THE DEVELOPMENT
AND IMPLEMENTATION
OF A MOOC PLATFORM MODEL
FROM A TECHNICAL
AND EDUCATIONAL PERSPECTIVE

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Universitatea Politehnica Timişoara a iniţiat seriile de mai sus în scopul diseminării expertizei, cunoştinţelor şi rezultatelor cercetărilor întreprinse în cadrul şcolii doctorale a universităţii. Seriile conţin, potrivit H.B.Ex.S Nr. 14 / 14.07.2006, tezele de doctorat susţinute în universitate începând cu 1 octombrie 2006.

Foreword

This thesis was written during my doctoral studies, which took place within the Department of Communications from the Politehnica University of Timişoara.

My research is directed towards one of the most discussed topics in education in the world during the last years, namely MOOCs (Massive Open Online Courses). The decision of undergoing this endeavour was mainly influenced by my constant desire to be part of the solution and not just a critic of the problem. My beliefs that a MOOC platform developed for the Romanian educational system would be beneficial to the Romanian students were the fuel that kept me going.

After carefully analysing the existing literature and understanding the needs, of Romanian students and teachers, of e-Learning solutions, I developed a model, from both a technical and instructional perspective, of a Romanian MOOC platform. The implementation of this model is also presented in this thesis, as I customized a Moodle platform to mould the model under the UniCampus name, a first Romanian MOOC platform.

Special thanks goes to the entire teams of the Multimedia Research Centre and the ID/IFR and e-Learning Centre, with whom I had a very prolific collaboration and who helped me gain better knowledge and achieve greater results. In particular, I am grateful to my colleagues Mihai Oniţa and Andrei Ternauciuc. The scientific results of our joint work can be seen in the pages of this thesis.

I am extremely grateful to Professor Radu Vasiu, my PhD scientific coordinator and to Diana Andone for their constant support during my doctoral period. Their wisdom and guidance were valuable assets to the development of this thesis. Without their support, the importance and impact of my scientific results would have been significantly diminished.

Finally, I am deeply grateful to my family and friends for inspiring and supporting me during this whole period. Their understanding of my status and their patience towards the priority of my PhD paper helped me a lot to get easily over these years.

Timişoara, February 2016   Vlad Mihăescu

For my family.

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LIST OF ABBREVIATIONS

ADDIE	Analysis, Design, Development, Implementation, Evaluation
cMOOC	Connectivist MOOC
CVUPT	Virtual Campus of the Politehnica University of Timişoara
HE	Higher Education
MOOC	Massive Open Online Course
OCW	OpenCourseWare
OER	Open Educational Resources
OEW	Open Education Week
OnER	Online Educational Resources
UPT	Politehnica University of Timişoara
xMOOC	eXtended MOOC/Behavioural MOOC

1. MOTIVATION

1.1.   General Overview of the Selected Subject

If you are involved with education, then the chances are extremely high that you have heard the term 'MOOC' being mentioned more than once. MOOC stands for Massive Open Online Course and is one of the most trending words in Higher Education today. The first generally recognized MOOC was developed by George Siemens and Stephen Downes at the University of Manitoba, Canada, in 2008. Siemens and Downes delivered an online course called "Connectivism and Connective Knowledge" [1] as the first MOOC, based on a connectivist pedagogy. The course attracted a number of over 2,300 people, of which only 25 were on-site students.

However, the term gained worldwide recognition starting with 2011-2012, when professors from the Computer Sciences department of Stanford started two of the most renowned MOOC platforms so far, Coursera (Andrew Ng and Daphne Koller) and Udacity (Sebastian Thrun). These two venture capital supported websites became so popular that New York Times called 2012, "the Year of the MOOC" [2].

Open online courses have been on the web for some time up to this point; nevertheless, it is only now, in the past few years, that they gained the right momentum. The massive enrolment that some courses obtained (e.g. 150.000 for Sebastian Thrun's "Artificial Intelligence" course on Udacity [2]) was the clear sign of the potential that MOOCs may bring to education.

During the time I was involved with the Politehnica University of Timişoara, I was part of several projects of the Multimedia Centre and the Centre of e-Learning. This experience as a whole helped me to better understand how the Higher Education (HE) system works in Romania. I decided that I do not want to be one of the many who only criticise and point fingers at everything that is wrong with our education system. I was going to be part of the solution.

In my opinion, and this is my main research hypothesis, one solution for the improvement of Romanian education, especially HE, in many of its flawed components, would be the use of MOOCs. This could happen in two main ways, either as a complement to existing education programs, embracing the flipped classroom concept and trying to use external MOOC platforms for completing or replacing parts of the traditional course, or through an independent Romanian MOOC platform.

In order to sustain that hypothesis I will present answers to some research questions, such as:

1. Is there a need for e-Learning solutions and MOOCs in Romania?
2. Can a MOOC improve education in Romania?
3. How can you measure the usability of a MOOC from an educational point of view?
4. Which tools and technologies influence the usability of a MOOC platform?
5. What is the best possible educational structure for a MOOC in Romania?
6. What is the best possible technological structure for a MOOC in Romania?

The undeniable influence of MOOCs over education, in general, and HE, in particular, is a strong reason for researching MOOCs' impact in Romania. There is a need of a thorough theoretical research, underlining the advantages and disadvantages of these platforms with particular study cases regarding their use in the Romanian education. The best outcomes for a utility analysis of MOOCs in Romania are going to emerge after the construction and use of an independent Romanian platform, built to serve the needs of Romanian students and teachers alike.

Therefore, my thesis presents a literature analysis of the MOOC subject, concentrating on what MOOCs are, how they work, how they are used and what the technologies behind them are. Then, I outline the research methods that I chose for conducting my investigation. I present different study cases of MOOC integration inside traditional courses in the Romanian higher education, analysing both the perspective of the students and the teachers. Afterwards, I propose the structure of a Romanian MOOC platform based on my research findings. Finally, I will draw the conclusions regarding my research of the implementation of MOOCs in Romanian education and present future study directions.

1.2.   List of Published Articles

My research activity, in the field of the thesis or related areas, has been backed up by the following list of published articles, both as author or co-author:

Vlad Mihăescu, Diana Andone, Radu Vasiu, "An Analysis of Different MOOC Environments from the Students' Perspective", Proceedings of the European Stakeholder Summit on experiences and best practices in and around MOOCs (EMOOCS 2016), pp. 417-424, ISBN 9783739237107, 22-24 Feb 2016, Graz, Austria, Experience Track.

Vlad Mihăescu, Radu Vasiu, "Teachers' Perspective into Higher Education and MOOCs in Romania", in Proceedings of the 10th International Conference on Virtual Learning, ICVL 2015, Timişoara, Romania, 2015, ISSN 1844-8933, pp. 393-398.

Vlad Mihăescu, Diana Andone, "A Word Cloud of MOOC Research Report", Proceedings of the 3rd International Conference on Social Media in Academia: Research and Teaching, SMART 2015, Voroneţ, Romania, 2015.

Diana Andone, **Vlad Mihăescu,** Radu Vasiu, "Using MOOCs within traditional courses: students' perspective", In Proceedings of E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2015 (pp. 256-262). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Diana Andone, Andrei Ternauciuc, **Vlad Mihăescu** and Radu Vasiu, "Integrating MOOCs in Traditional Higher Education", European Stakeholder Summit on experiences and best practices in and around MOOCs, eMOOCs 2015, 18-20 May 2015, Mons, Belgium, Experience Track, pp. 71-75.

Oniţa Mihai, **Mihăescu Vlad**, and Vasiu Radu, "Technical Analysis of MOOCs.", *TEM JOURNAL - Technology, Education, Management, Informatics*, ISSN 2217-8309, e-ISSN 2217-8333, WOS:000362664800007, Vol. 4, No. 1, Feb 2015, pp. 60-72.

Vlad Mihăescu, "MOOCs – an important step in education", Scientific Bulletin of the Politehnica University of Timişoara – Transactions on Electronics and Communications, Volume 59(73), Issue 2, 2014, pp. 27-30.

Vlad Mihăescu and Radu Vasiu, "Use of Web 2.0 and Web 3.0 in Developing a MOOC Platform", the 7th International Conference of Education, Research and Innovation, ICERI2014, Seville, Spain, November 2014, WOS:000367082903125.

Vlad Mihăescu, Radu Vasiu and Diana Andone, "Developing a MOOC: The Romanian Experience", 13th *European Conference on e-Learning* ECEL-2014, Aalborg University Copenhagen Denmark, 30-31 October 2014, ISBN 978-1-910309-69-8, ISSN 2048-8645, WOS:000351434400043, pp. 339-346.

Vlad Mihăescu, "MOOC Openness - Are MOOCs as Open as They Should Be?", Proceedings of the 2nd International Conference on Social Media in Academia: Research and Teaching, SMART 2014, Timişoara, Romania, September 2014, WOS:000367888300059.

Ternauciuc Andrei, and **Vlad Mihăescu**, "Use of Social Media in MOOC-integration with the Moodle LCMS", 10th International Conference "e-Learning and Software for Education" ELSE 2014, Bucharest, 24-25 April 2014, ISSN 2066-026X, WOS:000357153000043, vol. 1.

Mihăescu, Vlad, and Radu Vasiu, "Wrapping MOOCs – Analysis From a Technological Perspective.", 10th International Conference "*e-Learning and Software for Education*" ELSE 2014, Bucharest, 24-25 April 2014, ISSN 2066-026X, WOS:000357153000037, vol. 1, pp. 261-264.

Radu Vasiu, Diana Andone, **Vlad Mihăescu**, Radu Ticiu, "Antreprenoriat şi inovaţii digitale pentru mediul de afaceri", Editura U.T.Press, Cluj-Napoca, 2013, 177 pag, ISBN 978-973-662-894-8.

Diana Andone, Radu Vasiu, Iasmina Ermalai, **Vlad Mihăescu**, Silviu Vert, Bogdan Drăgulescu, Daniel Ivanc, "Tehnologii Web 2.0", Editura U.T.Press, Cluj-Napoca, 2012, 275 pag, ISBN 978-973-662-770-5.

Vlad Mihăescu, Radu Vasiu, "Open Tourism – An E-Tourism Concept", Proceedings of the IADIS International Conference *WWW/Internet 2011*, Rio de Janeiro, Brazil, 5-8 November 2011, 5 pages, ISBN (Book): 978-989-8533-03-6.

Vlad Mihăescu and Silviu Vert, "Learnability Testing: a Case Study," in *Proceedings of the 6th International Conference on Virtual Learning, ICVL 2011*,

Cluj-Napoca,   Romania,   28-29   October   2011,   ISSN: 1844-8933, WOS:000323685900017, pp. 135–140.

1.3.   Structure of the PhD Thesis

The thesis is organized in several chapters, described below.

Chapter 1 presents my motivation for choosing this particular subject as my thesis focus. I give a general overview of the selected subject together with my involvement in the MOOC phenomenon. This first chapter includes the list of the papers and publications of which I was an author or co-author, related to the topic, and delivered in the period of my doctoral research. The chapter ends with this overview of the structure of the thesis.

Chapter 2 gives an overview of Massive Open Online Courses, starting with a short introduction about what MOOCs are, their features and particularities. Then, I enlist important moments in MOOC, e-Learning and distance education history. Afterwards, follows the presentation of the biggest MOOC platforms on the market. Then, I present a short analysis about how "open" MOOCs really are. Finally, I present some aspects regarding the impact MOOCs have on education and economy.

Chapter 3 points out the web technologies that MOOCs use. I talk about social media in MOOCs with specific examples regarding the use of web 2.0 and web 3.0 technologies in these platforms. Furthermore, a presentation of the technological profile of MOOCs is included with accent being put on video distribution systems, format profile and audio-video metadata. Next, a description of the types of video lectures used in MOOCs is presented. This chapter also contains information about the Moodle platform and why I propose it as a basis on which to build my MOOC concept.

Chapter 4 is a description of existing research in MOOCs, followed by the methodologies used in this thesis. Next, I present the different types of MOOCs, categorised by their means of use. An overall evaluation of existing research is presented and a Word Cloud, constructed around over 1000 MOOC articles, gives a statistical overview of the subject.

Chapter 5 describes the current status of MOOCs in Romanian Higher Education. The chapter starts with a short presentation of Open Educational Resources in Romania, followed by a literature review of Romanian MOOC research. Two big studies were conducted, under the form of online surveys. The surveys were designed separately for students and teachers in Romania and contained questions related to Online Educational Resources, videos used in education and MOOCs.

Chapter 6 presents a study case of the use of MOOCs integrated within courses of the Politehnica University of Timişoara. The background of the courses offers a general perspective of the typology of students involved. I then present the methodology of the research. I offer the summary of the analysis of the students and my interpretation of that analysis.

Chapter 7 contains the proposed structure and methodology of the MOOC model. First, I describe the concept of this Romanian MOOC together with both instructional and technological aspects. Then, I present the structure in detail and offer a complete step-by-step description of the model. The chapter ends with the evaluation, made by education experts, of the proposed model.

Chapter 8 is the practical demonstration of the platform UniCampus, which is built around the model described in chapter 7. I explain how I customized the Moodle platform and the plugins that I have used. Afterwards, I present a pilot course, in order to be able to test the model. The test is realized with the help of education experts whose evaluation is presented. I conducted focus groups with students in order to proper test the platform from the students' perspective.

Chapter 9 represents the final part of the thesis. I start with general conclusions regarding the research that I have developed these past years. After that, I present the theoretical contributions that this thesis brings to the MOOC scientific field and the practical contributions that emerged. Finally, I finish by presenting future research directions useful for other researchers in the field or for my own future work.

2. DEFINITIONS OF MOOCS

2.1.   A Short Introduction to MOOCs

Since prehistoric times, one by one, each field has suffered more or less dramatic changes. Disruption appeared in economy, labour, health, technology, human rights, war and the list could go on. However, in my opinion, which is aligned with the majority of researchers in the field, one particular domain has remained, in a general understanding, unchanged. Of course, I speak about education. One could argue that a lot of change occurred, but, I underline the main concept of education in a symbolic learning-trinity: teacher-material-student. The educational flow states that the teacher will present the material to the student.

In fact, I want to point out the major changes education underwent in its history. In the beginning, education was done orally, and I can underline the best example in the philosophical school of the Greeks. The first big disruption happened at the moment of Gutenberg's invention of the printing press (1439), which was of great help for information dissemination, as until then most of the texts were hand written and access to knowledge was limited. We move now almost 500 years into the future, to the first public radio broadcast (1910) of a live Metropolitan Opera House performance, which opened the way to a new way of spreading information. One can honestly say that the 20th century brought many changes into the educational methods and ways of information transmission with the subsequent invention of the radio, television, computer and finally, the Internet. The Internet itself was a revolution, as it opened an unimagined potential for communicating and finding information on every possible field one could imagine. To quote Sir Tim Berners-Lee, "it's difficult to imagine the power that you're going to have when so many different sorts of data are available" [3].

