Intro to Descriptive Statistics	Udacity
6	Travel & history (Rome)	Rome: a Virtual Tour of the Ancient City	FutureLearn

Course 1. The topic of the course is literature, more precisely – poetry. It's the "Shakespeare: On the Page and in Performance"[24] course from the edX platform[25]. The "Shakespeare: On the Page and in Performance" course was designed by the Wellesley College[26]. The description of the course say that it is the introduction to "Shakespeare" topic consists of literary study and theatrical analysis, which in combination will help the students to understand popularity and greatness of Shakespeare. It consists of the videos of a real classroom lecture (see Illustration 6) with teacher-student communication: questions, answers and discussion. The lecture topic is Romeo and Juliet, and the teacher is Yu Jin Ko, professor of English at Wellesley College. The course's page says that there are no prerequisites for taking the course.

The course represents the following type of the MOOC content:

- video of real classroom lecture,
- quiz,
- text materials.

Course 2. The next course is "The Art of Poetry"[27] from edX platform. Its topic is also poetry. The course was created by Bux (Boston University). It's about the "pleasures of poetry" and the courses contains a variety of specific examples.   The description says that there are no prerequisites for taking the course.

The course represents:

- studio videos of the instructor talking with no audience,

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24 https://www.edx.org/course/shakespeare-page-performance-wellesleyx-eng112x - "Shakespeare: On the Page and in Performance" course from the edX platform
25 https://www.edx.org/ - edX platform website
26 http://www.wellesley.edu/#CsCaesZYJME0zKEf.97 - the Wellesley College website
27   https://www.edx.org/course/art-poetry-bux-arpo222x-0 - "The Art of Poetry" course from edX platform

- text,

- discussion,

- quizzes.

Course 3. The topic of the next course is nature (animals). This is the "Dog Emotion and Cognition" course[28] from the Coursera platform[29]. The "Dog Emotion and Cognition" course was designed by the Duke university[30]. The description of the course say that the course represents the new discoveries of dog psychology, which describe dogs' thinking and feelings about us. Also, it claims they students could use this knowledge to strengthen the relationships with their pets.

So overall, the course represents the following types of traditional MOOC content:

- video with Power Point slides presentation,

- Power Point slides,

- quiz.

Course 4. The next course is "Birds 101: Introduction to Pet Birds"[31] from edX platform. The topic of the course is also nature (birds). The course was designed by UTennesseeX (free online courses from University of Tennessee). The description of the course says that the course is introductory and has information about birds as pets, including care about it, its behavioural characteristics so on. The course's description also claim that this course is for different people, including bird enthusiasts, pet bird owners and so on. No previous knowledge is required for taking the course.

The course represents:

- studio videos of teacher using Power point slides,

- quizzes.

Course 5. The topic of the next course is data science. It is "Intro to Descriptive Statistics" course[32] from the Udacity platform[33]. The "Intro to Descriptive Statistics" course was designed by the Facebook and MongoDB. The description of the course states that the course will teach the students the basic concepts, which are used to describe data. Also, it claims that "Intro to Descriptive Statistics" course is a good starting point for students, who interested in different fields, like data science, economics,

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28   https://www.coursera.org/learn/dog-emotion-and-cognition - "Dog Emotion and Cognition" course from the Coursera platform
29   https://www.coursera.org/ - Coursera platform website
30   https://www.duke.edu/ - Duke university website
31   https://www.edx.org/course/birds-101-introduction-pet-birds-utenneseex-birds101-1x-0 - "Birds 101: Introduction to Pet Birds" course from edX platform
32   https://www.udacity.com/course/intro-to-descriptive-statistics--ud827 - "Intro to Descriptive Statistics" course from the Udacity platform
33   https://www.udacity.com/ - Udacity platform website

psychology, sports analytics so on. Most Udacity videos represent digital tablet drawing format of lectures, as well, as the chosen course.

The course represents the following types of traditional MOOC content:

- video in "digital tablet drawing format",
- quiz.

Course 6. The topic of the next course is a combination on travel and history. It's the course "Rome: a Virtual Tour of the Ancient City"[34] from FutureLearn platform[35]. The course was created by University of Reading. The description of the course says: "Explore the architecture and history of Rome, walking around a 3D digital model of the ancient city, with this free online course". It also states that this course is suitable for anyone with an interest in ancient Rome. It can be concluded that no prerequisite knowledge required for taking the course.

The course represents the following types of traditional MOOC content:

- discussion,
- text,
- video of the city + 3D digital model of the ancient city.

The types of video presentation and types of content presented in each course are assembled into a table 6 for better overview.

Table 4-6. The types of materials represented in the tested courses.

	Course	Type of video presentation	Type of other content
1.	Shakespeare: On the Page and in Performance (edX)	video of real classroom lecture	quiz, text materials
2.	The Art of Poetry (edX)	studio videos of the instructor talking with no audience	text, discussion, quizzes
3.	Dog Emotion and Cognition (Coursera)	studio videos of teacher using Power point slides	Power Point slides, quiz
4.	Birds 101: Introduction to Pet Birds (edX)	studio videos of teacher using Power point slides	quizzes

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[34] https://www.futurelearn.com/courses/rome - "Rome: a Virtual Tour of the Ancient City" course from FutureLearn platform
[35] https://www.futurelearn.com/ - the FutureLearn platform website

5.	Intro to Descriptive Statistics (Udacity)	video in "digital tablet drawing format"	interactive quizzes
6.	Rome: a Virtual Tour of the Ancient City (FutureLearn)	video of the city + 3D digital model of the ancient city	discussion, text, pictures

4.6 Analysing the data

As was mentioned in the Methodology chapter, after conducting all the user testing, the observations and the interviews, collected data were analysed through content analysis, which, according to Lazar et al. (2010) is in-depth analysis, used for compressing data into fewer content categories by using explicit rules of coding. Also, according to Lazar et al. (2010) this type of analysis is usually in-depth analysis, which can help us to find theoretical interpretations, which in its turn could help us to generate new knowledge.

During the research process following materials were collected: the audio files of the pre-observation interviews, the video files screen recording of mouse movement during the using of the Demo course, the observation notes in the notebook and the audio files of post-observation interviews. According to Lazar et al. (2010), the content analysis can be used for the data, which are represented differently, as text, audio or video files. The interviews, observation notes and video files were analysed, using this method, in order to find some patterns in terms of how participants carried out the MOOC courses and different types of content within the courses.

Afterwords, based on data analysis, a set of recommendations, which could be used for achieving potential increase of MOOC content accessibility and usability for elderly people, were developed.

4.7 Summary

In this part of the report the practical details of the current research were provided. First, the information about consent form. Since the observation and interviews involve real users, the consent form was prepared to deliver necessary information to the participants of the study. Then the procedure of user testing and post-testing interviews was provided. Each participant chose 2 courses, based on his/her preferences and went through the given tasks (all the tasks are listed in the chapter). The post-testing interviews were conducted in order to gain understanding about issues, identified during user testing and to clarify the participants' overall experience with the tested courses.

Also, in this section demographic information about the users and information about their experience with computers, Internet, their attitude towards e-learning and MOOCs and their English proficiency were provided. At the end, all the tested courses were described.

5. RESULTS AND ANALYSIS

In this chapter, as in the previous one, the practical details of the research are listed. Chapter is structured the following way: First, documentary analysis with result is presented followed by result of the user-testing, observations and interviews. In the final part of the section, issues and preferences which were identified during data collection methods are elaborated.

5.1 The literature review and documentary analysis

The results of literature review and documentary analysis have shown, that MOOCs have various types of studying materials. They could be distinguished it two types: traditional course materials and innovative type, which appeared thank to ICT and Internet advantages. The traditional course materials are readings, lectures, different kinds of assignments. The innovative materials are different types of video, audio, images and interactive user forums and quizzes (Yang, 2014). Of course, all the materials are used not only in online educational courses, but also as part of other web pages and services.   During the literature review and documentary analysis of the current thesis the information about accessibility and usability issues, which elderly users can experience with different types of MOOC content, was found (see Table 7).

As was mentioned in literature review section, it was investigated, that videos play essential role in the most of the popular MOOC platforms. Video materials constitute one of the biggest part of the MOOC content. They are important for learning experience in the most MOOC courses. So, it is logical, that a lot of possibly expected issues are related to video materials. For instance, according to W3C[36] the video without captions and transcripts can create an accessibility barrier for seniors, who have issues with hearing. On the other hand, the videos' captions and visual text can create visual dispersion and cognitive overload, which in its turn can be a reason of minor learning among people who need captions (Sanchez-Gordon & Luján-Mora, 2013). The possible ageing issues can affect the ability to view a video or to hear an audio track of the video.

If talk about text materials, the literature has shown that people over 50 years usually face more barriers related to syntax and search results understanding, in comparison to younger users (Slone, 2003), which could also be an accessibility issue for the elderly MOOC users.

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36 https://www.w3.org/WAI/intro/wcag - https://www.w3.org/WAI/intro/wcag – The World Wide Web Consortium website, information about Web Content Accessibility Guidelines

In case of pictures and images, the lack of alternative text is a possible accessibility barrier for elderly, who have visual problems. The poor colour contract could also become a barrier for elderly users.

Table 5-1. Accessibility issues, which can be experienced with different types of MOOC content.

Type of MOOC material	Possible issues
Videos	lack of video subtitles (captions)
	lack of video transcripts
	user's visual dispersion and cognitive overload caused by videos' captions
	issues related to user's vision, which influence the ability to watch videos
	issues related to user's hearing, which influence the ability to hear audio track of the video
	technical jargon, used in the content of the video
	Web terminology, used in the content of the video
	Text of the video in foreign language, which elderly user is not familiar with
Text	technical jargon, used in the content of the text piece
	Web terminology, used in the content of the text piece
	difficulties, related to syntax, which elderly user could experience
	text piece in foreign language, which elderly user is not familiar with
Images	lack of alternative text
	images of text could have contract lever, which not sufficient for a user
	issues related to user's vision, which influence the ability to see picture
Quizzes	the accessibility issues related to a lack of possible to change a size of radio-buttons and check-boxes in the quiz
	the issues related to the mistakes in the quizzes

	misleading information about questions
Discussions	elderly users could not understand the purpose of the discussion
	elderly users could want to keep their activities at educational websites private, that's why decide to not participate in the discussion

The issues related to technical jargon and Web terminology can appear in the text, video and audio materials. Hill et al, 2008 stated that senior users tent to have difficulties with understanding and coherence of technical jargon and, according to Slone (2003), Web terminology also can be a barrier for elderly, since they could miss the necessary data or information because of lack of understanding of it.