Nevertheless, one specific internet technology, so far, was the most stated to strongly disrupt education as we know it. In 2008, two Canadian researchers and teachers, Stephen Downes and George Siemens, developed a connectivist course [1][4], CCK08 "Connectivism and Connective Knowledge", which they held online and left entirely open for anyone to join. They were surprised to have over 2300 students enrolled who interacted and collaborated like never before seen. During a conference call they had with Dave Cormier, the latter came with the name "MOOC" [5][6] for the new educational paradigm. This is an acronym and it stands for Massive Open Online Course. In an amusing note, he keeps stating both in private and at conferences that he is sorry he did not came up with a better name.

As I just mentioned, MOOC is an acronym for Massive Open Online Course, where:

- Massive refers to the potential of extremely large enrolments; thousands of students register from all over the globe [7];
- Open can refer to the methods, tools and all content [8]; it can also be related to the enrolment of anyone who has Internet access regardless of their prior learning;
- Online, as Decker [7] says, is the mean of content delivery. From Levine's perspective, "Online is not just where it lives, but Internet culture is woven into the course itself as an ethos"[9];

As Hargittai said, "Achieving a knowledgeable Internet citizenry is unlikely to be resolved through a solely technical approach that focuses only on infrastructure without any consideration of the social processes and institutions in which people's Internet uses are embedded" [10].

The Course implies some non-official agreements/conventions of how it operates (the start and end date, design, credits, distribution methods, type of video lectures chosen, etc.).

The idea of education offered online, for free, to the masses was not new, as other ventures like OpenCourseWare [11], AllLearn [12], Fathom [13] or even Khan Academy [14], just to name a few, appeared and some of them even disappeared until MOOCs came into the picture. I believe that the time synchronization was not proper before. The next step into MOOC development was the year of 2011 when different professors from Stanford started, in parallel, the privately funded Coursera and Udacity, offering courses that gathered as much as over 100.000 students in one iteration [15][16]. The "MOOC-mania" was fully unleashed in 2012, sustained also by Laura Pappano's New York Times article "The year of the MOOC" [2].

Since then, a plethora of MOOC providers and courses appeared, offering a diversity of educational material that would have been unimagined 50 years ago. The concept of MOOCs is simple: you need an internet connection and a device on which to access it; you choose one of the multiple courses available; you start it right away, or wait for the starting date when the materials will be available, depending on the platform you choose; then, you start learning in your own rhythm and way - depending on the platform, this rhythm could be constrained, as there are weekly or monthly assignments that need to be completed. The fact that MOOCs are offered within a paced and time-dependent course model limits its flexibility [6]. If you choose to finish the course, most of them offer you the possibility of receiving some sort of credentials. You might be required to have a written exam or to submit a specific paper or project. Some platforms require payments in order to offer credentials, others offer open credentials and/or badges. Some platforms promote the idea of proctored exams in collaboration with institutions like Pearson VUE, others work in the system of peer-reviews or they have software or employees that review the final assignments of the students.

We can see the phenomenal growth of MOOC courses over the years in the Figure 2.1.

Growth of MOOCs

Cumulative number of courses started/scheduled
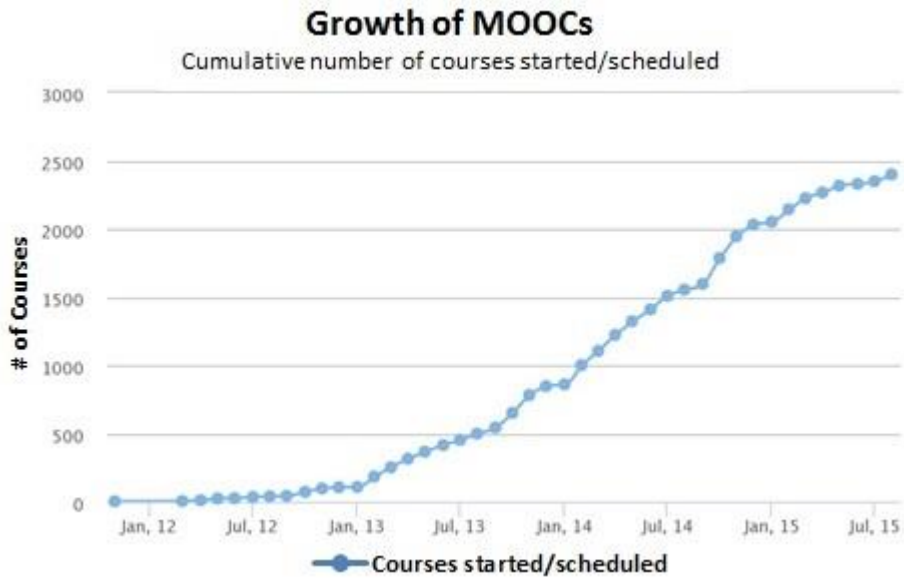
Figure 2.1. Growth of MOOCs. Adapted from [17].

The distribution of the courses among the different providers, calculated in December 2014, can be seen in Figure 2.2.
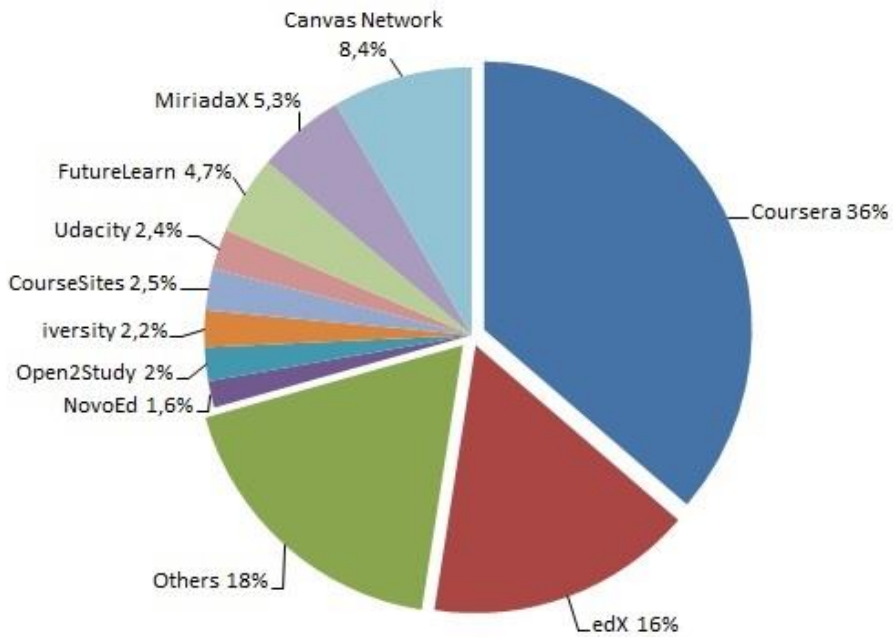
Figure 2.2. Course distribution by provider. Adapted from [17].

One of the first researches in the field states that, "a MOOC integrates the connectivity of social networking, the facilitation of an acknowledged expert in a

field of study, and a collection of freely accessible online resources" [6]. What is believed to be the most important by some is that the MOOC builds on the active engagement of a massive number of students who self-organize their participation according to learning goals, prior knowledge and skills, and common interests.

There are similarities and differences between MOOCs and traditional courses. The course structure, curricula and material are usually the same in large proportions for both types of courses [6]. However, in a MOOC there are no fees for participants; they only need Internet access and knowledge of Internet use. On the downside for some, there is no formal accreditation for MOOCs. However, lately, some MOOCs offer the possibility of obtaining some sort of formal credentials or diploma, of course for a specific tax that the student pays online.

MOOCs have been divided into two big groups that differ a lot from each other from the point of view of the pedagogy, the course structure and the interaction of the students with the teacher and with each other: cMOOCs and xMOOCs [18].

The cMOOCs are based on the connectivism theory of learning with networks developed informally. They provide a platform to explore new pedagogies beyond traditional classroom settings. cMOOCs provide great opportunities for non-traditional forms of teaching approaches and learner-centred pedagogy where students learn from one another [19]. Cormier defined five steps for success for a connectivist MOOC [20]: orient, declare, network, cluster and focus.

In a connectivist course, everything is optional. What is important about a connectivist course, after all, is not the course content. It serves merely as a catalyst, a mechanism for getting the projects, discussions and interactions off the ground [21]. Connectivist teaching and learning consists of four major sorts of activities: aggregation, remixing, repurposing and feeding forward.

Downes states that, "the theory of knowledge underlying the creation of the cMOOC suggests that learning is not based on the idea of remembering content, nor even the acquisition of specific skills or dispositions, but rather, in engaging in experiences that support and aid in recognition of phenomena and possibilities in the world. So the cMOOC is harder, requiring a greater degree of literacy, but in developing these literacies, promotes a deeper learning experience" [22].

The xMOOCs (appeared in 2011) follow a more behaviourist approach. It is the instructional model, essentially an extension (eXtended MOOC – xMOOC) of the pedagogical models practiced within the institutions themselves. xMOOCs can be divided into for-profit and non-profit. They are based mainly on interactive media, such as lectures, videos and text. They have been criticized for lacking any innovation in what pedagogy is concerned and for adopting a knowledge transmission model [23]. However, they have a huge success amongst students, possibly because of the effervescent nature of their discussion forums and their available learning tools and virtual laboratories [24].

xMOOCs are in essence considered to be a technology-enriched traditional teacher-centre instruction [23]. The xMOOCs have a formal (traditional) course structure and flow while the cMOOCs have some content as a starting point and then the learners are expected to create and extend the content. Some believe the xMOOCs are at the intersection of Wall Street and Silicon Valley [25].

Bates addresses the myth that xMOOCs are a new pedagogy. In fact, he notes, so far the teaching methods "are based on very old and outdated behaviourist pedagogy, relying primarily on information transmission, computer-marked assignments and peer assessment"[26]. Other researches show that students reported that assessing others' work was an extremely valuable learning

activity [27]. Bates goes on to remind the xMOOCs movement that it did not invent online learning and that the useful techniques that it is discovering – and likes to claim it has invented – are already well known in distance learning and in some cases go back 40 years [28].

However, the search is still on for reliable ways of making money out of xMOOCs, especially for the universities involved. It is unfortunate that Daphne Koller (one of the founders of Coursera) [29] "justifies xMOOCs in a particularly inept way by claiming that they are the answer to increasing access to higher education in developing countries" [28].

Siemens depicts beautifully the difference between the two: "our cMOOC model emphasises creation, creativity, autonomy and social networking learning", whereas the xMOOC model emphasises "a more traditional learning approach through video presentations and short quizzes and testing. Put another way, cMOOCs focus on knowledge creation and generation whereas xMOOCs focus on knowledge duplication" [18].

As Anderson said, "in order to achieve scalability, xMOOCs digitize teachers on video and use machine scoring of quizzes, thus morphing lectures, discussions, tutorials and feedback from classroom student-teacher interaction into student-content interaction. By contrast, cMOOCs induce students to take roles that are more active in their learning and to construct, share, distribute and comment upon artefacts of their learning experience. Thus, they are gaining scalability by substituting student-teacher interaction by scaling student-student interaction" [8].

The challenge is to combine the organic benefits of communities from cMOOCs with the more formalized structure of xMOOCs [30].

To finish this discussion looking into the future, we can catch a glimpse of hybrid MOOCs that will try to incorporate the best parts of both cMOOCs and xMOOCs creating a better user experience for students.

Clark [31] identifies eight types of MOOCs: transferMOOCs (majority of Coursera); madeMOOCs (hand on board) – VOOCs, Udacity courses; synchMOOCs (fixed dates); asyncMOOCs (no fixed dates); adaptiveMOOCs (Cogbooks); groupMOOCs (group work); connectivistMOOCs; miniMOOCs.

To conclude this introduction, I state that, even if some reports note that MOOCs represent a "pivotal development" in the evolution of higher education and have the potential to revolutionise the way a centuries-old industry has operated [32], there are some people who think that MOOCs are really just one point, if an admittedly large and very visible one, on the continuum of online education [33].

2.2. History

As I have mentioned before, MOOC is an acronym standing for "Massive Open Online Course", the term being first used during a Skype conversation between Dave Cormier [34] and George Siemens. In 2008, Siemens and Downes delivered an online course called Connectivism and Connective Knowledge [35] as the first MOOC – Massive Open Online Course, based on a connectivist pedagogy. Conole best described the course: "the course aimed to foster the affordances of social and participatory media. It relied on the benefits of scale though significant interaction with a distributed network of peers. Participants were encouraged to use a variety of technologies, to reflect on their learning and to interact with others. There was no 'right way' through the course; the emphasis was on personalized learning through a personal learning environment" [20].

One of the big advantages of MOOCs is the possibility of users to connect no matter what their expertise, age or background. No one who wishes to participate is excluded and students negotiate the degree and form of their participation according to their individual needs and desires, regardless of whether those needs are defined, for example, by personal interest or workplace requirements [6]. From a theoretical perspective, this creates a very broad form of "legitimate peripheral participation" [36] which allows individuals to be drawn into the community of practice at whatever rate is comfortable for them.

The original aim of MOOCs was to open up education and provide free access to university level education for as many students as possible. In contrast to traditional university online courses, MOOCs have two key features [19]:

1. Open access - anyone can participate in an online course for free.
2. Scalability - courses are designed to support an indefinite number of participants.

MOOCs have in common some of the aspects of an ordinary course, such as a predefined timeline and weekly topics to consider, but generally have no fees, no prerequisites other than Internet access and interest, no predefined expectations for participation, and, at the beginning, no formal accreditation (there exist some MOOCs that are affiliated with an institution and provide students the option of formally enrolling in the course and submitting assignments for official scores)[6].

The Horizon Report of 2013 states that "led by the successful early experiments of world-class institutions (like MIT and Stanford [11]), MOOCs have captured the imagination educational innovations have. High profile offerings are being assembled under the banner of institutional efforts like edX, and large-scale collaborations like Coursera and the Code Academy. As the ideas evolve, MOOCs are increasingly seen as a very intriguing alternative to credit-based instruction. The prospect of a single course achieving enrolments in the tens of thousands is bringing serious conversations on topics like micro-credit to the highest levels of institutional leadership" [37].

The interest is in new educational models and new course formats, as today, most of the courses provided through MOOCs, largely mirror the existing traditional course formats.

Education is in a period of change. The high tuition prices that increase each year, especially for the Universities from the United States of America, together with the open education vision of Salman Khan (founder of Khan Academy), on one side, and the "connectivist bunch" (George Siemens, Stephen Downes, Dave Cormier, Inge DeWaard, Alec Couros, David Wiley), on the other, has led some of the professors from Stanford's Computer Sciences Department to start their own companies providing the catalyst that MOOCs needed to become a world hysteria.

Online education, open education, distance studies, these have all existed, taking different forms over time. Much of the MOOC philosophy is based on Open University's open approach towards education. An influence for many other ideas that emerged after, the Open University (founded in 1969) revitalized distance education because it combined correspondence education, supplementary broadcasting and publishing, residential short courses and support services at local and regional levels. Its founders believed communication technologies could be explored to provide high-quality degrees [38].

Two early initiatives that were rather unknown were AllLearn (Oxford, Yale and Stanford collaboration) and Fathom (University of Columbia). The two were offering online courses for free but did not make it through financial problems [12].

Oxford, Yale and Stanford closed in 2006 their joint non-profit online venture, AllLearn (Alliance for Lifelong Learning) citing insufficient enrolments and funding as the primary reasons. AllLearn was established in 2001 at the peak of the 'dot-com boom' to offer online non-credit courses in general interest subject areas. Over the past five years, AllLearn offered 110 online courses to more than 10,000 students from 70 countries. The median age of learners was around 47 [12].

An additional failure was Fathom. Fathom was an online learning portal project, spearheaded by Columbia University, which opened to the public in late 2000. Partners in the venture included the London School of Economics and Political Science, the British Library, the New York Public Library, Cambridge University Press, and the Smithsonian Institution's National Museum of Natural History. Failing to turn a profit despite a 2002 business plan change, Fathom closed in early 2003 [13][39].

Another forerunner of MOOCs is Khan Academy, a non-profit educational website created in 2006 by educator Salman Khan to provide "a free, world-class education for anyone, anywhere" [14]. According to Khan, there are differences between MOOCs and his platform, as he classifies a MOOC as a "transplantation" of a traditional course, and he stresses the on-demand capabilities above mentioned as elements not found within a standard MOOC [40].

In 2011, Sebastian Thrun and Peter Norvig, two Stanford professors, set in motion another MOOC experiment, offering their "Introduction to Artificial Intelligence" course, free and online. More than 160,000 students from 190 countries signed up and, for the first time, an open online course was truly "massive". It is worth mentioning the fact that 23,000 students completed the course. After this, the two professors built the start-up business Udacity, in 2012.

Two other professors from Stanford, Andrew Ng and Daphne Koller, have also decided to start their own company, called Coursera, through which they would offer MOOCs. The for-profit company, started with a $22 million total investment from venture capitalists. The four initial partners that offered courses were Stanford, Princeton and the Universities of Michigan and Pennsylvania. Today, as mentioned on their website [16], they have more than 135 partners and over 1700 different courses.

Following the 1999 OpenCourseWare (OCW) movement start with the publishing of video lectures by the University of Tübingen in Germany, MIT OCW truly launched this movement in 2002, soon followed by Yale, Berkeley and the University of Michigan.

Ten years later, in 2012, MIT came with a new initiative, MITx which was supposed to extend the concepts of OCW by offering more structured formal courses to online students, including in some cases the possibility of earning academic credit or certificates based on supervised examination. MITx joined HarvardX to form edX, a non-profit company, initially founded by a $30 million investment from each of the two universities.

Martin Bean, the Vice Chancellor of the Open University UK, observed [41] that by the end of 2012, 18 of the top 20 universities in North America were offering MOOCs. This large scale involvement of the Ivy League representatives was one of the incentives needed to push the creation of United Kingdom's MOOC, FutureLearn, established in late 2012, as the first "nationally" defined initiative, as it is financially sustained by the British Government; it was also the first one launched outside North America.

One can understand the positioning of MOOCs by taking a look at the educational delivery models as envisioned by Hill in 2012 and presented in Figure 2.3.
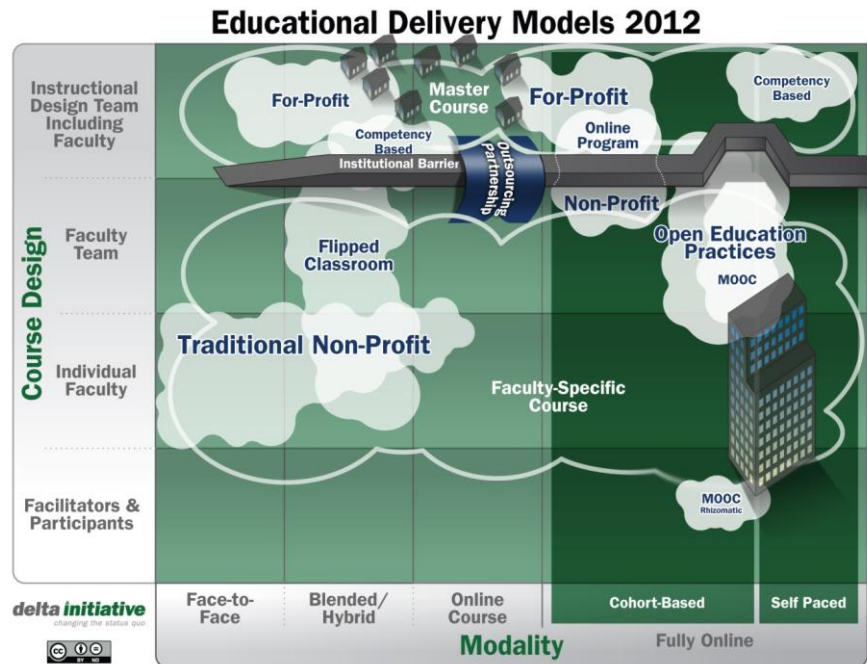
Figure 2.3. Educational Delivery Models [42](image by Phil Hill, licensed as CC BY ND)

2.3.   Most Important MOOC Platforms

I will analyse some of the most renowned companies on the market, **Coursera**, **edX** and **Udacity**, taking into account market requirements, technological differences and usability, for a better understanding of choice for future MOOCers. Each of these providers has their own online learning platform. The main difference between them consists of the courses they offer and the structure and style of delivery of these courses.

Of the three providers, Udacity stands out because all of its courses are openly available. There are no start and finish dates, the courses can be taken at any time and students can work at their own pace, completing each unit or module at their own leisure with no time constraints whatsoever. It is fair to mention the more 'corporate' approach they have adopted since the end of 2013.

Coursera, by far, has the most courses available and the broadest range of topics, having these days over 1700 courses on their platform.

Coursera and edX both offer some of their courses on a self-study basis, which means practically that one can study at their own pace, without time constraints. However, this will not allow him or her to receive any credentials or official form for completing the course. This applies well to those who only study for broadening their horizons for the course they have enrolled in.

One of Coursera's advantages [43] is the great range of courses covering many subject areas. Before applying to a course, the student is offered a lot of

information about that specific course, such as course curricula, bibliography, activities and previous knowledge requirements. There are also introductory videos for almost all courses, similar to the trailer of a movie. A technological advantage is the fact that the videos have the possibility of displaying captions, most of them in English, but some in other languages as well. Coursera offers certifications for almost all of their courses.

Nevertheless, Coursera also has some disadvantages, such as students not being able to enrol to some courses the platform advertises. However, the most underlined issue is with the deadlines of the courses. If people do not meet all the deadlines, they are not able to achieve any form of certification. In addition, the estimated weekly hours and deadlines can be difficult to meet for some people.

If we move to Udacity, I can point out as well both pros and cons. The fact that you are able to sign in with Facebook or Twitter is a big plus. In addition, as opposed to Coursera, all advertised courses are available, to enrol into, straight away. Udacity offers great interactive tutorials that, combined with the non-traditional course format, make the experience a very pleasant one for users. Furthermore, in opposition to Coursera, there are no deadline pressures, therefore the students can learn at their own pace, being able to receive a certificate upon completion. However, there is a limited range of courses and for the existing ones there is not much written information on individual course contents. Udacity does not offer yet any form of translation into other languages.

EdX is in between Coursera and Udacity, in what courses covering is concerned, having a good amount of subjects. Some courses have foreign language options, in either text transcription or whole course format. EdX offers certificates of mastery for all courses and proctored certificates if the exam is taken under proctored conditions. This second type of certificate requires a certain fee. As a negative aspect, not all advertised courses are currently available for enrolment. Some courses that require prior knowledge offer a self-assessment but this is not available until the course has actually started. Just like in Coursera, estimated weekly hours and deadlines can be difficult to accomplish for some people.

Both Coursera and Udacity have forums where users can discuss, encouraging participation, by means of gamification and rewards. All three have videos to explain the course and to highlight its most important aspects.

MOOC providers are designing their own credentials, as each of the three important American MOOC providers introduced their own credentials for paid courses: Udacity's Nanodegrees, Coursera's Specializations and edX's Xseries [17].

Next, I am going to enlist other major participants on the MOOC market.

FutureLearn is the property of The Open University, being launched in December 2012. It has over 70 partners from around the world, not only universities but also institutions such as the British Council, the British Library or the British Museum [41].

Iversity.org is a European-based platform, founded in 2013 by German specialists [44].

MiriadaX is the platform committed to promote open knowledge in the ibero-american space, based on the edX open source platform. MiriadaX was launched in 2013 under the supervision of universities and private companies and promotes Spanish and Portuguese language MOOCs [45].

For the French speaking world, **FUN** (France Université Numérique) was launched in 2013, also on the skeleton of edX. FUN is funded by the French Republique as well as other private investors [46].

Other edX based platforms are **XuetangX** [47] in Mandarin Chinese and **Edraak** [48] for the Arab world.

Going back in the United States area, I mention **Udemy**, a platform that was offering online education since 2007. Udemy has more than 32.000 courses, and its main particularity is the fact that anyone can request to be an instructor and create a course [49].

Codecademy is a programming language MOOC oriented platform, created in 2011, based on private founders [50].

Australia offered its own MOOC platform through its Open Universities Australia, **Open2Study**, launched in 2013 [51].

The first Italian language MOOC platform appeared in 2015 and is called **Master University** [52].

Of course, the list could go on, as there are far more platforms offering MOOCs.

2.4.   Openness in MOOCs

One could consider the recent past for a moment, back to 1999, when the OpenCourseWare (OCW) movement started with the published video lectures of the University of Tübingen in Germany. OpenCourseWare is a generic term for course lessons created at universities and published free via the Internet. Until October 2002, OCW was not very popular, but after the launch of MIT OCW, the movement took off. Yale, Berkeley and the University of Michigan launched similar projects. An OCW project, according to the OCW Consortium [53]:

- is a free and open digital publication of high quality educational materials, organized as courses;
- is available for use and adaptation under an open license, such as certain Creative Commons licenses; and
- does not typically provide certification or access to faculty.

Through "open education", one understands institutional practices and programmatic initiatives that broaden access to the learning and training traditionally offered through formal education systems. When one says that the education is "open", one means that there are no barriers for participating in institution-based learning.

In this period of economic uncertainty, access to higher education is a necessary element for economic expansion and improvement of the quality of life [54]. Sir John S. Daniel [55] identified the problem of the growing demand of education almost 20 years ago. This is mainly because, economy is becoming more and more dynamic, and there are a growing number of individuals who do not have fixed jobs anymore. Therefore, they require proper training and education access, depending on their current area of work. There are not enough resources to build sufficient new campuses everywhere they are required, and the traditional methods of education cannot suffice for preparing students today. Open education could be a solution for this problem.

Open education is directly connected to the internet, the medium in which most of it is taking place. The deepest impact of the internet is its ability to support and grow on the various aspects of social learning [54].

The building blocks provided by the OER movement, along with e-Science and e-Humanities and the resources of the web 2.0, are creating the conditions for the emergence of new kinds of open participatory learning ecosystems [56].

I agree with Iiyoshi and Kumar when they state that "open education brings with it its own set of goals, values, and aspirations that transcend any specific project or functional quality of technology" [57]. Furthermore, "equal access to current knowledge and a standing invitation to everyone to participate in advancing new ideas are common themes of the open education movement" [57]. Opening knowledge in education goes a step beyond opening the classroom door to students. It involves co-creating, experimenting, reflecting, sharing, and reusing accumulated ideas and knowledge about teaching and learning [57].

One answer to open education related issues may lie in Europe. Under rules designed to promote student mobility between the member-states of the EU, students can transfer course credits, with the approval of the universities, in any of the 53 countries that have signed the Lisbon Recognition Convention, "regardless of whether the knowledge, skills and competences were acquired through formal, non-formal or informal learning paths". The unsure aspect is how to get European universities to accept MOOC credits, in order to barter them [58].

It has been highlighted that "open access" to educational resources through MOOCs have been welcomed by many educators, researcher and learners [59][60][61].

It is my opinion that distance education has come a long way, since the postal correspondence study. The evolution is remarkable, and the new technologies continuously developed, make me believe that even better e-Learning platforms will emerge. The discussion about openness remains 'open', but I tend to think that this is more of an OCW 'open' than a company based MOOC 'open'. According to some, there are only 13% MOOCs that are truly open [62] and this makes one wonder if the commercial type of MOOCs are really part of the OER (Open Educational Resources) or are just using the 'open mirage' as an entrance in the education market. However, from my point of view, it is undoubtable that the benefits of the educational materials these platforms provide (by themselves or their institutional partners) are not to be neglected.

As Liyanagunawardena said, "MOOCs are generally made available under strict copyright terms: registration in the course is (money) cost-free and open (though charges are often made for additional services ranging from marking of coursework or taking exams to formal academic credit recognition) but the material is only available to be used by learners as learners on the course and not allowed to be copied, and re-used (in the original form or as revised derivative work)" [63].

There are some voices that share concern over the threat that MOOCs could cause to the OER movement [62], stating that the term "open" has different meanings for OCW and for MOOC. In OCW, the term is very clear, open meaning free, accessible and reusable. In MOOCs, however, open means free (the materials) and accessible (during the course timetable for some platforms), but it is not very clear if they are reusable or not. To exemplify, I can say that Copyright laws protect the content of a MOOC platform. Coursera states the following:

"All content or other materials available on the Sites, including but not limited to code, images, text, layouts, arrangements, displays, illustrations, audio and video clips, HTML files and other content are the property of Coursera and/or its affiliates or licensors and are protected by copyright, patent and/or other proprietary intellectual property rights under the United States and foreign laws" [64].