Another barrier is MOOC material in foreign language, which elderly users are not familiar with. This issue is related to text, video and audio materials.   Since, according to Altbach (2014), most of the MOOC content is in English and, according to Onwuegbuzie et al. (1999), seniors have high level of anxiety to foreign language, it could create a serious barrier for elderly, who want to use MOOCs.

5.2 User testing: results of observation and post-testing interviews

The elderly participants' interaction with all the tested courses were observed. All the emerged issues were carefully noted by the observer. Additionally, all the screen activities during all the user testing sessions were recorded. The results of data analysis show, that all the participants experienced a number of barriers during MOOC testing. Afterwards, the results of user testing and observation were clarified by summarizing the data from post-testing interviews.

Most of the participants expressed positive attitude towards online education, e-learning, and MOOC courses in particular. Despite the difficulties, which they faced sometimes using the tested courses, all of them managed to watch the videos from start to end, to read text, to answer for most of the quizzes' questions and to participate in the discussions. The elderly participants stated that MOOCs and overall e-learning is a great way to learn new things or expend the knowledge in the interesting topic. They also expressed positive attitude towards using video for educational purposes. During the post-testing interviews, most of the participants also mentioned they were thinking of possibly join some MOOC courses in their free time afterwards.

Unfortunately, all the elderly participants faced a number of challenges during their engagement with all of the tested MOOCs. Some of the participants emphasized, that these barriers negatively affected their attitude towards the MOOCs and could stop them from join MOOC in the future, although they like the idea of online education and this kind of online courses. All the identified issues are listed further in the section.

5.2.1 Video

The videos constitute a major part of all the tested MOOC courses. All the tested courses have subtitles for all the video materials. Also, most of the courses have the transcripts of the video materials, except the course "Intro to Descriptive Statistics" from Udacity platform. However, still some of the participants faced problems taking full advantage of these accessibility features, for instance, they had difficulties with operating the video player (turn off/on subtitles or change the speed of the video), or they simply were not aware of some features, due to lack of experience with educational website and videos. For instance, although Coursera and edX courses contain the clickable transcripts of the videos, the possibility to click on transcript lines, in order to play a certain part of the video, was not known or obvious for the elderly participants, which makes this usually very helpful option useless for them.

- **Making a video slower/faster**

Also, as was mentioned before, during the user testing of the courses, the participants were given the task to make the video slower/faster. Most of the participants had difficulties with finding the way to do it in case of "Dog Emotion and Cognition" course from Coursera. Some of them stated that they did not understand the meaning of "Playback rate" (the option of changing the speed of the video in the Coursera video player), which in its turn caused the difficulties (see Figure 1).
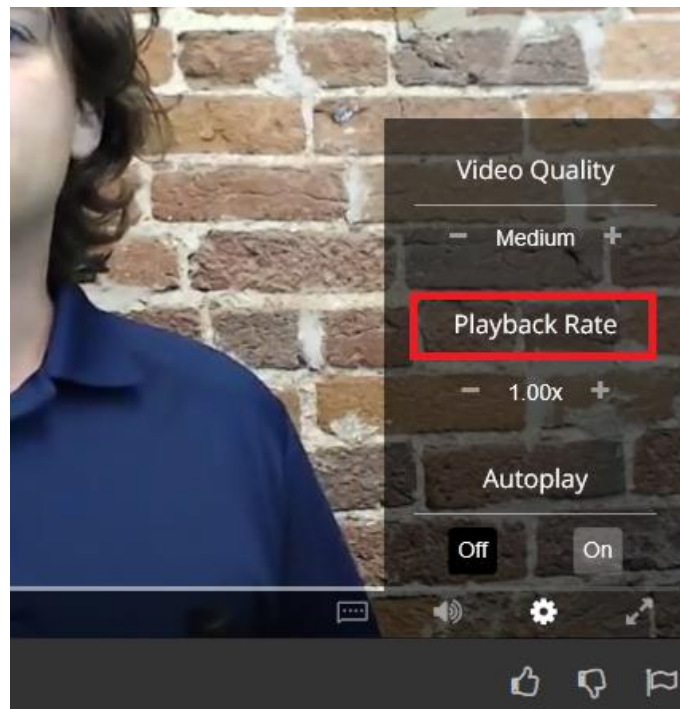
Figure 5-1. The option of changing the speed of the video in Coursera course.

In the course "Rome: a Virtual Tour of the Ancient City" most of participants, who tested this course (P5, P8, P11, P12), also had difficulties with the task to make video slower/faster. During the post-testing interviews, the participants explained that the reason for these difficulties was that the buttons didn't have any mention about "speed" of the video, just numbers with the letter "x", such as "1x", "1.25x" so on (see Figure 2).
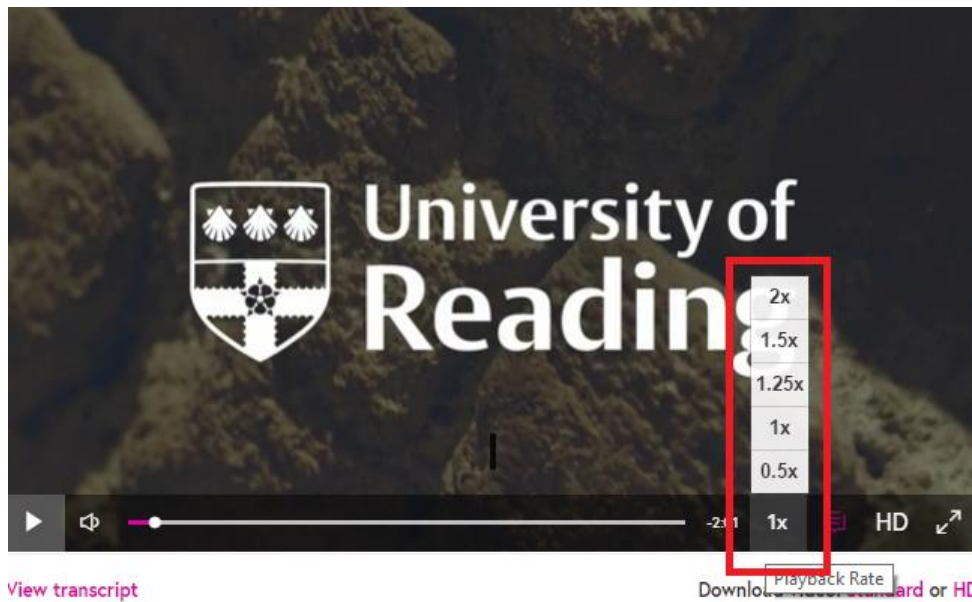
Figure 5-2. The option of changing the speed of the video (FutureLearn platform).

Only the Participant 10 easily found the way to finish the task. At the post-testing interview he explained, that he found the button so fast, since he tested the course "Birds 101: Introduction to Pet Birds" form edX platform first. In the edX video player the same marking was used, but this the clarification by word "Speed" on the button (see Figure 3).
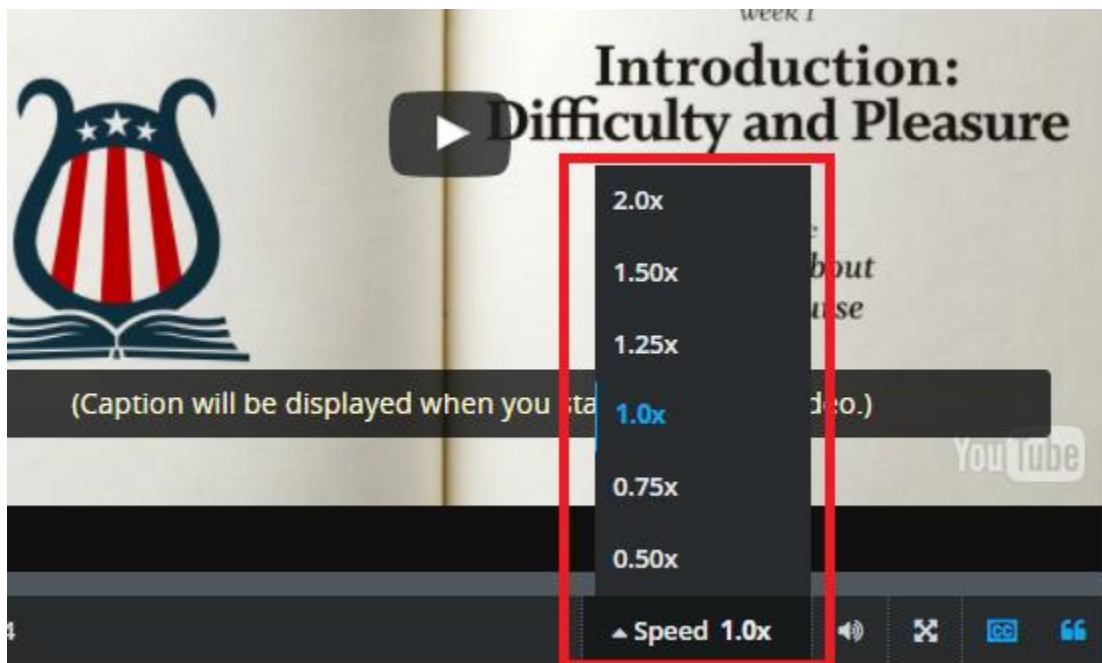

Figure 5-3. The option of changing the speed of the video (edX platform).