Furthermore, Udacity participants, for example, agree to grant each provider with a wide license for their own content:

"With respect to any User Content you submit to Udacity (including for inclusion on the Class Sites or Online Courses) or that is otherwise made available to Udacity, you hereby grant Udacity an irrevocable, worldwide, perpetual, royalty-free and non- exclusive license to use, distribute, reproduce, modify, adapt, publicly perform and publicly display such User Content on the Class Sites or in the Online Courses or otherwise exploit the User Content, with the right to sublicense such rights (to multiple tiers), for any purpose (including for any commercial purpose); except that, with regard to User Content comprised of a subtitle, caption or translation of Content, you agree that the license granted to Udacity above shall be exclusive" [65].

There is no mention about the possibility to use the materials on either of these two sites under Creative Commons or a similar open licence.

Coursera is also doing its part to link the concept of openness with online higher education, Downes said, and the next frontier for MOOCs should be "open credentials" [66].

In general, you have to sign up and get access to the course. It would be much more useful to be able to have access at all times and reuse elements in other courses. "Free is very good, but interesting things happen when they're open" [67].

The 'terms and conditions' of commercial MOOC companies require critical observation. Voss claimed that "some commercial MOOC platforms have highly proprietary terms and conditions that claim ownership of course content and prohibit sharing or remixing of material. Not all MOOCs should be assumed to be 'open'" [68].

Anderson [8] identifies six types of openness:
* Expansion of education beyond geographical barriers;
* Freedom of speech;
* Removal of restrictions on the learning content;
* Enrolment without prerequisite;
* The freedom to determine a learning pace;
* The provision of a course free of charge.

Some researchers found MOOCs to be the most open courses although they are not open in all respects [69].

EdX is the most open of the popular MOOC platforms, as I have already shown in the previous subchapter, offering its code for the use of others. This approach has been received with very positive thoughts by educational experts. "They're not just worried about growing their brands, but they're making something that others can use," Siemens said, about EdX open code [70].

One of the purposes of MOOCs is to serve tens or hundreds of thousands of people with high-quality educational material. By adopting Creative Commons (CC) licenses, MOOCs:
* could increase the reach of their content by making the rights to use and adapt them crystal clear from the beginning;
* would be able to serve even more students because they would be granting legal permissions to use their course material in other educational environments; and
* would not have to respond to individual permissions requests from students and could instead focus on delivering quality educational materials to a large number of learners [71].

"If we lose the battle over intellectual property, it's over. Being a professor will no longer be a professional career or a professional identity", says Cary Nelson, former President of the American Association of University Professors [72]. What I

believe he intended to state was the fact that without proper open credentials regulations there is a danger for the position of the professor.

MOOCs should attend to copyright and licensing from the start so it would be clear to students how they can use and reuse educational content offered on the platform. MOOCs should choose to adopt an open license that meets their purposes, but at least it is recommended that they choose a public, standardized license that grants to its users the "4Rs" of open content: the ability to Reuse, Revise, Remix, and Redistribute the materials [71].

Yuan and Powell [19] found a number of openness related aspects regarding education, that can be seen in Figure 2.4.
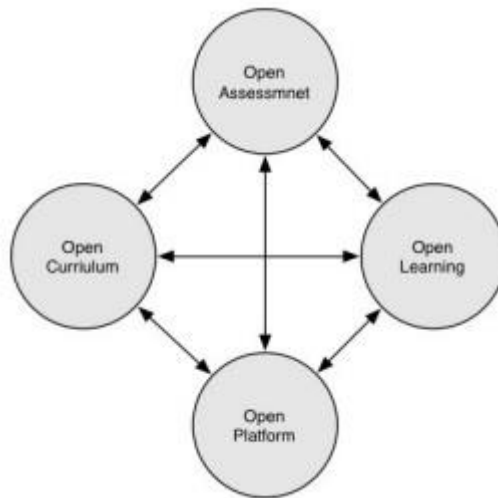
Figure 2.4. Opening Up Higher Education [19] (created by Yuan and Powell, licensed as CC BY 3.0)

What do these aspects mean? Open curriculum refers to the mix of educational resources and activities, allowing the learner to choose what he studies in order to meet his or her personal needs. The open learning is connected to the sharing of ideas about the learning process, which provides the learner with independent and interested-guided learning. Open assessment refers to peer-to-peer or crowd-sourced assessment with "on-demand accreditation" for learners. Finally, the use of open standards and cloud-based provision allows open platforms to create and maintain usable and stable user interfaces.

As Sandeen said, "the term open in MOOC parlance is something of a misnomer, since it refers to open enrolment rather than to ownership of course content and platform design, which is asserted and protected by course developers. This allows them to monetize their intellectual property. Only EdX provides open educational and platform resources in the normal sense of "open"—that is, material that is available for use or adaptation by others" [73].

After analysing both types of MOOCs, I conclude that there are big differences between openness in regards to cMOOCs and xMOOCs. cMOOCs offer a larger autonomy and freedom for users, encouraging the remixing and reusing of materials. Peers are given a medium where to share with others and contribute together to the education experience.

However, in xMOOCs, there are major restraints in what openness is concerned. For starters, analysing the copyright pages of major MOOC platforms one learns that one is simply not authorised to use the content from their platforms without the consent of the platform. There is a time frame limitation, as some courses can only be accessed in specific time intervals, for example they are open for 3 months, then closed for 3 months, then they open the course again and so on and so forth. There is a privacy limitation, as you cannot access the majority of the courses without creating an account and registering.

Some courses do not allow you to follow your own pace, especially if you want some sort of written recognition or badge for completing the course.

Furthermore, there is a movement towards monetization of MOOCs, restraining different parts of the course from people who do not pay some amount of money. In addition, in order to gain a certificate or a form of acknowledgement for completion of the course students also have to pay.

As I have shown in this chapter, it is highly debatable if MOOCs are truly open or not. The degree of openness varies from completely open to only slightly open, depending on the type of MOOC, platform or course one chooses to follow.

2.5. Impact on Education and Economical Perspective

Some have called MOOCs a tsunami for education [74], others, a revolution. As the Economist magazine reported, "A revolution has begun thanks to three forces: rising costs, changing demand and disruptive technology. The result will be the reinvention of the university" [75]. This revolution is not about Information Technologies; it is about teaching and learning [76]. There are many who define MOOCs as a disruptive landmark [77][78][79][80].

During a presentation to the Educause NGLC Summer Learning series on MOOCs, George Siemens asked a very interesting question [81]: "What do MOOCs actually change?" and offered a series of answers amongst which were the recognition of online learning, rethinking of the course model, reflection on university structure and heavy investment in technology/new tools. And to continue with the thoughts of the other pioneer of MOOCs, Stephen Downes, I note that "the whole MOOC phenomena is about reducing and eventually eliminating the learned dependence on the expert and the elite - not as a celebration of anti-intellectualism, but as a result of widespread and equitable access to expertise" [82].

The mixture of technology enablers and new business models opens up the possibility that MOOCs can extend a low-cost new-market disruption to learners demanding better performance from themselves and from education. If MOOCs can be developed to the point whereby students can complete full degrees and gain qualifications, it may impact on enrolment at traditional institutions and contribute to a reshaping of the HE market in the future [19].

Still, why should a university develop a MOOC or join the MOOC business? I believe there are many reasons. To begin with, the impact of MOOCs being so high in the current period, the publicity that doing a MOOC brings can help the university attract new students both for their online programs but also for the traditional brick-and-mortar type education programs. Furthermore, the challenge to rethink the course structure and materials could be beneficial to the instructors and policy makers because they get a fresh perspective and get more involved and enthusiastic about this new endeavour. Moreover, offering quality online courses makes a clear statement that the institution offering them is looking into the future

and is positioning itself as a leader of innovation and education. "The possibility MOOCs hold out is that the educational parts of education can be unbundled" [83]. There is a diversity of reasons to offer MOOCs, including marketing for the organization, outreach, providing professional development, support enrolment in "traditional" programs, etc. It is very important that these objectives be clearly established from the beginning so that the correct decisions regarding design and development can be made to support those objectives [84]. One of the reasons why universities want to have a MOOC is that they try to position themselves as global leaders of innovation, and as educational institutions capable of delivering high-quality education on a global scale. The current value propositions for institutions to engage with MOOCs are identified as "education access, experimentation and brand extension" [68].

This is underpinned by the fact that online learning has experienced a steady growth over the past decade, with more than 30% of HE students participating in at least one online course — despite the fact that the majority of institutions are not yet involved in the provision of online education.

However, I have to state the issues as well. One big problem is the quality of this new type of pedagogy. Because it is my opinion that the way of disseminating the course material is innovated but the pedagogy style, not so much, and I am not the only one to state this [26][28][85][86]. Usher [87] questions whether our interest should be really about making the existing "old" education cheaper – or rather about making education more meaningful and relevant for 70% of the young people, who have to find a job after graduation. The flipped classroom concept, in which the student studies the theory at home and then discusses the issues and the examples in the classroom, is connected with MOOCs and could be one solution to the positive change that is looked for by many people involved in education.

Seven MOOC concerns, expressed by Kim [88]:
1. Education requires dialogue;
2. Authentic learning does not scale;
3. More inputs, not less, equates to better educational quality;
4. MOOCs come with opportunity costs;
5. MOOCs should align with strategic goals;
6. The danger of MOOCs as a money saving substitute;
7. Be cautious about commercial partners.

MOOCs demand a certain level of digital literacy from the participants, which has raised concerns on inclusivity and equality of access.

Another major discussion over MOOCs is about the low retention and completion rates of the courses, with 5 to 15% numbers [89][90][28][91], depending on various sources. Meyer [89] reported that the dropout rates of MOOCs offered by Stanford, MIT and UC Berkley were 80-95%. Is this a problem? Is the goal of a MOOC to have high numbers in percentage? If we consider that 5% of 10.000 represent 500 people, this is a good number after all. From my perspective, the goal of a MOOC student differs from person to person so we need to come with new ways of measuring the success percentage, adding different filters depending on what students want to achieve. This has been strongly supported by other researchers as well [92][8][69][93][94]. If the goal is to give the opportunity of access to free and high-quality courses from elite universities and professors, then high dropout rates may not be a crucial concern [90]. As Anderson says, "this range of engagement styles shows that while the issue of students 'dropping out' of MOOCs points to a genuine and important distinction in types of student activity, it

is arguably a distinction being made at too superficial a level. Indeed, even asking whether a student 'completes' an online course is a question already based on the assumption that there is a single notion of completion" [93]. It is actually very rare to find media of any sort that is intended to be consumed in its entirety. Most of the time, in most situations, we pick and choose what is important to us. That is the normal mode of interacting with content, and it is the normal mode of interacting with a MOOC [94].

It seems that most learners intend to explore the subject rather than complete the course, with the top ten reasons for dropping out reported to include that the course required too much time, was too difficult, or even too basic. Poor course design has also been highlighted as a reason for students not continuing with a MOOC, as well as a lack of introduction to the course technology and format. Mandatory readings from expensive text books have also been cited as a reason for students dropping out as this limited to a great extent their access to the learning materials. Apparently, the most important contributing factor to learners completing a MOOC is interpersonal interaction and support, which aligns with what is seen for online distance courses generally [95].

Here are the reasons people drop out of MOOCs, as seen by a 2013 report [96]:
1. Takes too much time;
2. Assumes too much knowledge;
3. Too basic, not really at the level of Stanford, Oxford and MIT;
4. Lecture fatigue;
5. Poor course design;
6. Clunky community/ Communication tools;
7. Bad peer review and trolls;
8. Surprised by hidden costs;
9. You are just shopping around;
10. You are there to learn, not for the credential at the end.

The line between an online certificate and a degree from any particular institution shall be drawn by the admissions office. Touve put it extremely well, as "most importantly, however, we should resolve the paradox that emerges from this debate over MOOCs, wherein the substance — whether chunks of matter or ideas or right answers or genuine insights — that determines whether a student earns a university degree rather than a course certificate would be in the selection of that student through admissions standards rather than in the content and quality of the education or the impact of that education as measured through the student's experience, accomplishments, or dynamic capacity to act upon and even develop new knowledge" [97].

The online classes, some teachers fear, will at best prove a distraction to education administrators and at worst, they will end up diminishing the quality of on-campus traditional education [98].

One of the 'forefathers' of MOOCs, George Siemens stated that "the value of MOOCs may not be the MOOCs themselves, but rather the plethora of new innovations and added services that are developed when MOOCs are treated as a platform" [18].

Some said that MOOCs inform, but they do not educate and there is a difference [85]. Edmunson points the following: "A truly memorable college class, even a large one, is a collaboration between teacher and students. It is a one-time-only event. Learning at its best is a collective enterprise, something we have known since Socrates. You can get knowledge from an Internet course if you are highly

motivated to learn. However, in real courses the students and teachers come together and create an immediate and vital community of learning. A real course creates intellectual joy, at least in some. I do not think an Internet course ever will. Internet learning promises to make intellectual life more sterile and abstract than it already is – and for teachers and for students alike, far more lonely" [99]. Nevertheless, this does not solve what does not work in the field of education. It massively scales what is broken, as said in a very negativistic way [100].

Siemens points out seven primary tensions in open online courses [18]:
1. Automation vs. Creation;
2. Social vs. Scripted;
3. Structured vs. Self-Organized;
4. University-based vs. Informal learning;
5. Assessment/recognition vs. Personal growth;
6. Functioning in existing system vs. Transforming existing system;
7. Learner owned vs. Organization owned interaction spaces.

Four barriers to overcome from the point of view of Hill [101]:
- Developing revenue models to make the concept self-sustaining;
- Delivering valuable signifiers of completion such as credentials, badges or acceptance into accredited programs;
- Providing an experience and perceived value that enables higher course completion rates (most today have less than 10% of registered students actually completing the course);
- Authenticating students in a manner to satisfy accrediting institutions or hiring companies.

Mintz [102], on the other hand, points out the following ten challenges of MOOCs: Discussion forums – unproductive or offensive postings/ bad rating system; cohorting – similarities; interactivity; student engagement and persistence; progressive personal profile; personalization – adaptive learning; data analytics and learning dashboards; the user experience; credentialing; a sustainable business model.

Holton remarked that, "especially disturbing is that none of the major MOOC providers have hired anyone trained in instructional design, the learning sciences, educational technology, course design, or other educational specialties to help with the design of their courses. They are hiring a lot of programmers…" [103].

Some say there is nothing particularly new about MOOCs. Most universities have offered online courses for many years, as I have presented already, and the basic technologies involved have been used for some time now with on-campus and distance students. The only major difference is the scale of these courses [104] and the proper timing of their appearance.

From an economical point of view, there is still to find the proper way in which these MOOCs could be financially sustained. After all, it is estimated that a course costs around $50.000 to put online [105]. For example, Udacity has changed its focus towards corporate training, which brings more money to satisfy the venture capitalists that supported the original costs of the platform. Sebastian Thrun, Udacity's owner, went so far to say that they have created a lousy product and that they need to rethink their whole strategy [106].

It has been also estimated that it can take 100 hours for a faculty member to create a MOOC (some find that it takes much longer) [107], which increases the difficulties encountered by the ones who want to build one from scratch.

Having millions of users who register for MOOCs in the past years, one cannot ignore the financial opportunities that arise from its use. On the first view, I can point out that universities gain money directly from students who wish to have a certified degree or badge and indirectly from a growth in their popularity that can result in future new non-digital enrolments. However, if we look at the bigger picture, we have the whole world economy to benefit from MOOCs. People have more possibilities to study, without paying anything, topics that help them directly in their field of work. This may lead to better deployment of their duties, which creates a plus for their company, economical sector and of course economy in general.

According to contract documents, Coursera will pay the universities 6 to 15 percent of revenues, which will be determined on a per-course basis and dependent upon the duration of the course, the number and quality of assessments. The company also gets 20 percent of gross profits (accounting for costs and previous revenue) [108].

Kolowich [109] presented the edX financial model, as follows. For the university self-service model, where edX is only the distribution platform, edX collects $50.000 plus $10.000 for each recurring iteration of the course. The partner university gets 50% after the closing of the balance. In the edX-supported model, where edX is helping also with the developing of the course, the company earns $250.000 for each course plus $50.000 for every extra iteration. In this case, the partner university gets 70% after the balance is closed.

Clayton Christensen [110], a Harvard Business School professor and author of "The Innovative University", predicts "wholesale bankruptcies" over the next decade among standard universities, which was one of the main catalysts of MOOC expansion.

I want to point out some theoretical arguments as well for this affirmation, and I remember the words of Lesser in 2000, who pointed out that in a digital economy, capital lies in the capacity to leverage, connect, and promote knowledge [111]. The capacity to create, improve, innovate with, and apply knowledge will define prosperity in a digital economy [6].

All economic activity is at its core a knowledge activity [112]. I believe this affirmation is obvious, taking into consideration the fact that one of the key factors of a healthy economy are the workers that sustain the economy using their own knowledge and abilities. Therefore, the more knowledge accessible to these workers, the healthier the economy should be, ceteris paribus.

Young notes that Coursera "isn't yet sure how it will bring in revenue. In this respect it is following a common approach of Silicon Valley start-ups: build fast and worry about money later" [70].

Business models of MOOC providers include selling student information to potential employers or advertisers, fee-based assignment grading, access to the social networks and discussions, advertising for sponsored courses, tuition fees for credited courses [68].

The flexibility required in collaboration is itself valuable within the digital economy, as the digital emphasis on innovation and participation makes lifelong learning an implicit societal expectation [113].

However, in my opinion there is also a downside. A key implementation challenge for taking advantage of the potential of the MOOC model is the accreditation issue [11]. Why is this happening? In contemporary society we only value learning when it can be categorized with reference to frameworks of academic disciplines that we recognize as „knowledge" or when it can be „certified" [114].

A study published in 2014 [115] showed that participants who aimed at getting an open badge or a certificate of attendance showed a reduced decrease of investment. Thus using open badges or similar certificates could support users to set their own learning goals and ensure ongoing participation.

To give one example of an epic failure, I mention the experiment made by San Jose State University, that announced in January 2013 [116] that it would let students take credit-bearing online courses through the MOOC-provider Udacity. The courses were focusing on topics like basic math, elementary statistics, college algebra, introductory computer programming and psychology. The idea behind this was to reduce costs for education - $150 per online course versus $620 for a traditional course. Even though students enthusiastically welcomed this, the failing rate was between 56 and 76%. Thus, the program was suspended. However, after the summer iteration of the course, the percentage of successful students increased and another session was announced for the spring of 2014.

It is interesting to understand what could be the reason of this large failing rate, from the perspective of the students. From evidence published by Liyanagunawardena et al. [117], it can be seen that for MOOC participants, 'dropout' means achieving their aims (or not) in a course rather than finishing the course by completing all parts. Besides, from my perspective, the challenge is to find the intersection between the student, university and economy interests.

Not everyone embraces MOOCs, as Oxford says that MOOCs "will not prompt it to change anything", adding that it "does not see them as revolutionary in anything other than scale". Cambridge even says it is "nonsense" to see MOOCs as a rival; they are "not in the business of online education" [110].

Furthermore, Downes points out [118] that "when we are evaluating a tool, we evaluate it against its design specifications; It is only when we evaluate the use of a tool that we evaluate against the actual outcome. So, measuring drop-out rates, counting test scores, and adding up student satisfaction scores will not tell us whether a MOOC was successful, only whether this particular application of this particular MOOC was successful in this particular instance".

2.6. Conclusion

In this chapter I tried to offer a comprehensive definition of MOOCs. The explanation of the acronym, Massive Open Online Course was defined, word by word. During my research I found that one of the main reasons for the rapid evolution and success of MOOCs was the economic crisis combined with the large amount of student debt, especially in the United States of America. Furthermore, the growing hunger for access to knowledge, propelled by the distribution of technology and the internet in most of the world, was another key reason for the scalable aspect of MOOCs. Overall, I believe that there is a general feeling and understanding of a need of change in education, and MOOCs seemed like a potential candidate for that change, or in greater proportions, even a disruption.

I presented a brief history of these technologies, starting with pre-MOOC platforms that either failed or did not get as much success as their followers. CCK08, the connectivist course of George Siemens and Stephen Downes was the first acknowledged MOOC course and from its arrival in 2008 until the end of 2011 the most analysed and discussed. However, the autumn of 2011 will be remembered as the period when Stanford based professors launched Coursera and Udacity, followed by a 2012 hype year which New York Times enthusiastically called

"the year of the MOOC". From that point forward, MOOCs gained more and more momentum in research, funding and popularity. More platforms emerged, more institutions were interested in developing massive courses and more students were eager to enrol and try these courses. The future will show if this was just a soap bubble that will eventually burst or if it is a technology capable of disrupting education or at least to change the paradigms in which we perceive education and the educational process.

Afterwards, the most important platforms that offer MOOCs have been presented with a comparison made in more detail around the "big three" built around the Ivy League: Coursera, Udacity and EdX. Other important platforms were also mentioned and described, the list being non-exhaustive.

The openness of MOOCs was analysed, with me supporting the idea that MOOCs are not open in all aspects and I start a discussion about what open meant in the concept of the MOOC precursor, OCW, and what open means in the context of today's Massive Open Online Courses.

I consider the educational and economical aspects to be of extreme importance, especially since around them, the most "loud" debates have emerged in what MOOC research is concerned. I tried to keep a neutral tone presenting facts and opinions both for and against MOOCs.

MOOCs support free interaction among participants, establishing a critical point of idea interaction and a place for the creation of knowledge [119]. The possibility for individuals to create knowledge and share it online replaces the old classroom exchange where the teacher knows and transmits, and the learner in turn absorbs. Looking at phenomena emerging from technologies can point us in the direction of a renewed educational equilibrium [119].

This chapter represents theoretical contributions to this thesis, as the MOOC history, importance and particularities are explained and presented in a comprehensive and complex manner. I have realized an intensive state of the art of MOOCs paying special attention to their appearance, development and impact, studying in detail the most important platforms. Also, I presented a critical analysis of how open MOOCs really are.

Some results presented in this chapter have been published in [120] and [121].

3. TECHNOLOGIES IN MOOCS

This chapter contains different technologies used in MOOCs and related to them. I am going to present types of web related technologies currently used in MOOCs and how MOOCs are usually built around technology. The infrastructure of MOOCs will be analysed in detail. Then, I focus on videos, which are a crucial part of these new educational platforms. A special attention is given to Moodle as this will be the proposed platform on which I apply the model that I present in chapter 7.

3.1. Social Media in MOOCs

MOOCs are participatory platforms that engage students into interacting amongst themselves in order for a better understanding of the course material. Usually, work groups are organized for students residing in the same area. However, when this is not the case, virtual work groups are formed with the help of social media tools.

Every MOOC integrates a number of tools to help with the learning process, user interactivity and connection and network construction. There are different type of course structures, different type of course curricula, different types of student groups; therefore, the creator of the course has to take into consideration all of these facts, find out the most efficient and customize it for his or her course. Social media amplifies reputation, and therefore personal branding is the means by which a great deal of creative work gains attention and audience.

An example of the different types of MOOC users can be seen in this info-graphic made by Hill in 2013, presented in Figure 3.1.
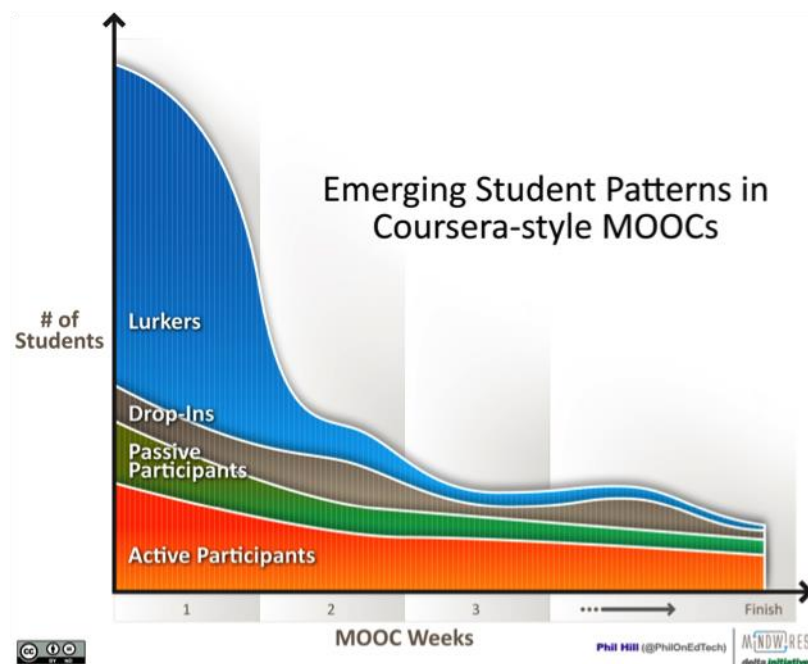
Figure 3.1. Emerging Student Patterns in xMOOCs [122] (created by Hill, licensed as CC BY ND)

Hill identifies four major types of students who attend MOOCs: active participants, passive participants, drop-ins and lurkers. The active participants are the ones who are involved in the course, they participate in the forum and the social activities. The passive participants only follow the course material and solve the activities, without being socially engaged. The drop-ins are only completing parts of the course, whatever suits their needs. Finally, the lurkers are the users who are mostly curious of what the course is about but are not motivated by anything in particular to complete any course activities. As the weeks pass, we can see from the chart that the number of students decreases constantly, with the biggest difference observed in the lurkers group.

Similar to Hill's findings, a study by Cornell and Stanford from 2014 identified five broad types of MOOC students:

1. Viewers "watch lectures, handing in few if any assignments."
2. Solvers "hand in assignments for a grade, viewing few if any lectures."
3. All-Rounders "balance the watching of lectures with the handing in of assignments."
4. Collectors "primarily download lectures."
5. Bystanders are "registered for the course, but their total activity is below a very low threshold." [93][123].

As pointed out by deWaard in 2011 [124], if the course creator or administrator knows the target audience, he will be able to use those social media tools that the respective MOOC participants are already familiar with. If that audience is unknown, then one might want to think about using the most accessible communication tools available. Some of these tools are:

- A wiki – Could be useful for setting up the course syllabus and perfect for collaborative work of students.
- A discussion group – Similar to a forum, allows topics to be nicely organized after their title and email lists to be used when posting new threads.
- Microblogging – Allows a quick exchange of resources and thoughts. It is an advantage to find course information looking for specific hashtags.
- Social bookmarking – Students can share resources on the Web for themselves or their peers.
- Virtual classrooms – Enable synchronous sessions (live meetings) so that people can work together from different locations. Virtual classrooms also allow more human, immediate interaction to occur, and they are ideal to give an expert the floor to express her/his framework of ideas.

One observation that I want to make is that the wikis and virtual synchronous classrooms are not always very mobile friendly. So, if the MOOC is designed to be used from mobile devices as well, it is suggested to work around these limitations, for instance by using YouTube, Vimeo or other video hosting platforms to publish reformatted recordings from synchronous sessions [125].

Some researchers point out that "we need to return to the MOOC as originally envisioned: social learning. Best-in-class corporate education creates a place where colleagues can connect, form networks, and share ideas. It is increasingly important to engage learners socially, because they stand to learn as much from each other as from formal instruction" [126].

The main gain of web 2.0 tools for education has been the possibility for students to share easier with their peers, their work, thoughts and ideas. These technologies have also provided students with a greater customization and more choices from which to choose.

What has web 3.0 to offer to education? I believe that the main change is the content of the class that can be contextually reinvented and the leaner transition from student to teacher.

3.2.   Examples of Web 2.0 in MOOCs

It is understood that the lack of familiarity with the digital skills privileged and rewarded within the MOOC will limit participation. The same will happen with a lack of access to the basic technologies necessary to participate, specifically a computer and Internet access. Moreover, the lack of experience with both the software/platforms and the educational content may be limiting [6].

I have shown [127] that even though only seven years passed since the first MOOC, CCK08, appeared, the behavioural habits of MOOC users have evolved. If we take a glimpse at the analysis of Fini from 2009 [92], we learn that the first MOOC users were not happy with using forums and they preferred mailing lists for interaction. Wikis were also favoured for the collaborative possibilities that they have to offer. For web conferencing, Siemens and Downes opted for Elluminate, a tool well appreciated by students. Finally, yet importantly, the blog tool was received well by the MOOC participants. One of the least useful tools, in the participants' view, was Pageflakes, an Ajax-based start page or personal web portal that closed in 2012, a service that was perceived as a "disorganized mess". Also interesting from my point of view is the fact that Social Sites were considered of low relevance. One example of Fini's survey results can be seen below, referring to the tools that were considered of low relevance.
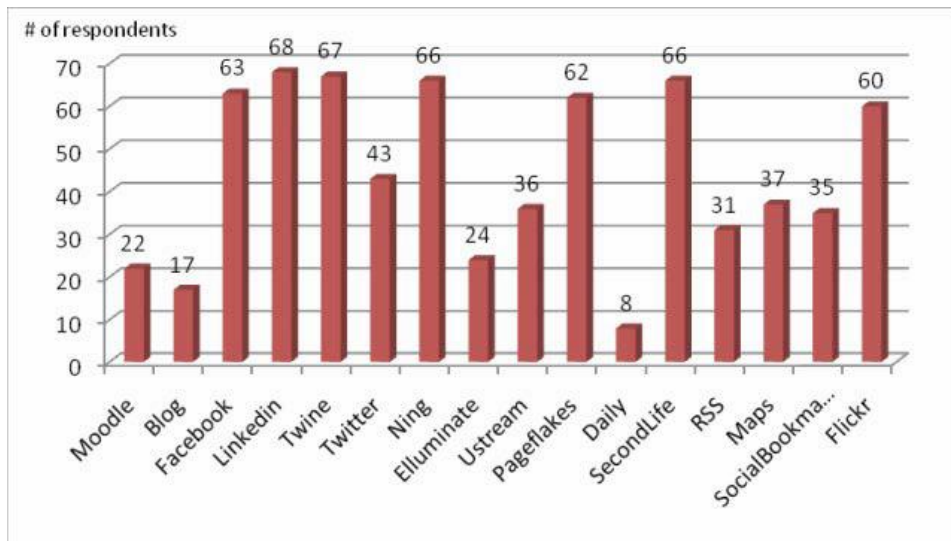
Figure 3.2. Frequency of low relevance of Web 2.0 tools in MOOCs (N=83) [92] (created by Fini, licensed as CC BY 4.0)

What the author found was that there are many controversial tools, which have equal numbers of critics and praises. "These highly controversial results show that participants have very different opinions about the tools, probably due to their various learning styles, personal objectives, time availability, etc." [92].