- *Turning subtitles on/off*

During the user testing of each course, the participants were also given the task to turn off/on subtitles of one of the videos. Some of participants (P4, P5, P8 and P12) had difficulties with this task during the testing of courses from edX platform ("Shakespeare: On the Page and in Performance", "The Art of Poetry' and "Birds 101: Introduction to Pet Birds").

During the post-testing interviews the participant 4 and participant 5 stated that they did not understand that "captions" and "subtitles" are the same thing and the button in the edX video player says "captions", not "subtitles" (see Figure 4).
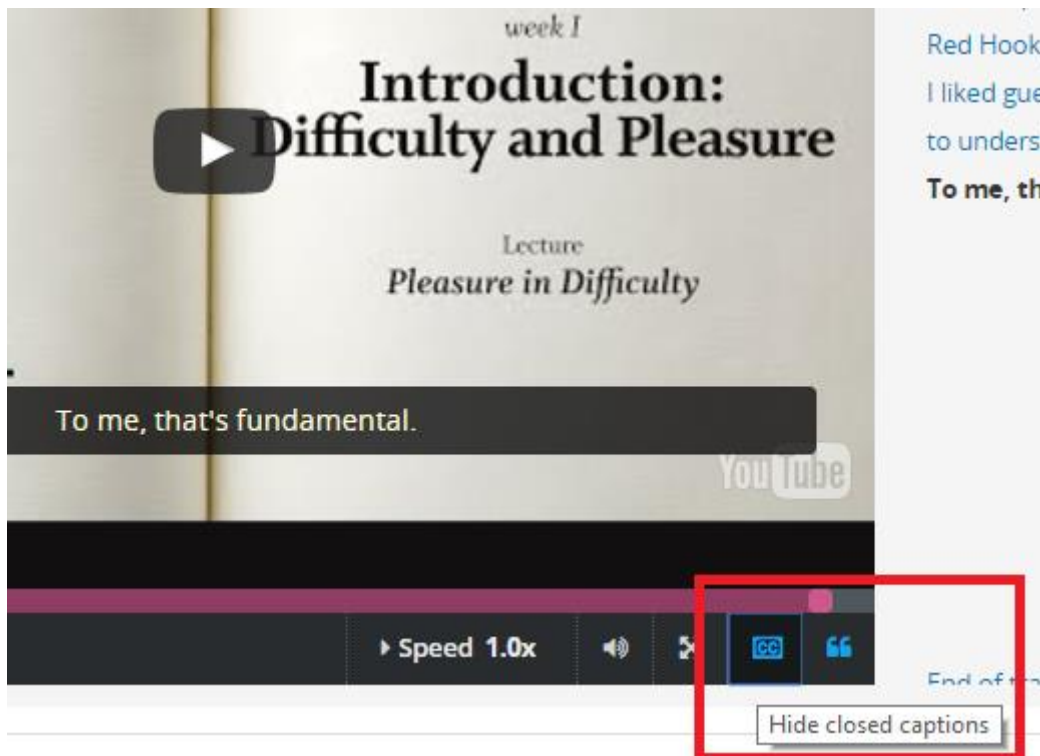

Figure 5-4. The option of turn on/off subtitles (edX video player).

- *Playing next video*

In the course "Dog Emotion and Cognition" from Coursera platform, some of the participants (P3, P4, P11) had difficulties with working out how to play the next video, after they finished the previous step. They emphasized, that the buttons (see Figure 5) were not really noticeable for them and the colour contrast was not sufficient. According to colour contrast checker tools, the contrast ratio in this

situation is 4.61:1, which does not meet 1.4.6 success criteria of WCAG 2.0 – at least 7:1 (level AAA). Although this issue is mostly related to framework of the MOOC platform, this problem creates a barrier for users on their way to access the materials of course.
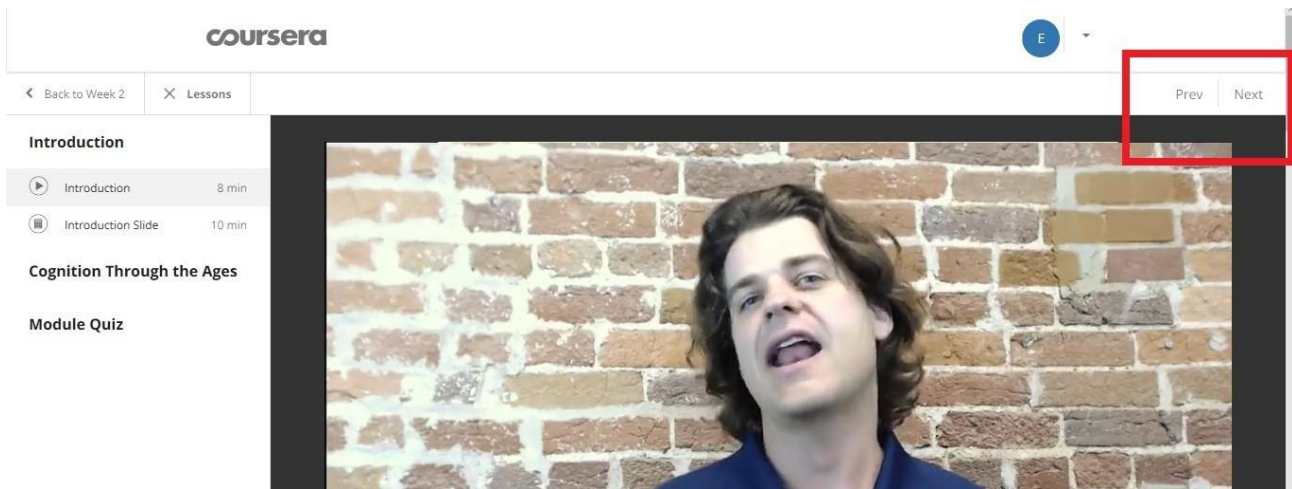

Figure 5-5. The buttons "Prev" and "Next" in the course of Coursera platform.

- ***Length of a video***

Another issue is length of the videos in some of the tested courses. The participants commented, that some of the videos in "Dog Emotion and Cognition", "Shakespeare: On the Page and in Performance" and "Birds 101: Introduction to Pet Birds" courses were too long for them, which made it very hard to concentrate on the video the whole time. The average length of the video in these courses is 7-8 minutes, although one of the previous research stated that "shortest videos (0–3 minutes) had the highest engagement and much less variance than all other groups" (Guo et al, 2014). As opposed to "The Art of Poetry" and "Intro to Descriptive Statistics" that have recommended length of the videos.

5.2.2 Slides

Two of the tested courses ("Dog Emotion and Cognition" from Coursera and "Birds 101: Introduction to Pet Birds" from edX) contain videos, in which teacher provide the lecture with the help of Power Point slides presentation. In the "Dog Emotion and Cognition", the slides are not only described by the lecturer in the course videos, but also are attached to the course as separate materials.

Overall the participants expressed positive attitude towards Power Point presentations, used in the video. However, most of them (P2, P3, P4, P11, P13) said that the slides in "Dog Emotion and Cognition" course did not contain enough information, which makes the slides less useful.

On the other hand, the participants expressed, that Power Point slides from the course "Birds 101: Introduction to Pet Birds" were more beneficial and contained information, which helped them to better perceive the lecture.

However, in case of these slides another problem appeared. During most of the videos, the text in the slides was not visible for most participants (P10, P12, P13), the slides become bigger only periodically for a few seconds. Participant 10 said, that he couldn't focus on the speech, because he was waiting for the slides become bigger all the time (see Figure 6).

Participant 12 was forced to press "full-screen" in order to see slides more clearly, however these was no "Next" button in full-screen mode, which was confusing for the participant.

In case of slides as addition materials attached to the course, the participants claimed that having the slides is a good option, however if slides do not contain useful information, the presence of the slides is unnecessary and even disturbing.
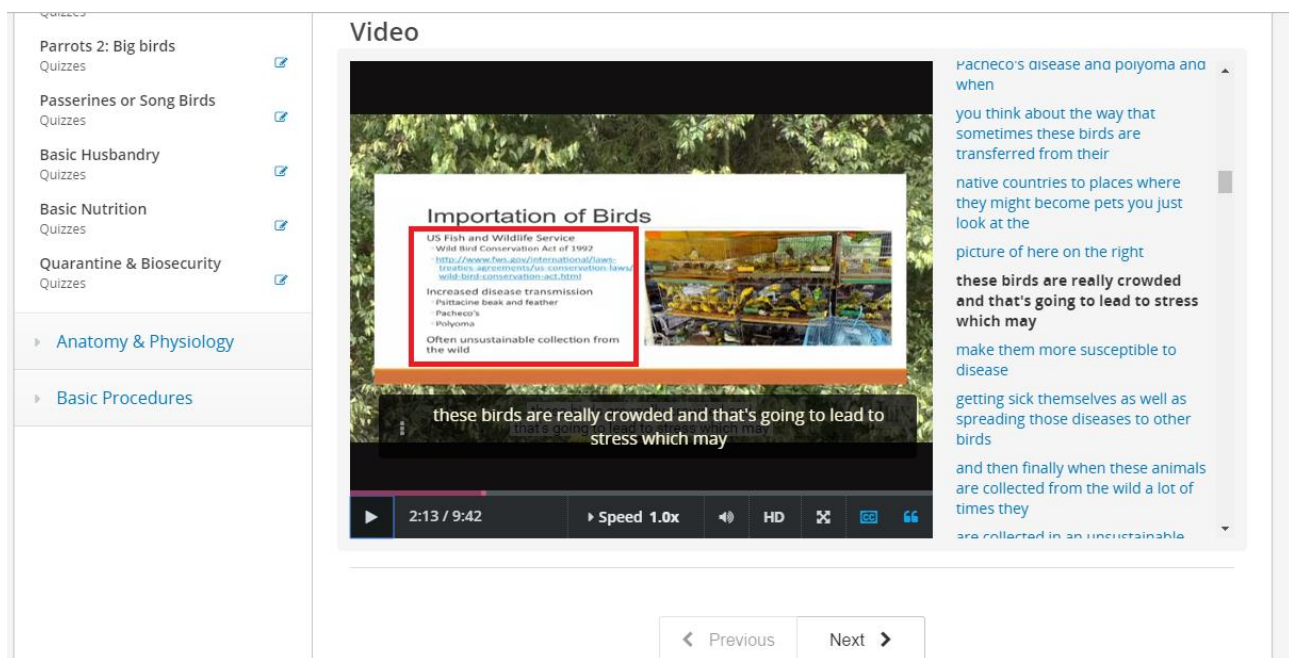

Figure 5-6. Power Point slides from the course "Birds 101: Introduction to Pet Birds".