A study from 2012 [128], after analysing several MOOC platforms, got the following word cloud for tools used, presented in Figure 3.3. I want to present these two images in order to notice the differences and similarities between technologies used in 2008 and 2012. For example, social technologies are far more used than at the beginning of MOOCs. Moodle, RSS, the Daily (mailing list) and blogs are the technologies that have been preferred by students since the beginning until 2012. Two new technologies that one can observe are Google Groups and YouTube.
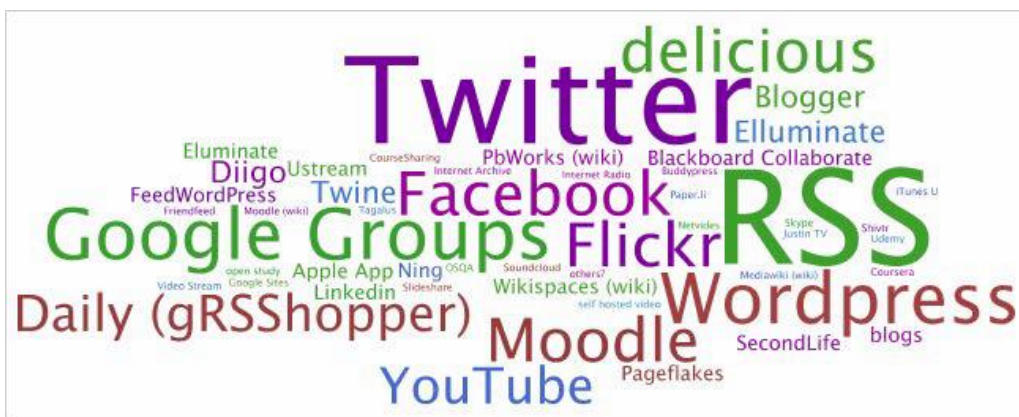
Figure 3.3. Word cloud of the frequency different technologies were used in the MOOCs surveyed [128] (created by M. Hawksey, licensed as CC BY 3.0)

One of the most used tools in MOOCs is the forum. Forums are pervasive in MOOCs and have been characterized as "an essential ingredient of an effective online course" [129], but early investigations of MOOC forums show struggles to retain forum users over time [130]. Cheng et al. [131] have shown that students who voluntarily participate in forums perform better and receive higher exam grades. Reputation systems provide concrete, yet limited benefits for MOOC forums [130]. A reputation system is a technology that computes reputation scores based on a collection of objects, in this case of forum posts.

In a MIT Technology Review article [132] about a scientific paper [133], it is said that Stanford Professor Mung Chiang's research team, together with collaborators from Boston University and Microsoft, studied the behaviour in online discussion forums of over 100,000 students taking MOOCs. They say that "participation falls precipitously and continuously throughout a course" and that, "almost half of registered students never post more than twice to the forums". Furthermore, the participation of a teacher does not improve the situation. Indeed, they say "there is some evidence that a teacher's participation in an online discussion actually increases the rate of decline" amongst learners.

With large numbers of students and only a limited number of instructors, peer communication, support and assessment are seen as key elements of the MOOC pedagogy model. Forums play a central role in most platforms, with various expectations including increasing engagement, promoting deep learning, maintaining motivation and decreasing risk of drop-out [134].

Schweizer's account of MOOC participation acknowledges the benefit of forum discussion for promoting reflection but expresses frustration at the general level of contribution as being "unfocused, tentative, and frankly, misinformed" [135].

The descriptive statistic ran by Jiang et al. [136] shows that the discussion forum is mainly dominated by a small percentage of learners who contributed far more than the rest of learners. This group of opinion leaders or knowledge source helps to build up and maintain the network. It also implies that the MOOCs' network is more an information network than a social network. This suggests that the discussion forum serves an important role in facilitating help seeking and in promoting communication between the things known and the things unknown.

Another well-used tool is the blog. When the survey of Mak et al.'s respondents were asked why they participated in blogs, the most important reasons, in rank order, were [129]: space to develop my own ideas; ownership; self-expression; familiarity with using blogs; an attractive layout to express ideas; personal learning; quiet slow reflection; personal relationships; own pace; establishing a presence; thoughtful long-term relationships; personal voice.

In addition, conferencing tools could be useful for virtual meet-ups. One tool that is open and accessible is Google Hangouts, an instant messaging and video chat platform. As analysed by McGuire [137], experiments in MOOC with Hangouts, despite being a disaster from the technological point of view, were quite interesting. McGuire took Coursera's 'Introductory Human Physiology' by Duke University. Students that were interested were asked to announce in advance their participation. Only six students were invited to join the Hangout at a time. This is a great opportunity for shyer students to be able to interact with the teacher in a more comfortable environment. The problem appeared when because of a technical glitch, one of Google's servers crashed and the Hangouts failed to finish.

One of the recent technologies used, especially to nourish the students' need for some form of credentials, are the badges. It has been shown that even

small variations in badge presentation had an effect on activity of students in MOOCs [93]. Something different from the rest of the platforms is used by Udemy, which includes a video presentation mashup tool that gives teachers the ability to modify presentation slides and synchronise them with video footage [138]. One example of how things go wrong if the structure is not designed well enough was pointed out by Morrison [139]. A factor that could cause considerable distress to students is the lack of instructions for the assignments or the group activities. When we decide to create a group activity, we have to give very clear and detailed instructions. The students should easily find a description of the purpose of the assignment, why we chose a group activity over an individual one and how the student will benefit from this type of activity. Access to technical tools should be provided so students can easily communicate and share in their own group. When Google Spreadsheet is used for collaborative work, one might expect the Google server to not being able to handle the traffic and crash [139].

Barry [140] analysed some courses on MOOCs and he pointed out that for 'Digital Storytelling' (DS106), a MOOC from the University of Mary Washington, USA the technologies used were: Wordpress Website, Gravatar, Twitter, Flickr, YouTube, SoundCloud, Google+ Hangout, RSS Feeds/Aggregation. For a course on Coursera, the tools were Content Management System, Discussion Forum, Submission Form, Peer Feedback Form, and Simple navigational bar. For an Udacity course, they used the following technologies: CMS, Discussion Forum, Auto-Graded Quizzes, and Simple navigational bar.

Using an existing platform, which already meets the access control and analytics requirements, is one way to obtain an effective delivery system for MOOCs.

Therefore, after reviewing some of the major MOOC providers, I have seen that web 2.0 technologies are one of the favourites of developers, teachers and students. If we think about it, the whole concept of e-Learning platforms, as we understand them today, is an integrant part of web 2.0 closing in to becoming part of web 3.0 and even web 4.0.

3.3. Examples of Web 3.0 in MOOCs

In this subchapter, I am going to focus on the use of data mining, data analytics and machine learning in MOOCs. George Siemens was anticipating the need of using analytics for MOOCs and defined learning analytics as "the use of data and models to predict student progress and performance, and the ability to act on that information" [141].

I agree with Carr, when he states that in order "to fulfil their grand promise, MOOCs will need to exploit the latest breakthroughs in data processing and machine learning. Delivering a complex class to thousands of people simultaneously demands a high degree of automation". Furthermore, "advanced analytical software is also required to parse the enormous amounts of information about student behaviour collected during the classes. By using algorithms to spot patterns in the data, programmers hope to gain insights into learning styles and teaching strategies, which can then be used to refine the technology further" [98]. Machine learning may be a catalyst for an automated system for detecting cheating in online classes, a challenge which is becoming more urgent as universities consider granting certificates or even credits to students who complete MOOCs [98]. Moreover, courses with machine scoring as opposed to peer evaluation are associated with

higher completion rates that likely confirms the value of immediate reinforcement used in cognitive-behavioural pedagogical models [8].

However, learning analytics can be used to substantively improve our understanding and our subsequent remediation and adaptation of learning sequences, to improve learning as well as sell products [142][8].

e-Learning technologies that are widely used in MOOCs include:
- High-quality indexed video;
- Data capture and analytics;
- Delivery platforms that combine the qualities of social networking sites like Facebook with the content delivery, discussion, and grading functions of the traditional learning management system [68].

If different (culturally motivated) learning styles are integrated into the course directly, the students' time and effort to adjust is reduced, individual learners can be better supported and learning satisfaction is likely to increase. I believe that personalization of learning content is a very promising approach to achieve this [143]. Preserving the freedom of choice for each learner is targeted to remove the observed rigidity in present MOOC learning [143].

Experts in technology are actively working to add to MOOC platforms a variety of products such as tools to support contextual in-text and in-video discussions and comments, creation of study groups and project teams, discussion boards with voting, filters and reputation systems, and ways MOOC students could connect not only in real time, but also in the real world [144].

The system may draw these data from four different sources:
1. the learning content, i.e. what has to be learned?
2. the learner history, i.e. what has already been learned?
3. the learning environment, i.e. what are the temporal, spatial and physical parameters?
4. the learner, i.e. what are the characteristics of this person? [143].

An effectively personalized course, consisting only of the content relevant for a certain student, but even so following a well-defined pedagogical model, could be the result of the above mentioned facts [143].

Michael Feldstein, a partner with the consulting firm MindWires sees a 'natural marriage' between MOOCs and adaptive software, which could help compensate for the absence of individual handholding in a massive course [145].

George Siemens said what was happening was part of a natural process. "We're moving from the hype to the implementation". "Now that we have the technology to teach 100,000 students online," he said, "the next challenge will be scaling creativity, and finding a way that even in a class of 100,000, adaptive learning can give each student a personal experience" [146].

Butin pointed out that "these subprograms could themselves be linked to a formidable array of computer-based intelligent tutoring systems (ITS) that have been shown to be as effective as human tutors by mimicking the 'interaction granularity' of real-life tutors as they 'walk students through' a problem and its solution. So, if a student got stuck at any point in the course, she could, for example, click on a 'hint' button and the ITS would scaffold the student—through prompts, demonstrations, natural language feedback, etc.—toward both the right answer and the logic and reasoning behind it" [86].

The Georgia Institute of Technology, which received in 2012 a Gates Foundation grant to develop three introductory-level MOOCs in English composition, psychology and physics, is considering incorporating high-tech authentication

processes for these courses, including retina scans and facial recognition software [147].
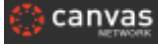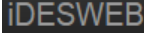
I concur with Bond when he says that "for some applications, real-time processing is irrelevant, however, for the application to MOOCs it might be necessary for the biometric application to make a decision in near real time, e.g. when it is used for continuous evaluation. Furthermore, it should be taken into account that the biometric sensor and the biometric application are remote of each other, processing takes place on a remote site and is dependent on an internet connection. Big chunks of data can seriously delay the transfer time, and thus slow down the biometric application. Proper compression of the data, without significantly affecting the performance of the biometric application, is important" [148].

Learning analytics and machine learning are offering new perspectives into understanding how to better use the data gathered by the platforms and integrate it in adaptive software that is intended to give the students a unique experience of the learning process.

3.4.   Technological Profile of MOOCs

For this analysis, my first goal was to establish a list of the most popular educational platforms that align to the MOOC paradigm. The classification criteria was based on: the number of existing courses in a platform, global users number, popularity, Alexa actionable analytics for the web, literature suggestions and recommendations made by e-Learning specialists [149][150][151][152][153].

Together with Mihai Oniţa, we gathered up everything we have been analysing [154], reading and searching. People who have time, motivation and a desire for free education [150] can choose from this list, presented below in alphabetical order:

Name	Hyperlink	Logo
Acade.me	http://acade.me	açade.me
Alison	http://alison.com	ALISON A NEW WORLD OF FREE CERTIFIED LEARNING
Canvas Network	https://www.canvas.net	canvas NETWORK
Code_cademy	http://www.codecademy.com	code cademy
Coursera	https://www.coursera.org	coursera
Creative	https://www.creativelive.com	C R E A T I V E L I V E
edX	https://www.edx.org	edX
Eliademy	https://eliademy.com	Eliademy
France Université Numérique	http://www.france-universite-numerique.fr/moocs.html	FUN FRANCE UNIVERSITÉ NUMÉRIQUE
FutureLearn	https://www.futurelearn.com	Future Learn
iDESWEB	http://idesweb.es	iDESWEB
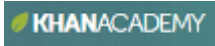
iversity	https://iversity.org	
Khan Academy	https://www.futurelearn.com	
MiriadaX	https://www.miriadax.net	
MOOEC	http://www.mooec.com/	
MRUniversity	http://mruniversity.com	
Novoed	https://novoed.com	
Open2Study	https://www.open2study.com	
OpenHPI	https://open.hpi.de	
OpenLearning	https://www.openlearning.com	
P2PU	https://p2pu.org/en	
Stanford	http://online.stanford.edu	
TedEd	http://ed.ted.com	
Udacity	https://www.udacity.com	
Udemy	https://www.udemy.com	
Unimooc	http://unimooc.com	
Veduca	http://www.veduca.com.br	

Table 3.1. Alphabetical list of popular MOOC platforms

According to Avangate [155], alexa.com represents a ranking system that displays information about the frequency of visits on specific Web sites. The algorithm is based on the amount of traffic recorded over a period of three months and includes two parameters: reach and page views. The reach is a mathematical value, a number of users that visit a specific Web site in one day. The page views represent "the number of times a particular page (URL) is viewed by Alexa users".

For analysing each platform, we enrolled as users/students in 2-3 courses per MOOC (different domains: information technology, history, mathematics, economics or geography). We created for each MOOC platform an account with our credentials. We took into consideration the following: the technological profile, the types of video lectures and the audio-video metadata of the video content.
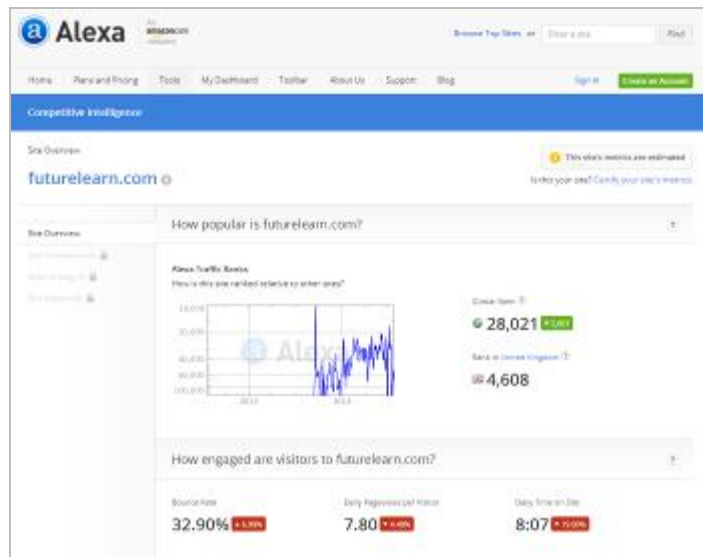
Figure 3.4. Alexa.com - futurelearn.com popularity analysis

Each system has its own unique advantages to offer:
- Content management systems with respect to the flexibility of the management and delivery of learning content;
- Collaborative platforms with respect to the communication features;
- Learning management systems with respect to the support for quizzes and course design [24].

For the technological profiles we referred to and analysed: Hosting Providers, Web Server, Nameserver Providers, CMS, Frameworks, Analytics and Tracking JavaScript Libraries, Audio/Video Media, Widgets, Content Delivery Network (CDN), Document Information (HTML5 DocType, Conditional Comments, X-UA-Compatible, JavaScript, CSS, HTML5 Specific Tags, WAI - ARIA, X-Frames-Options, Apple Mobile Web App Capable, Handheld Friendly, Mobile Optimized, Viewport Meta, Canonical Content Tag, Meta Keywords, Meta Description, MetaRobot, JavaScript, Open Graph Protocol), Encoding and Server Information.

To identify the information listed above we chose the BuiltWith application[1] and the Chrome Developer Tools [156]. We investigated three different web pages: the index page (e.g. https://www.futurelearn.com), a page with all the courses available (e.g. https://iversity.org/courses) and another page with a video lesson included (e.g. https://open.hpi.de/courses/semanticweb2014). BuiltWith represents a tool for identification of technologies used in web applications. It is designed for a small group of users, including web developers and researchers. The generated results provide an overview of the complexity of technical parts required in the development process.

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[1] http://builtwith.com
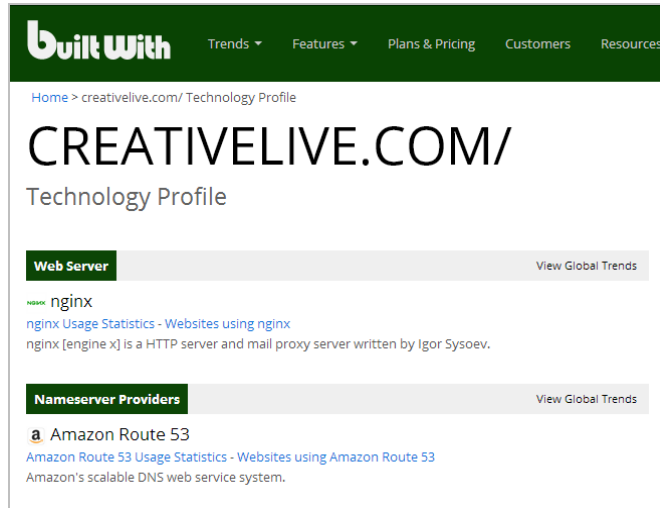
Figure 3.5. BuiltWith.com - creativelive.com profile

As found on https://developer.chrome.com/devtools [156], Chrome Developer Tools are a "set of web authoring and debugging tools built into Google Chrome. The DevTools provide web developers deep access into the internals of the browser and their web application".
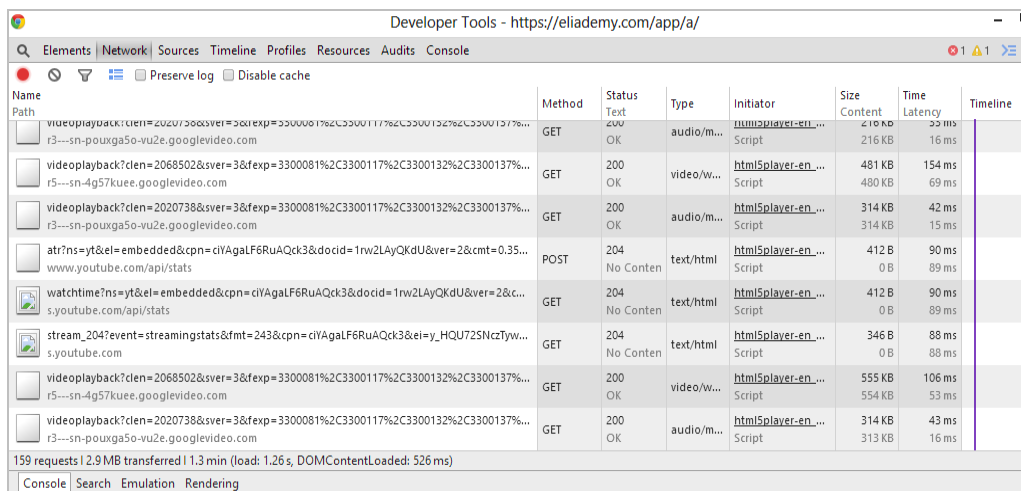
Figure 3.6. Chrome Developer Tools - eliademy.com network analysis

A Web server represents a computer where a program runs that combines a standardized language of communication between browsers and web servers, called HTTP (Hyper Text Transfer Protocol), and based on a specific model, known as client/server model. Dipak [157] says that "web servers often come as part of a larger package of Internet - and intranet - related programs for serving e-mail, downloading requests for File Transfer Protocol (FTP) files, and building and publishing Web pages".

When a user on a remote computer types in the address field of his browser, the URL (Uniform Resource Locator) http://www.example.com/doc/sample.html, the browser slices this URL in 3 parts [158]:

- http://, indicates that the document/file can be retrieved from a web server, which understands the HTTP protocol;
- www.example.com, the host name of the computer from which the document can be downloaded;
- /doc/sample.html: This is the virtual path of the document in the www.example.com's web server.

There are many web server software applications, including public domain software from NCSA and Apache, and commercial packages from Microsoft, Netscape and others [159]. The two leading Web servers are Apache, the most widely-installed Web server, and Microsoft's Internet Information Server [160]. In the particular case of the MOOCs' analysis, we found out that the main player remains Apache (http://www.apache.org), followed by nginx server (http://nginx.org) that released in 17 November 2015 the 1.9.7 mainline version. However, these results are inconclusive as nginx is a caching server and could have also Apache behind it.
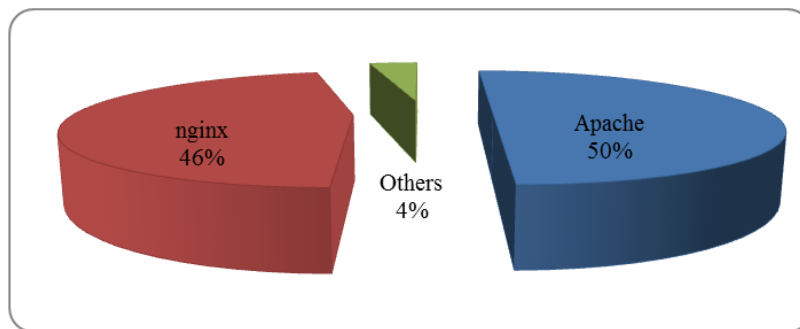
Figure 3.7. MOOCs' web servers

According to Dipak [157], "considerations in choosing a web server include its ability to handle server-side programming, security characteristics, and publishing, search engine, and site building tools that may come with it". A connection channel between the web server and the remote computer is possible with the assistance of a DNS, an abbreviation for Domain Name System. A DNS represents a system for naming computers and network services and is often used in TCP/IP networks, such as the Internet, to locate computers and services through user-friendly names, instead of IP address associated with the name [161]. The DNS for our MOOC list includes GoDaddy DNS, Dyn DNS, Zayo, Amazon Route 53, Cloud Fare DNS, RackSpace DNS Cloud, Linode DNS and DNSimple, as it is shown in Figure 3.8.
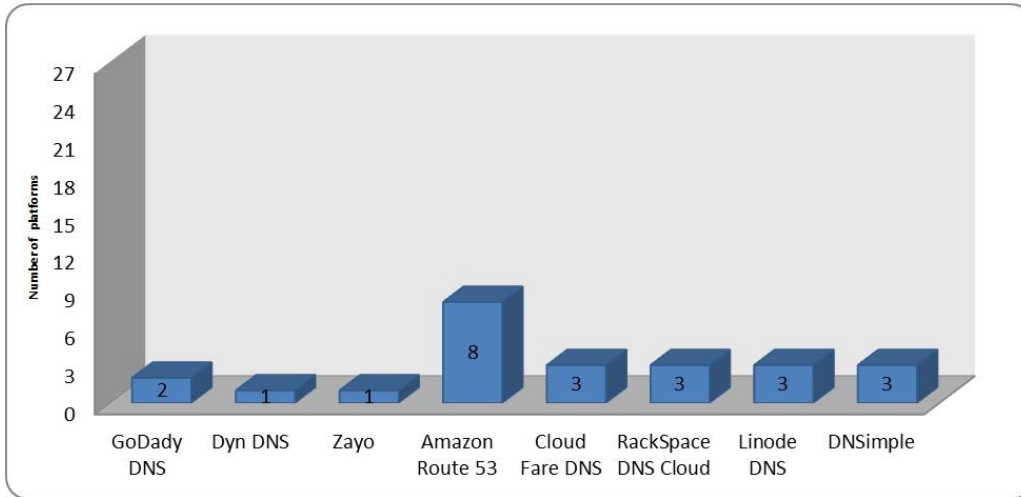
Figure 3.8. MOOCs' DNS

Hosting (also known as Web site hosting, Web hosting, and Webhosting) is, as mentioned in Business News Daily [162], the service provided by a Web host, an organization that sells or leases memory space on its servers. Web hosting is typically done in a data centre, which provides services to clients that enable them to publish websites on the Internet. A Web host can also provide data centre space and Internet connection for servers owned by others. The MOOC platforms show a large diversity; from our study emerged the following types of hosting:
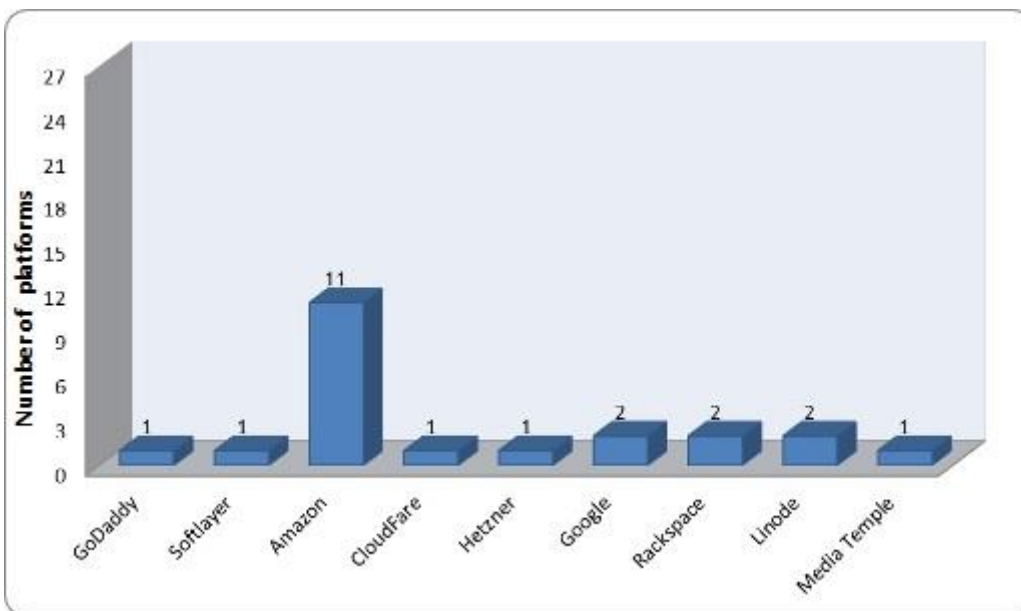
Figure 3.9. MOOCs' Web Hosting

Goodrich said that "those looking for a Web host need to examine their requirements before choosing a Web hosting service. Some of these may include database server software, software for writing scripts, emails for business purposes, streaming media and the operating system offered. Often, the technical aspects of managing a website may be more easily managed if the Web host also provides a Web Content Management System" [162]. Managing content refers to creating, editing, archiving, and publishing, collaborating on, reporting, distributing website content, data and information [163]. Several web-based CMSs are available, the most popular, from our research point of view, in MOOCs, can be seen in Figure 3.10.
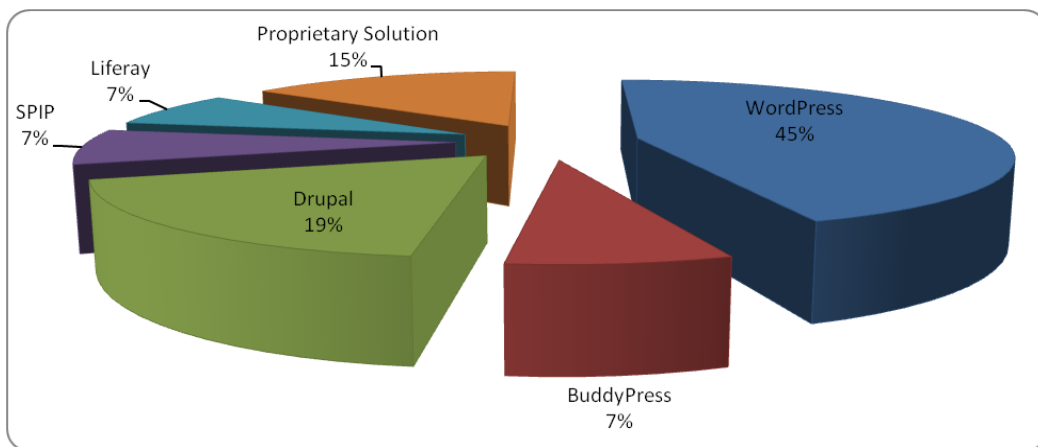
Figure 3.10. MOOCs' CMS