5.2.3. Quizzes

- **"Show the answer" button**

All quizzes in courses from edX platform have a button "Show the answer" (see Figure 7). It appears only when the user has already chosen and clicked on a right answer. The "Show the answer" button shows the theoretical information and/or explanation, why the answer is right, not the "answer" itself,

as it seems to be based on the wording on the button. The user testing showed that for most of the participants, who clicked the button, this misunderstanding was confusing.

Figure 5-7. The "Show the answer" feature in quizzes from edX platform courses.

Another identified issue, related to this feature, is that in "Shakespeare: On the Page and in Performance" course, after pressing "Show the answer" button, there is no explanation for the answer at all (see Figure 8). During the user testing, the participant 9 have tested the course "The Art of Poetry" (also from edX platform) first. She has used "Show the answer" button and knew that if she would press on it, she should find an explanation for her answer or theoretical details related to it. As she mentioned during post-testing interview, it was disappointing and frustrating for her not to find any information after pressing the button.

Figure 5-8. The screenshot of Shakespeare: On the Page and in Performance" course.   After pressing the "Show answer" button (a), no explanation for the answer appears (b).

- **Iterative questions in the video**

The course "Intro to Descriptive Statistics" from the Udacity platform is an interactive course. The quizzes in this course are presented in the video, as interactive forms for answering questions. The user testing showed that elderly participants perceived this type of questions' presentation, and interactive courses in general, in different ways. The results of observation showed that participant 1 had a lot of difficulties operating check marks and answering the questions in the course. First, he did not understand, that he need to answer a question, when it appeared on the screen, then he spent few minutes in order to answer the question. During the post-testing interview participant 1, suggested that possibly the problem was related to his limited experience with the courses, like this. He said: "I have never try to use something like this course before, and the style is very unusual to me. It was hard to follow the teacher words and quickly answer the questions."

On the other hand, participants 2 and 7, expressed positive attitude towards interactive question. The observation showed that they did not face a lot of barriers during "Intro to Descriptive Statistics" course testing. During the post-testing interviews, both of them said that they like structure and presentation type of the course, it is easy to follow the course.

- **Open question**

The course "Intro to Descriptive Statistics" from the Udacity platform also contained open questions,

which users cannot skip (see Figure 9). However, it is possible to submit any combination of symbols or letters, when answering, which did not make any sense for the participants. In addition, the user does not receive any feedback for his/her submitted answer. During the post-testing interviews, the elderly participants emphasized, that mentioned above question's properties were frustrating for them.
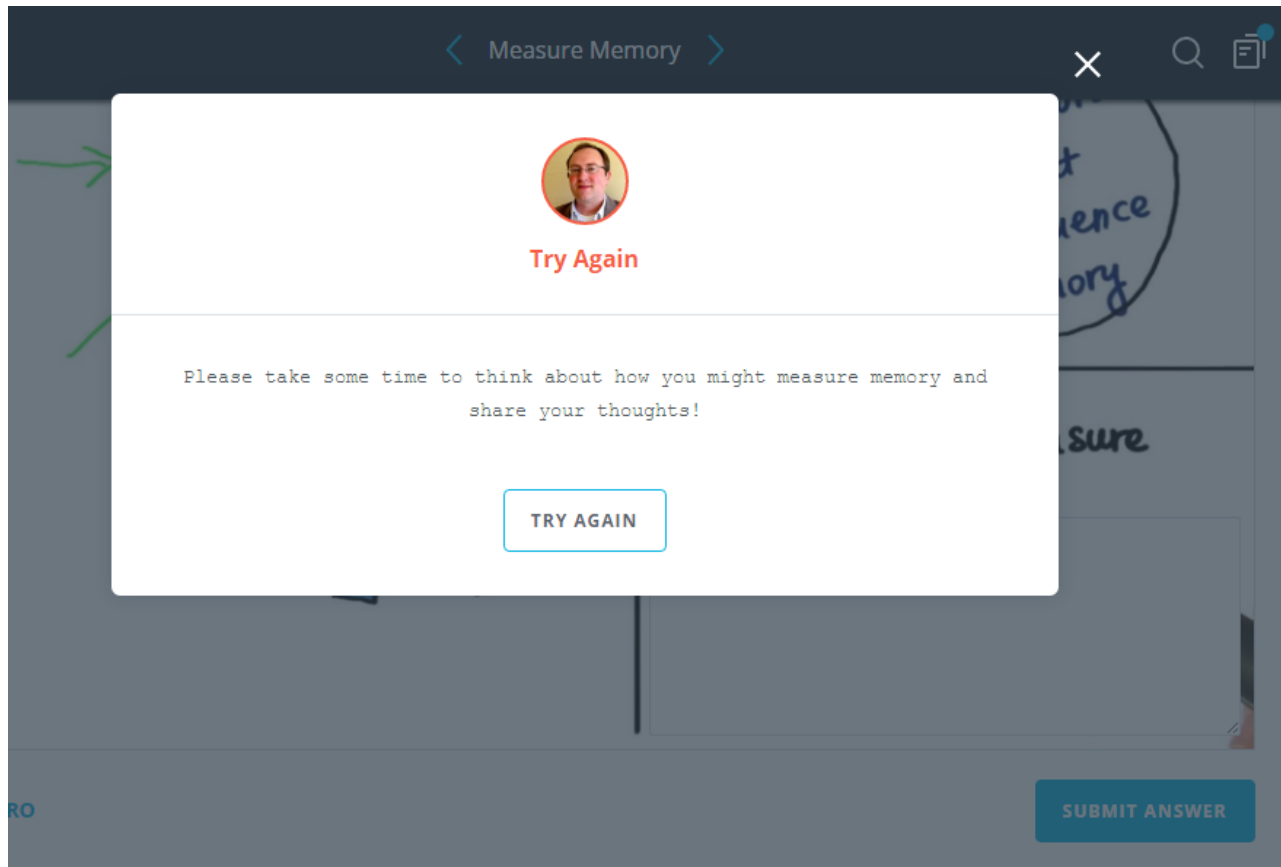
Figure 5-9. The open question in "Intro to Descriptive Statistics" from the Udacity platform, which users cannot skip.

- **Amount of the questions in the quizzes**

Most of the quizzes in all the tested courses consist of two-three questions (for instance, quizzes from "The Art of Poetry" and "Dog Emotion and Cognition"), or, in some cases, even one question (for example, quizzes from "Intro to Descriptive Statistics" course). The user testing showed, that this amount is more comfortable for elderly participants and it was easy for to concentrate on the quiz. On the other hand, the course "Birds 101: Introduction to Pet Birds" from edX platform has the quiz, which consists of 7 question, and another one, which consists of 22 questions. The observation showed, that the elderly users faced more issues answering these quizzes, for instance, spent much

more time on each of the questions from "long" quizzes, than from "short" quizzes, which consist of 1-3 questions.

During the post-testing interviews the participants supported the observations, by saying that the quizzes with 1-3 questions were much more easily to follow and answer.

5.2.4 Discussions

Overall the results of the user testing and post-testing interviews show that elderly users didn't like to actively participate in the discussion sectioned on the MOOC courses, however they like to read the comments of the other users.

The discussions in some of the courses are closed, since the courses were archived, not on-going. In the course "Rome: a Virtual Tour of the Ancient City" the participants didn't know, that discussion and commenting is the same thing, so some of the participants spent some time to figure it out.
The participants also didn't expect that a course could start from discussion, as the course "Rome: a Virtual Tour of the Ancient City" from FutureLearn platform does.

5.2.5 Text

During the post-testing interviews, few participants mentioned, that the length of some text pieces was too long for them to concentrate, so they needed to read through some sentences few times to perceive the meaning. For instance, the text piece from "Rome: a Virtual Tour of the Ancient City" course took (in average for all participants) around 15 minutes to read.
Some text parts represent the course's instruction for the user. However, some of the text instructions were given to the users after few steps finished, in the situation, when they should use new for them features from the start of the course. For example, in the course "Rome: a Virtual Tour of the Ancient City" the link to the instructions for the new users of FutureLearn platform was provided only on the third step of the course.

The participants 8 and 10 followed the link and read the instructions. The guide provides the information about the platform and some specific features of it. For example, the "Mark as finished" button on the FutureLearn platform. This feature allows users to mark finished steps, which could help them to track their progress in the course, by updating user's 'To do' list (see Figure 10).
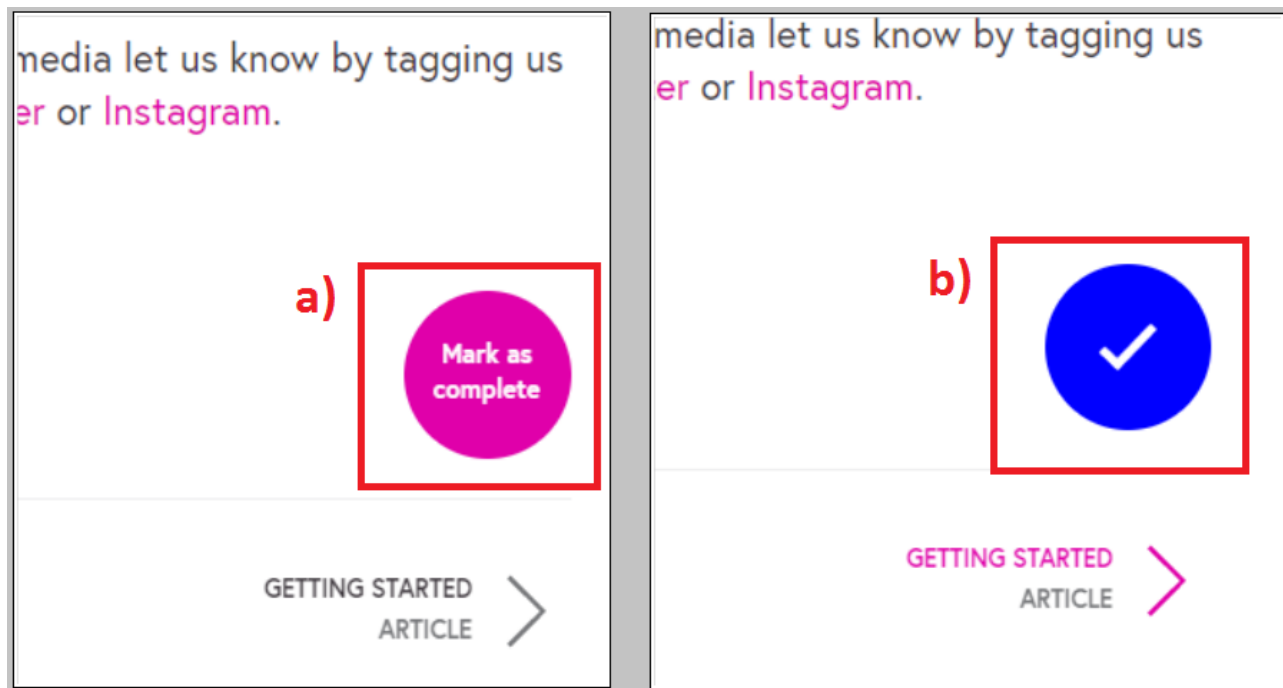
Figure 5-10. The button "Mark as complete": a) before a user pressed the button; b) after a user pressed the button. (FutureLern platform).

Also, according to FutureLearn's start guide[37]: "leaving the switch off does not prevent you from moving on to the next step. If you're not sure that you properly understood something, you can leave it and come back to it later."

After reading the information about the feature, both participants decided to go back and mark previous steps as "finished", which created inconvenience and took additional time to go through the steps. During the interviews, both participants mentioned their confusion due to this situation. The participant 8 said: "I do not understand, why this link was not provided in the beginning of the course. These instructions were helpful to me, as a new user".

5.2.6 Other issues

During the post-testing interviews few participants expressed the opinion that some of the wording in the texts pieces and videos were too scientific to them, it was hard to understand and they had difficulties with perceiving it. For example, participants 3 and 4 said that they had difficulties with the course "Dog Emotion and Cognition" from Coursera platform.

Also during the post-testing interviews few elderly participants, who tested courses from edX platform,

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37   https://www.futurelearn.com/using-futurelearn - FutureLearn's start guide

mentioned that the structure of the platform's interface seems to complicated for them. They claimed that it took some time to get used to a big amount of the buttons on the screen (e.i. tabs and tab bars). The participant 12, who tested "Birds 101: Introduction to Pet Birds" course, said: "Few times I got lost in all these buttons and could not find the way to go to the next task of the course".

5.2.7 Results summary

The user testing, observation and post-testing interviews with the elderly participants helped to identify a number of barriers and issues related to different types of MOOC content presentation. All the found issues are listed in the Table 8.

Table 5-2. The issues discovered during user testing and post-testing interviews.

Video	Limited information about how to use transcripts, subtitles so on
	The wording of some features is not clear so the inexperienced users
	The length of some videos in tested courses seems too long
	The slides, which are used in the video seems not enough informative
	The slides are not clearly visible for the elderly users
Quiz	The amount of questions in some of the quizzes seems too big
	The wording of some features is not clear
	A quiz with complicated questions at the beginning of the course discourage an inexperienced user to continue a course
Discussion	Some of the discussions are closed, since the course is archived, not ongoing
	The wording of some features is not clear
Text	The length of some text pieces seems too long to concentrate
	Some text instructions are given to the users after few steps, when they should use new for them features from the start of the course
	Some wording in the text pieces was too scientific for the elderly users' perception

5.2.7 The preferences of elderly users

The last section of the post-testing interview was aimed to identify elderly users' opinion about MOOC content presentation formats, and their preferences in it. The participants were asked questions like

"What do you think about the courses?", "Which of the content do you liked best? Why?", "Which of the presentation format do you liked best? Why?" so on.

The elderly users' answers demonstrate that the real classroom lecture format is one of the most preferable among the participants of the research, who have tested the course "Shakespeare: On the Page and in Performance", which was the only course represents this type of video format in the research. Answering the additional interview questions the participant 3 said that this lectures was interesting and easy to follow, because of the "real classroom" spirit and discussions between the lecturer and the students.   The participant 4 called this video presentation format more entertaining, than studio videos of teacher using Power point slides (the participant 4 tested courses "Dog Emotion and Cognition" form Coursera and "Shakespeare: On the Page and in Performance" from edX, see Table 1).

Another reason that few participants mentioned during the interviews was that watching the real classroom lecture was nature for them, since it looked like typical university lecture, which is familiar for them from their life experience.

Also, the participants mentioned the format of videos in "Rome: a Virtual Tour of the Ancient City" course from FutureLearn platform as one of the most preferable. The videos of this course contain the video of the city, video of 3D city model, video of the lecturer talking with the city as a background. Also, the videos contain the interviews with the experts, which were perceived very good by the participants. The participant 5 compared the format of the video with "educational TV-show", and emphasized that it is one of the reasons, why she liked it.

The results of the research also demonstrated that the elderly users expressed different opinions in case of interactive video format. Participant said that it was hard for him to follow the course. The observation of his user testing identified a number of barriers, which participant experienced during the course usage. He few times mixed up the "View answer" and "Submit answer" buttons (He explained, that the buttons were too close to each other and he confused the meaning of them). When the participant, chose the wrong answer for the quiz's question, he didn't know how to continue and got stuck for a while. The participant also had difficulties with interactive check marks and open question, as was mentioned before.

However, two other participants, who have tested the course (P2 and P7) expressed opinion that

format of the course is nice, it was easy to follow the videos and answer the questions. The participants also said that they liked the structure of the course and that videos continued automatically.

5.2.8 Elderly participants' suggestion

In order to better understand the elderly users' perception of the tested MOOCs and their opinion about it, the participants were asked to list the things, which they would like to change in each course ("Would you like to change something in the course? What exactly?", for the interview guide see Appendix 2).

The participants mentioned a lack of information, instruction and guidelines as a big issue for them. Naturally, a lot of them suggested that putting more instructions (or make it more detailed) in the MOOC courses would be very helpful for them and would solve a significant number of problems for the elderly users. Also, some of the elderly participants assumed that more clear and suitable names of the buttons would also help them to better operate with the courses.

Also, few participants mentioned that they would like to simplify the interface of the edX platform and reduce the amount of buttons and tabs on a page. The participant 12 claimed, that it would help him to get used to the website much easier.

The participants also suggested that it would be good for them to have an opportunity to see the right answer for the quiz questions, in the case they do not know the right answer themselves. It is noteworthy, that all the tested quizzes were not limited in attempts to answer, so few participants tried to answer a number of times (until they found the right answer).

5.3 Summary

In this part of the report the information about empirical findings of user testing, observation and post-testing interviews were provided. The results of documentary analysis were presented and accessibility issues, which can be experienced with different types of MOOC content were listed and grouped into the table. Then, the results of the user-testing, observations and interviews were provided. It showed that the elderly participants faced a number of barriers during their engagement with all of the tested MOOCs (such as, a lack of information about different features, unclear wording of some features, the length of some videos and some text pieces seems too long to concentrate, the

slides were not clearly visible for the elderly users in one of the course, so on). All the identified issues were grouped into the table. In the end, the information about elderly participants' preferences and suggestion were provided.

6.   DISCUSSION

In the following section of this research elaborated discussion about how theory and practice match will be presented. This chapter represents researcher's thoughts on how research findings could prove or vice versa refute some theoretical findings. Chapter starts with description of what gap this research is filling and practical findings which were found out throughout data collection process. Findings in the following areas are presented: elderly attitude towards MOOCs, ICT barriers, subtitles and transcripts, length of the videos, Power Point presentation, language, discussions, quizzes and text. Afterwards, based on the results of the current research and the identified issues, a set of recommendations was developed. In the final part of the chapter limitations of the study were elaborated in order to show areas of potential improvement for future researches in this area.

6.1 Filling the gap in universally designed MOOCs.

The literature analysis showed the timeliness of the MOOC investigations. The online education, and Massive Open Online courses in particular, are becoming more and more popular every day. A lot of researchers are focusing on MOOCs, its accessibility, usability and other related issues in their works. Despite a sufficient amount of studies in the area of MOOC accessibility, the researchers still claim the importance of further investigations in this field. The literature has shown, that one of the segments, which needs more careful investigations is the elderly users' engagement with MOOC courses. There are only few studies related to this issue and all of them state the need of further and deeper research. Moreover, more of previously conducted researches were dedicated the issues related to a framework of MOOCs, and the issues of MOOC content accessibility and usability was not sufficiently investigated. The current thesis focusing on the elderly people engagement with the different types of the MOOC content in the context of universal design, their perception of it and their preferences. The initial goal was to investigate ICT barriers in MOOC content for senior citizens in context of Universal Design, and find out, what issues can be expected during the elderly users' engagement with each type of MOOC content, which barriers elderly users could face using MOOC and how each MOOC content type is perceived by seniors.

6.2 What do the results show?

Elderly attitude towards MOOCs

As was mentioned in the previous chapter, all the elderly participant of the current study, expressed positive attitude towards online education and MOOC courses. During the post-testing interviews the elderly participants stated that it is nice and convenient approach to get new knowledge and learn new things. One of the participant said: "I like the idea of education online and such courses. I was always interested in Renaissance art and wanted to learn more about it, but I have never found the time. Maybe now I will join one of these courses." The other participants expressed similar opinion.

These words support the literature review findings. For instance, the Koustriava & Papadopoulos (2014) stated, that senior users tend to have positive attitudes towards distance education. As was mentioned in the literature review chapter, MOOC is relatively new type of distance education (Sanderson et al, 2016). These practical findings of the current research also confirm the results of other study (Way Kiat Bong and Weiqin Chen, 2016).   Their article presented the findings from the MOOC course user testing with elderly participants and concluded that they expressed positive attitude towards using MOOCs at their leisure time.

ICT barriers

The results of the user testing and observation demonstrated that MOOC content holds a number of ICT barriers for senior users. The issues related to perception of video format, difficulties with operating video player, difficulties with quizzes features, lack of instructions and misunderstanding of the wording were identified. One of the participant mentioned in her interview, that sometimes she struggled to finish a task. That confirms the results of previous investigations of this issue (Sanchez-Gordon and Luján-Mora, 2013; Way Kiat Bong and Weiqin Chen research, 2016), which showed that there are many accessibility issues in the MOOC courses for elderly users.

In the post-testing interviews, most of the elderly participants associated the experienced difficulties with the lack of experience with such courses. One of the users said: "The format of the course was unusual for me. I have never tried web sites like this before." Several participants expressed the same thoughts. These results support the opinion that a lot of barriers, which elderly people face using Internet caused by the lack of their experience. As was mentioned in the literature review chapter, Lee et al (2011) claimed, that seniors have a lack of experience with Internet and ICT, which causing a lack of confidence and, as a result, difficulties with these technologies. Also, Eastman & Iyer research (2004) stated that seniors experience plays an important role in their ICT skills development.

Due to the barriers, which elderly participants faced during the user testing, they often felt uncomfortable and frustrated. According to Dickinson et al (2005), this negative aspect could become a reason of future computer anxiety. One of the participants said: "Even though I like the website, I would prefer to use books and journals for learning… It just takes a lot of time for me to figure out how to use the site". Few participants raised the same concern.   These results once again show the importance of MOOC accessibility and usability.

Video (subtitles and transcripts)

According to the World Wide Web Consortium[38] the lack of subtitles and transcripts for the video can create an accessibility barrier for elderly users. The guideline 1.2 of WCAG 2.0 "Time-based Media" stated: "Provide alternatives for time-based media". The results of the current study show, that most the selected for testing courses have subtitles and transcripts for the video materials, except "Intro to Descriptive Statistics" course from Udacity platform, which does not have transcripts of the videos. In case of the current research, it did not make a problem for the elderly participants. However, it is still possible, that the lack of transcripts for the video in this course could create difficulties for other elderly users, especially considering that participants of the current study do not have severe age related issues or disabilities.

Another possible issue related to video subtitles and transcripts has been mentioned in the Sanchez-Gordon & Luján-Mora study (2013). The researchers claimed that videos' captions and visual text can create visual dispersion and cognitive overload, which in its turn can be a reason of minor learning. The results of the interviews with the elderly participants show that availability of subtitles and moving transcripts at the same time on the screen (as it was in the courses "Shakespeare: On the Page and in Performance", "The Art of Poetry" and "Birds 101: Introduction to Pet Birds" from edX platform) was tiring and disturbing for them. During the post-testing interview, one of the users even used a word "overload" in order to describe his opinion, about the moving captions on the screen. These results confirm the Sanchez-Gordon & Luján-Mora (2013) statement. The video player had an option to turn off the captions, however none of the users tried to use it, even these, who mentioned their inconvenience with the captions during the interview. One of the participants explained it by saying, that he simply didn't thought about turning it off, since he didn't know that it is possible. So, this issue

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38   https://www.w3.org/WAI/intro/wcag - The World Wide Web Consortium website, information about Web Content Accessibility Guidelines

partially also related to participants' lack of experience.

In the "Dog Emotion and Cognition" course from Coursera platform, some of the participants had difficulties with working out how to play the next video, after they finished the previous step. Even though this issue is mostly related to framework of the MOOC platform, this problem creates a barrier for users on their way to access the materials of course, so it is also related to accessibility of the MOOC content. During the interviews, the participants, which tested this course, mentioned that the buttons "Prev" (which means go to the previous lesson) and "Next" (which means go to the next lesson) were not noticeable enough for them, mostly because of not sufficient colour contrast between the words and the background. Afterwards, the colour contrast was checked with the help of online colour contrast checker tool[39]. The results show that the contrast ratio is 4.61:1, which does not meet 1.4.6 success criteria of WCAG 2.0: "The visual presentation of text and images of text has a contrast ratio of at least 7:1"[40].

A lot of identified issues are related to the lack of instructions and guidance for the new inexperienced users of the MOOC platforms. For instance, the information about the available accessibility features, such as clickable transcripts, was not provided. Also, the link to the platform guide was provided after few steps of the course. These results demonstrate the importance of providing the instructions to the new MOOC students, especially in the case, when the student is inexperienced Internet user. The same recommendation was provided by Bong W.K. and Chen W. (2016), who claimed, that the tutorial for users should be placed in the courses, in order to provide "context-sensitive help". Also, they emphasized that the users should be able to access the information during all the course's usage. This requirement is also present in the WCAG 2.0 guideline. The Guideline 3.3 "Input Assistance: Help users avoid and correct mistakes" contain the criteria number 3.3.5, "Help", which claim that: "Context-sensitive help is available. (Level AAA)".

The results of the research also demonstrate, that unclear wording and name of the buttons and features can create a barrier for the elderly users. For instance, the purpose of buttons in the video player should be clarified (i.e. button, which allow user to change speed of the video, button for turn on/off subtitles, the button "Show answer", mentioned in the previous chapter so on). WCAG 2.0

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39 https://snook.ca/technical/colour_contrast/colour.html#fg=000000,bg=FFFFFF – Online Colour Contrast Check
40 https://www.w3.org/TR/WCAG20/#visual-audio-contrast - Web Content Accessibility Guidelines (WCAG) 2.0 W3C Recommendation 11 December 2008

"Guideline 3.1 Readable: Make text content readable and understandable."

Length of the videos

Another issue is length of the videos in some of the tested courses. The Guo, P. J. et al stated in their study (2014), that shorter educational videos, which are up to 3 minutes long, have the higher engagement than longer videos, and much less variance than all other groups. The results of the current research show that several videos in "Dog Emotion and Cognition", "Shakespeare: On the Page and in Performance" and "Birds 101: Introduction to Pet Birds" courses were too long for the elderly participants, which made it very hard for them to concentrate on the video the whole time. The average length of the video in these courses is 7-8 minutes. It can be assumed that these results confirm the statement from the Guo, P. J. et al study (2014).

Power Point presentation

The results also show that if there is Power Point presentation in the video, the slides should be useful for the user. Even more important is an ability to clearly see the text of the slides, especially considering, that usually in this type of video lecturer words are only partially repeat the content of the slides.

Language

As was mentioned before, the language issue is very important in the context of Web accessibility in general and accessibility of learning platforms in particular. Based on the research results, it can be assumed, that the foreign language issue is also a barrier for elderly users, who use the MOOC courses. Altbach (2014) states that most of the courses' content is in English, since the biggest part of MOOCs courses are American or from other Western countries. The data from 2014 shows that 80% of all MOOC courses were in English, although in 2015 this percentage decreased[41]. So it could be an accessibility issue for non-English speakers. All the participants of the current study are Norwegian and Norwegian is the native language for all of them. As was mentioned before, the English language proficiency of most of the participants is Intermediate. However, some of the participants, who have less than Intermediate level had serious difficulties with operating the courses, since all the tested courses are in English. These results support the Onwuegbuzie et al. Research (1999) statement, which

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41   By The Numbers: MOOCS in 2015 – https://www.class-central.com/report/moocs-2015-stats/

claimed that seniors have high level of anxiety to foreign language.

Discussions

As was mentioned in the literature review chapter of the current thesis, there are limited studies related to elderly engagement with the MOOC discussions. The literature has shown that MOOCs could be beneficial for seniors, since they give them a possibility to better integration with the rest of society, and, as a result, solve the problem of social isolation and loneliness, which elderly users often experience (Sandra Sanchez-Gordon and Sergio Luján-Mora, 2013). The researchers suggested that this goal could be achieved with the help MOOC interactive forums and discussion, which give the possibility to communicate with other students (Yang, 2014). However, the results of the current study demonstrated, that elderly participants did not show the desire to participate in the discussions. Moreover, according to Koustriava & Papadopoulos (2014), one of the reasons, why elderly users tend to have more positive attitudes towards distance education compared with younger people, is no need of peer interaction. The current research findings supported by Bong W.K. and Chen W. (2016) research, which showed that elderly do not understand the aim of the discussions and do not consider it as important element of the MOOCs. The authors mentioned that possibly the reason of it could be that usually elderly do not actively participate in the social media, and probably they want to keep their activities at educational websites private. Another possible reason could be the statement provided by Lee, Chen, & Hewitt (2011). They claimed, that elderly people would prefer conversations in person, rather than messaging online, due to difficulties related to typing.

Quizzes

As was mentioned in the literature review chapter there are limited research in the area of MOOC quizzes accessibility and usability. Also, this issue was not addressed in the context of elderly users.

Only few statements related to this problem were found. For instance, one of the research showed that MOOC quizzes have accessibility issues associated with radio-buttons and check-boxes, more specifically, the possibility of its resizing. The researchers claimed the importance of further investigations of the indicated accessibility issues.

During the current thesis, a lot of issues related to accessibility and usability of MOOC quizzes were identified. For instance, problems associated with the names of the buttons, a lack of explanations for

the answers, difficulties with interactive questions, problems with open question, amount of questions in the quizzes, so on.

The issue related to the name of the button was identified in the courses from edX platform. The button "Show the answer" was responsible for showing the explanation of the answer and didn't show the answer itself. Moreover, it appeared only after user have already clicked on the right answer. The purpose of the button was misunderstood by elderly participants, which caused an inconvenience for them. Also, one of the courses missed the explanations for the quizzes' answer at all. As was mentioned in the results section of the thesis, one of the participants, who have tested another course from edX platform, expected to find an explanation for the right answer after pressing the button, but she didn't. The results showed that this situation caused disappointment and frustration for her.

During the post-testing interviews, the elderly participants also expressed an opinion that after answering the quiz question (and it case the user does not know the right answer), the option, which allows to see the right answer would be very helpful for them. Even though most of the MOOC quizzes allows to answer multiple times, sometimes it takes several attempts to find a right answer.

The practical findings also show that one of the elderly participants had problems with operating the interactive quizzes in the course "Intro to Descriptive Statistics" from the Udacity. He personally explained this by saying that: "I have never try to use something like this course before, and the style is very unusual to me. It was hard to follow the teacher words and quickly answer the questions". He suggested that limited experience with the course format could be the reason for these difficulties.

However, some of the participants did not experienced such problems during the users testing of the course. These differences could indicate the exception of some of results or be associated with differences in participants' experience with the ICT and Internet, since the participant personally associated the difficulties with the limited experience.

Another identified issue related to the usability of the quizzes is open questions, which a user cannot skip. However, it does not matter, which combination of symbols or letters a user will submit. Furthermore, a user will not receive any feedback from the system. The results of the post-testing interviews of the current thesis show that the participants expressed the frustration and confusion. One of the participants emphasized that he did not understand the purpose of this kind of questions.

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The elderly participants also faced another barrier related to the MOOC quizzes during the user testing of the current research. The reason for it was the amount of questions in some quizzes from the tested courses. More specifically, the participants expressed the opinion, that some of the quizzes were too long for them to concentrate.   The observation demonstrates, that quizzes, which contained small amount of questioned (1-3 questions) were more easily perceived by senior users.

During the literature review, another issue related to the quizzes was found. One of the research identified that a multiple-choice question had two right answers instead of one (Bong and Chen, 2016). The authors stated that the participants expressed the confusion due to this situation.

Based on practical findings and literature review, it is possible to assume that unexpected events and results during the Internet usage lead to elderly participants' confusion and sometimes even frustration. Most probably, the reason for such reaction is a lack of experience with ICT, which elderly users have. As was mentioned in the literature review, the elderly people often are inexperienced Internet users (Dickinson et al,2005). Another reason could be their resistance to the changes, which elderly people could often demonstrate (Karahasanović et al, 2009).

Text

The results of the current research also demonstrated that some of the wording in the courses' text pieces (as well as words used in the videos) seemed too scientific for the elderly participants. During the post-testing interviews they mentioned that sometimes it was hard to understand the words and difficult to perceive it. Of course, it is possible to avoid scientific and technical words in some MOOC courses. The use of the words depends on the topic and level of the course. However, as was mentioned in the section "User testing… ", all the selected for the testing courses are introductory. That means that the users do not need any prerequisite knowledge to participate in a course. One of the course's description contains the following words: "The class is designed to be interesting and fun for all backgrounds. Whether you are a scientist of someone who has never take a science class you will have the background you need."

The same issue was identified in Bong W.K. and Chen W. research (2016). The authors claimed that some text wording was too technical for the seniors.

Video presentation format

As was mentioned in the literature review chapter of the current thesis, Guo et al (2014) investigated that some types of video presentation formats are more engaging for the users, than other. The results of their study demonstrated that "informal talking-head videos" are more preferable for the users. The authors also stated that "Khan-style tablet drawings" (interactive format) are more engaging, that classroom lectures. However, as was mentioned in the previous chapter, the results of the interviews with the elderly participants showed that real classroom lecture is one of the most engaging format for the seniors. This results contradict with the Guo et al (2014) statement. It is possible that this difference is due to the difference in the target groups of the studies. When the Guo et al (2014) analysed the data of all the MOOC participants, the current research focused only on the elderly users.

Interface

As was mentioned in the results and analysis section, several elderly participants emphasized that the interface of the edX platform were too complicated for them, which interrupt them from perceiving the content of the courses. During the post-testing interviews, few of the elderly participants mentioned that reducing the number of buttons and tabs on a page would help them to easier operate through the website. The similar recommendation was mentioned in the Bong W.K. and Chen W. research (2016). It states that: "Interface should be simple, organized and informative while icons should be intuitive".

6.3 A set of recommendations

Based on the results of the current research and the identified issues discussed in relation to the literature review findings, the following set of recommendations can be provided:

- It is important to provide the information about how to use transcripts, subtitles and other accessibility and usability features.

- The wording of all features and buttons should be clear and understandable for all the users, including the inexperienced Internet users.

- The length of the educational videos should be kept less than 3 minutes, in order to improve the users' engagement with the videos and hold their attention.

- If there are slides used in the video, it should be informative enough, clearly visible and

accessible.

- The amount of questions in the quizzes should not be more than 5-6 questions.

- A quiz with complicated questions at the beginning of the course discourage an inexperienced user to continue a course, so it is better to start from simple questions.

- The length of text pieces should not be too long, so it would be easier to concentrate for the users.

- The instructions should be given to the users at the beginning of the MOOC course (and not after few steps/lessons) and be easily available during the course usage. The instructions should be more detailed and consider the new Internet users.

- If the course is suitable for a new user, the information provided in the course should be not too scientific or complicated.

6.4 Limitations of the study

One of the limitations of the current research is small amount of the tested MOOC courses. Especially considering, that they represent different types of MOOC content and different types of video format presentation, e.g. video of real classroom lecture, studio videos of the instructor talking with no audience and video in "digital tablet drawing format". However, some of the tested courses represent the similar approaches, for instance, courses "Dog Emotion and Cognition" and "Birds 101: Introduction to Pet Birds" consist of videos with Power Point slides. Five out of six tested courses contain quizzes; three courses have different types of text materials and so on.

Another limitation of the current study is a limited number of participants – fourteen elderly users, and unfortunately, due to limited amount of time, the participants were not able to test a lot of different courses, so each of them tested two courses, based on their preference, so first course was tested with five users, second course – five users, third course – six users, fourth course– four users, fifth course – three users, and sixth course– five users (see table 1). Nevertheless, according to Virzi (1992) five users are enough in order to identify around 80% of usability issues. Also, according to The Nielsen Norman Group (NN/g)[42] and their articles "How Many Test Users in a Usability Study?" (2012) and "Why You Only Need to Test with 5 Users" (2000) by Jakob Nielsen, the best results from usability

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42   https://www.nngroup.com/ - The Nielsen Norman Group (NN/g), American user experience consulting firm

testing come from testing no more than 5 participants. Furthermore, the author claimed that a researcher can learn almost a third part of all usability issues from a user testing with a single user, the data from testing with a second user will already cover a part of the same results as the first user, but also will add a number of new information. When it comes to the third user the expected amount of new insights will be small. The author states, that: "As you add more and more users, you learn less and less because you will keep seeing the same things again and again". In the light of the above, we can see that number of participants in the current research seems reasonable.

Although the participants represent the research's target group – elderly people, none of them have severe age related issues, which could be a serious barrier, when using ICT and Internet. So, recruiting more elderly users, including persons with diverse abilities, could give more complete picture of usability and accessibility issues related to MOOCs.

The current thesis focuses on the issues related to the content of the MOOC courses and MOOC content perception by the elderly people. That is why it is important to understand that different qualities of the courses' materials (its level of difficulty, used wording, topic of the course, so on) could influence the results of the study, especially in the case, when users have limited Internet experience. However, the researcher tried to minimize these factors by selecting the courses, which represent the similar approaches and have the same level of difficulty (introductory level).

Summing up, despite some limitations, the research represented in current thesis may still present a valuable step in the investigation of MOOC content accessibility.

6.5 Summary

In this part of the current thesis the empirical results were discussed in the relation to the literature review findings. The results of literature analysis showed that elderly users' engagement with MOOC courses needed more investigations. As well as issues of MOOC content accessibility and usability were not sufficiently studied.

The findings conformed the literature, which stated that usually elderly users express positive attitude towards MOOCs. As well as the statement that MOOCs hold a number of accessibility and usability barrier for elderlies (related to subtitles and transcripts, length of the videos, text materials and language of the course). The results also identified the issues, which were not mentioned in the literature (for example, related to quizzes). Based on the findings of the current research, a set of

recommendations was developed. In the final part of the chapter limitations of the study were

elaborated in order to show propositions for future researches in this area.

7. CONCLUSION AND FUTURE WORK

7.1 Conclusion and contribution

This research describes and analyses elderly users' engagement with Massive Open Online courses. First, I presented critical literature review where importance of understanding barriers, which elderly users experience while using the Internet, is stressed and elaborated on the existing issues. Then these issues are overviewed in the context of usage of different types of MOOC content by elderly people.

As empirical part 14 user testing sessions with post-testing interviews were conducted. Afterwords, all empirical findings were analysed through the prism of literature review. As a result, the following conclusion can be formulated.

The research aims at contributing to the filling the gap in this research area, which is caused by the lack of the empirical studies. It sought to gain understanding on how elderly people perceive different types of MOOC content and its presentation. What changes should be done in order to make the MOOCs more accessible and usable?

Answering the first research question *"What known ICT barriers can be experienced with each type of MOOC content?",* results indicate that the following ICT barriers that could be expected in this case: lack of subtitles (captions), lack of transcripts; visual dispersion and cognitive overload caused by videos' captions; issues related to user's vision, which influence ability to watch video, issues related to user's hearing, which influence ability to hear audio track of the video; technical jargon and Web terminology; foreign language issue; problems related to syntax; lack of alternative text.

Answering the second research question "*Which barriers elderly users could face using MOOC?",* it is safe to assume that elderly participants can face following ICT barriers: limited information and instructions of how to use transcripts, subtitles and other accessibility features; not clear and not understandable wording of the buttons; the length of some MOOC videos, as well as the length of some text pieces, is too long to concentrate; the slides in the MOOC videos could be not clearly visible for the elderly users; some of the discussions could be closed; some text instructions are given to the users after few steps, when they should use new for them features from the start of the course.

Answering the third research question "*How each MOOC content type is perceived by seniors?",* it is

possible to say that the real classroom lecture video format was considered as the most preferable by all the participants who tested it; that the less experienced participant had difficulties with the interactive format of one of the tested courses, while the more experienced user highly appreciated the interaction part.

This research was one of the first attempts to put bigger emphases on MOOC content types in order to investigate issues faced by elderly in relation to each of the types. The study concludes that elderly users express positive attitude towards MOOC as a way of learning new things. With that being said, some adjustments need to be made in order to make the MOOC content more accessible and usable, because there are several issues with different content types which make it harder for elderly people to take full advantage of MOOCs. Based on the results of the research, the set of recommendations for potential accessibility and usability improvement of MOOCs for senior users were elaborated.

7.2 Propositions for future research

Even though a lot of research already has been conducted in this field, this area of study still has a lot of room for additional research. The results of the literature review showed that the issue of MOOC quizzes accessibility and usability was not sufficiently investigated, and this topic was not illuminated in context of elderly MOOC users. So, this issue could become a focus of future studies, especially considering the amount of issues related to the quizzes usability, which were identified in the current thesis. As well as elderly users' engagement with the MOOC discussions.

Sample size and diversity of disabilities could be considered as the main limitation to this research. Even though sample was big enough, it is better to have even bigger sample with inclusion of people with bigger and more diverse set of disabilities. So, it seems to be logical to provide some similar empirical research and include elderly people with reduced vision or/and hearing, reduced motor skills, some cognitive issues or other disabilities. Another suggestion is that it could be useful to test more MOOC courses from different MOOC platforms. Also, as was mentioned before, due to limited amount of time, the participants have tested only few lessons of each course, so the next step could be a testing of a course from start to end.

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Appendix 1

Consent form

The current research is part of the Master Thesis in Universal Design of ICT,

Department of Computer Science, Faculty of Technology, Art and Design,

Oslo and Akershus University College of Applied Sciences

The information about the student:

Name: Anna Nishchyk

Phone: 451 28 733

E-mail: annanishchyk@gmail.com

Purpose of the Study: The goal of this study is to explore accessibility and usability barriers related to MOOC content for elderly students.

Procedures: Participation in this study required one meeting lasting approximately 2 hours. In the meeting, we will ask you to 1) answer some general questions about your experience with IT (computer technology), 2) do some tasks involving MOOC courses while the researcher is observing, and 3) participate in an interview about how you experienced the MOOC courses in part 2.

Risks/Discomfort: There are no known health risks involved in participating in this research. If you would feel any discomfort or fatigue during the process, it is possible to make breaks to rest. You will be given several opportunities to rest, and additional breaks are also possible.

Benefits: Your participation may contribute to results that, we hope, will be useful to the future improvement of MOOC courses.

Alternatives to Participation: Participation in this study is voluntary. You are free to withdraw or discontinue participation at any time. The withdrawing from the study will not have any consequences to you. You can demand that your data be deleted from the study.

Confidentiality: All information collected during the study period will be kept strictly confidential. No publications or reports from this project will include identifying information on any participant. If you agree to join this study, please sign your name below.

___I have read and understood the information on this form.

___I have had the information on this form explained to me.

_____   _____

Signature   Date

If you have any additional questions about the current research please contact Anna Nishchyk, phone: 451 28 733, e-mail: annanishchyk@gmail.com

The supervisor of the Master thesis:

Norun Christine Sanderson,

Associate Professor at Oslo and Akershus University College of Applied Sciences

Contact information:

E-mail: Norun-Christine.Sanderson@hioa.no

Phone (office): +47 67 23 86 73

Visiting address: Pilestredet 35, Oslo, PS336

Appendix 2

The interview guideline

The question: "What topics are you interested in? Are you interested in animals, poetry, health, programming, statistics or other?" will be asked before the interview.

- **Pretesting interview (information about user, his/her experience with computer, Internet, his/her attitude towards e-learning and MOOCs)**

G1. Personal information

- How old are you?

- How many years are you retired?

- What kind of work did you have?

- How well do you understand (read/write) English?

- Are you interested in leaning something new in your free time? Why?

   If "yes":

4. a) How do you like to learn (reading books, join courses, studying with friends)?

G2. Computer proficiency and Internet experience

- Have you used computer (laptop, tablet) before (at work or just for yourself)?

   If "yes":

5. a) How many years have you used computer?

5. b) How often do you use computer?

5. c) Did you participate in any computer trainings?

5. d) What do you usually use computer for?

- Have you used Internet before?

   If "yes":

7. a) Do you use it often?

7. b) What do you usually use Internet for?

7. c)Which devices do you usually use to access Internet?

- Have you had any difficulties using computer or Internet? (Based on the answer ask additional questions).

If "yes":

8. a) What do you think what the reason or reasons of these difficulties?

G3. Learning, education preferences (if the participant has some experience with Internet)

- Have you used Internet for learning purposes?
- Do you have experience with any websites for education? As e-learning, online learning…
  If "yes":

10. a) Please, describe your experience.

- Have you heard about MOOCs before? (if not, explain)
- When learning some new information on Internet, do you prefer text, video, audio?
- Do you like quizzes, when learning something on Internet?

Post-test interview (after each course)

Course 1. Example: Coursera, "Dog Emotion and Cognition" (represents the video lecture with Power Point slides). The course consists of video (approximately 8 min each), Power Point slides and quizzes.

Task 1 (approximately 25 min): *Please follow the course and watch first and second lessons and answer two quiz questions after the second lesson.*

    a) During the first video: could you please make the video slower/faster?

    b) During the second video: Could you please turn on/off subtitles?

Questionnaire:

- How did you experience the course? What do you think about it?
- Was it easy to follow the course? If not, why?
- Was the content easier to comprehend?
- Did you experience any difficulties?

If "yes":

4. a) What kind of difficulties did you experience?

4. b) What do you think? What were these difficulties caused by?

4. c) Is this could have something to do with how it was presented to you? (type of video, text)?

- What do you think about the presentation format?
- Was it difficult to operate the course?
- How did you experience the language of the course? Was it understandable for you?
- Did you experience any difficulties with wording? Were some word not clear for you? Do you remember any examples?
- Was the original speed of the video too slow or too fast for you?
- Were the subtitles useful for you? Or was it distracting?
- **Special question for the course:** Was the transcription of the video useful for you? Or was it distracting?
- **Special question for the course:** Was the Power Point slides clear to you? Was it useful?
- Did you feel that you need any additional materials?
- Would you like to change something in the course? What exactly?

   If the user pressed pause during the usage of the course:
- Why did you press pause?

A small break (approximately 10 min)

Course 2. Example: Udacity, "Intro to Descriptive Statistics" (represents video in "digital tablet drawing format"). The course consists of interactive video (approximately 40 sec each) mixed with quizzes, few short lecture video and text instructions.

Task 2 (approximately 20 min): *Please follow the course and finish first 7 steps in lesson 1.*

Questionnaire:

1. How did you experience the course? What do you think about it?

2. Was it easy to follow the course? **If "no":** why?

3. Was the content easier to comprehend?

4. Did you experience any difficulties?

If "yes":

4. a) What kind of difficulties did you experience?

4. b) What do you think? What were these difficulties caused by?

4. c) Is this could have something to do with how it was presented to you? (type of video, text)?

5. What do you think about the presentation format?

6. Was it difficult to operate the course?

7. How did you experience the language of the course? Was it understandable for you?

8. Did you experience any difficulties with wording? Were some word not clear for you? Do you remember any examples?

9. Was the original speed of the video too slow or too fast for you?

10. Were the subtitles useful for you? Or was it distracting?

11. **Special question for the course:** What do you think about the quizzes?

12. **Special question for the course:** Was it easy to find the way how to answer the quiz questions?

13. Did you feel that you need any additional materials?

14. Would you like to change something in the course? What exactly?

If the user pressed pause during the usage of the course:

15. Why did you press pause?

A small break (approximately 10 min)

Course 3. Example: edX, "Shakespeare: On the Page and in Performance" (represents video of "real classroom lecture"). The course consists of video of real classroom lecture (approximately 8 min each).

Task 3 (approximately 25 min): *Please follow the course and watch first and second lessons and answer quiz questions after the second lesson.*

   a) During the first video: could you please make the video slower/faster?

   b) During the second video: Could you please turn on/off subtitles?

Questionnaire:

1.   How did you experience the course? What do you think about it?

2.   Was it easy to follow the course? If not, why?

3.   Was the content easier to comprehend?

4.   Did you experience any difficulties?

If "yes":

4. a) What kind of difficulties did you experience?

4. b) What do you think? What were these difficulties caused by?

4. c) Is this could have something to do with how it was presented to you? (type of video, text)?

5.   What do you think about the presentation format?

6.   Was it difficult to operate the course?

7.   How did you experience the language of the course? Was it understandable for you?

8.   Did you experience any difficulties with wording? Were some word not clear for you? Do you remember any examples?

9.   Was the original speed of the video too slow or too fast for you?

10. Were the subtitles useful for you? Or was it distracting?

11. **Special question for the course:** Was the transcription of the video useful for you? Or was it distracting?

12. **Special question for the course:** Was the Power Point slides clear to you? Was it useful?

13. Did you feel that you need any additional materials?

14. Would you like to change something in the course? What exactly?

   If the user pressed pause during the usage of the course:

15. Why did you press pause?

III. Post-test interview (after all courses)

1. How did you experience the MOOC courses? What do you think about them?

2. Which course have you experienced as more easy or difficult than other? Why?

3. Which of the content do you liked best? Why?

4. Which of the content seemed easier to comprehend? Why?

5. Which of the presentation format do you liked best? Why?

6. Would you like to use these courses in the future? Why?