The profile technology synthesis ends with the CDN which is the acronym for Content Delivery Network. The goal of a CDN is to serve content to end-users with high availability and high performance. As more aspects of daily life move online, organizations use CDN to accelerate static and dynamic content such as: text, graphics and scripts, downloadable objects (media files, software, and documents), applications (e-commerce, portals), live streaming media, on-demand streaming media, and social networks [164]. The MOOCs' CDN analysis provides two main players: Amazon Cloud Front and Akamai (Figure 3.11.).
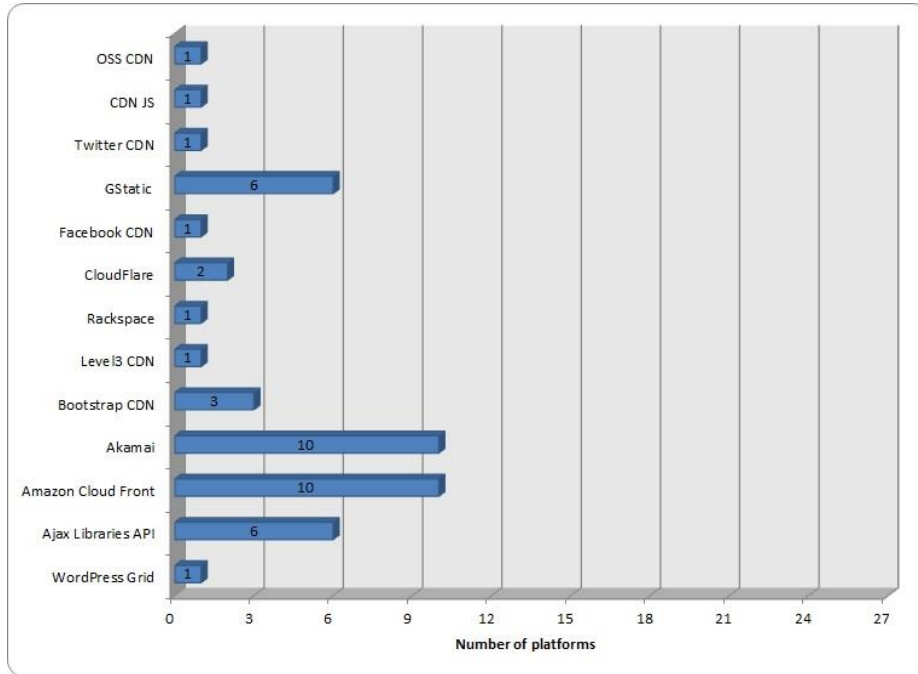
Figure 3.11. MOOCs' CDN

3.5. Video Distribution Systems, Format Profile and Audio-Video Metadata

The main core of a MOOC platform is the video element, which ensures the right delivery of educational content. Using robust video distribution systems becomes mandatory. Following the study results, six commercial or part-free solutions (YouTube, Vimeo, Ustream, DailyMotion, Google Video, and Brightcove) interlaced with the MOOC platforms' proprietary method (22%) were identified by us and presented in Figure 3.12.
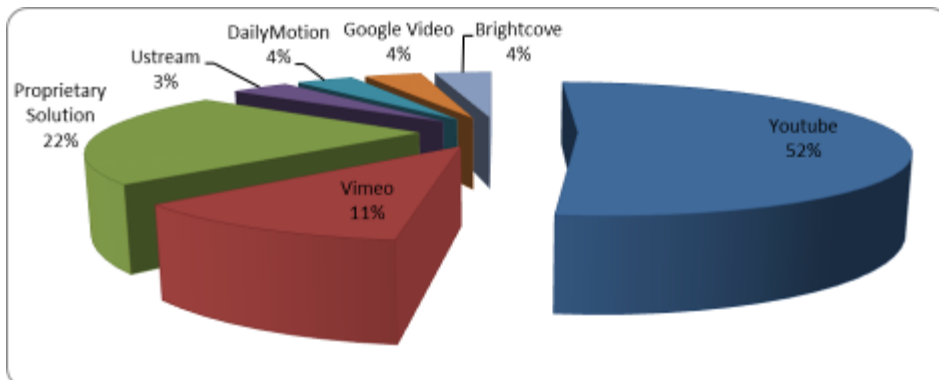
Figure 3.12. MOOCs' video distribution systems

After the establishment of the video distribution platform used for the particular case of each MOOC, we proceeded to the next step of our case studies. We analysed the compression and encoding parameters characteristic to a specific video content that plays inside the MOOC. We downloaded the video lessons (using Video DownloadHelper) on our local machine to extract the audio-video metadata information with specific free software like GSpot®, MediaInfo® and VideoInspector®. Video DownloadHelper is a tool for web content extraction. Its purpose is to capture video and image files from many sites. It has Add-ons for Firefox - Mozilla.
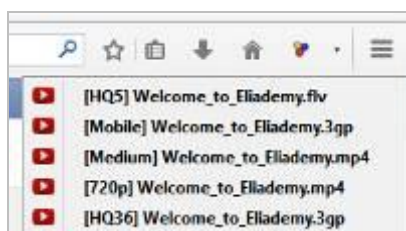
Figure 3.13. Video DownloadHelper

GSpot provides a single-window view of the metadata available in a video; most of the data extracted is technical metadata. But if there is any information published by the author, the application provides this as well. GSpot has an export function that allows the user to save the metadata for being included in a report. A disadvantage of this software is that GSpot has not been updated since 2007.
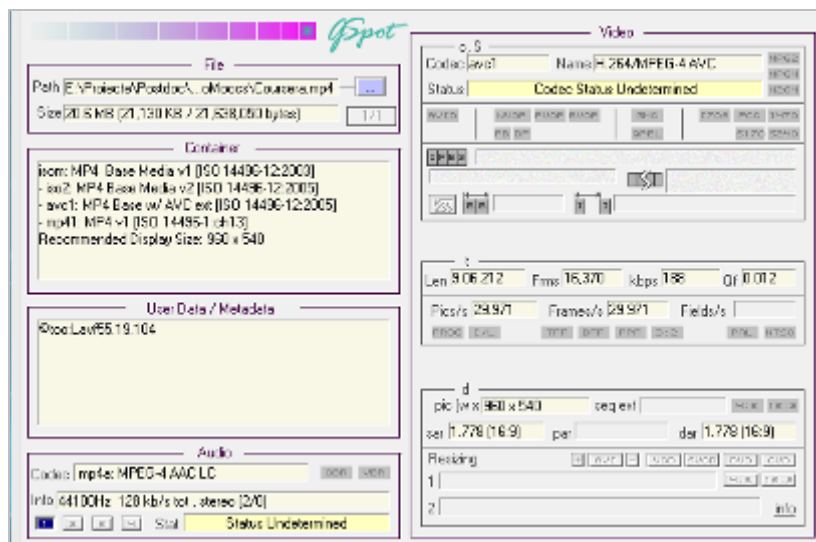
Figure 3.14. GSpot - Coursera video parameters

VideoInspector provides the user with the essential metadata present in the video file. The tool was designed to assist the user in identifying missing codecs required to play the video, reading all the available metadata not being its main function.
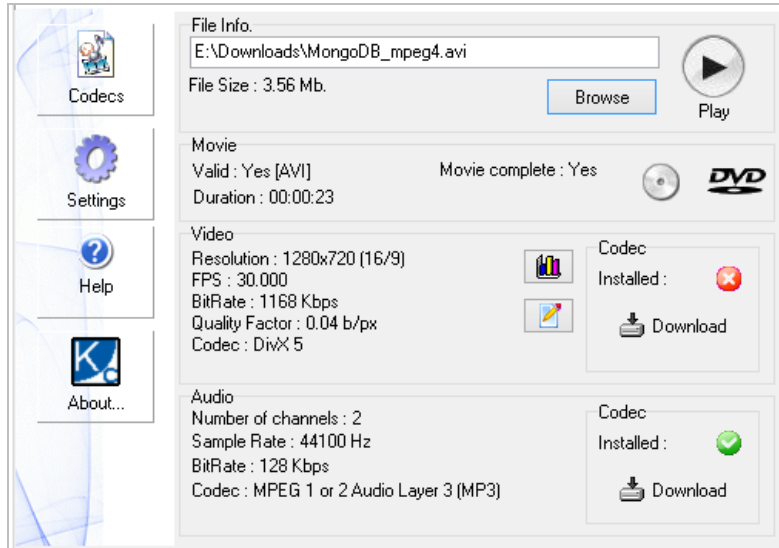
Figure 3.15. VideoInspector - MongoDB audio-video parameters

MediaInfo has a much simpler display than GSpot, but it offers several different visualizations of the information that allow you to determine what metadata are present. MediaInfo offers technical metadata. In the same time it has an interface with a tree structure; it can quickly make reports and export them in text or HTML formats.

Figure 3.16. MediaInfo - MiriadaX video parameters

We extracted values for the following components:
- Format profile: format/container, file size, duration;
- Audio parameters: audio codec, (maximum) bit rate, channel(s), sampling rate, compression mode, stream size;
- Video parameters: video codec, profile level, settings (CABAC or CAVLC, GOP, M, N), video frame size, (maximum) bit rate, display aspect ratio,

frame rate, colour space, Chroma subsampling, bit depth, scan type, Qf - bits/(pixel*frame), stream size.

An overview of relevant parameters is found in table 3.2.

Name	Format	File size	Duration	Audio codec	Audio bit rate	Sampling rate	Video codec	Video bit rate	Video frame size	Frame rate
Acade.me	mp4	216 MiB	18m 2s	AAC	192 Kbs	44.1 KHz	AVC	1477 Kbps	1280 x 720 pixels	29.97 fps
Alison	mp4	1.52 MiB	1m 37s	AAC	54.8 Kbps	22.05 KHz	AVC	62.5 Kbps	640 x 480 pixels	15 fps
Canvas Network	mp4	18.6 MIB	1m 29s	AAC	147 Kbps	48 KHz	AVC	1604 Kbps	1280 x 720 pixels	25 fps
Coursera	mp4	20.6 MiB	9m 6s	AAC	128 Kbps	44.1 KHz	AVC	180 Kbps	960 x 540 pixels	29.97 fps
Creative	mp4	68.3 MiB	1m 17s	AAC	125 Kbps	48.0 KHz	AVC	7273 Kbps	1280 x 720 pixels	59.94 fps
edX	mp4	7.11 MiB	2m 44s	AAC	102 Kbps	44.1 KHz	AVC	265K bps	640 x 360 pixels	29.97 fps
Eliademy	mp4	14.9 MiB	1m 46s	AAC	192K bps	44.1 KHz	AVC	982 Kbps	1280 x 720 pixels	25 fps
France Université Numérique	mp4	78.5 MiB	1m 50s	AAC	126K bps	44.1 KHz	AVC	5851 Kbps	1920 x 1080 pixels	25 fps
Future Learn	mp4	61.7 MiB	9 m 34s	AAC	128 Kbps	44.1 Kbps	AVC	768 Kbps	646 x 364 pixels	25 fps
iDESWEB	mp4	30.6 MiB	15m 6s	AAC	192 Kbps	44.1 Kbps	AVC	235 Kbps	1280 x 720 pixels	25 fps
iversity	mp4	30.6 MiB	15m 6s	AAC	48.0 Kbps	44.1 KHz	AVC	235 Kbps	1280 x 720 pixels	25 fps
Khan Academy	mp4	4.03 MiB	2mn 22s	AAC	96.0 Kbps	44.1 KHz	AVC	138 Kbps	576 x 360 pixels	30 fps
MiriadaX	mp4	41.2 MiB	2m 37s	AAC	192 Kbps	44.1 KHz	AVC	1994 Kbps	1280 x 720 pixels	29.97 fps
MOOEC	mp4	5.15 MiB	3m 26s	AAC	129 Kbps	48.0 KHz	AVC	74.9 Kbps	640 x 360 pixels	30 fps
MR University	mp4	53.8 MiB	9m 17s	AAC	192 Kbps	44.1 KHz	AVC	615 Kbps	960 x 720 pixels	30 fps

Novoed	mp4	169 MiB	2m 49s	AAC	317 Kbps	44.1 KHz	AVC	8043 Kbps	1920 x 1080 pixels	23.97 fps
Open2 Study	mp4	26.9 MiB	2m 48s	AAC	192 Kbps	44.1 KHz	AVC	1148 Kbps	1280 x 720 pixels	25 fps
OpenHPI	mp4	35.1 MiB	14m 19s	AAC	112 Kbps	48.0 KHz	AVC	226 Kbps	640 x 360 pixels	25 fps
Open Learning	mp4	320 MiB	36m 28s	AAC	144 Kbps	44.1 KHz	AVC	1080 Kbps	1280 x 720 pixels	25 fps
P2PU	mp4	10.9 MiB	7m 7s	AAC	93.5 Kbps	44.1 KHz	AVC	117 Kbps	480 x 360 pixels	15 fps
Standford	mp4	59.8 MiB	12 m 36s	AAC	192 Kbps	44.1 KHz	AVC	469 Kbps	960 x 720 pixels	30 fps
TedEd	mp4	23.4 MiB	3m 54s	AAC	192 Kbps	44.1 KHz	AVC	641 Kbps	1280 x 720 pixels	29.97 fps
Udacity	mp4	9.20 MiB	1m 5s	AAC	192 Kbps	44.1 KHz	AVC	979 Kbps	1280 x 720 pixels	29.97 fps
Udemy	mp4	52.7 MiB	4m 22s	AAC	192 Kbps	44.1 KHz	AVC	1490 Kbps	1280 x 720 pixels	25 fps
Unimooc	mp4	11.2 MiB	8m 53s	AAC	53.5 Kbps	44.1 KHz	AVC	277 Kbps	480 x 360 pixels	29.97 fps
Veduca	mp4	157 MiB	58m 36s	AAC	96.0 Kbps	44.1 KHz	AVC	277 Kbps	480 x 360 pixels	29.97 fps

Table 3.2. Format profile and audio-video metadata

These parameters can be defined as follows:

A format, container or wrapper brings together several streams (e.g. audio, video, subtitles, metadata, and data synchronization) which are played simultaneously. In most cases, the header, the synchronization data and part of the metadata are specific to the container. The audio-video stream is encoded using different codecs, multiplexed with subtitles, metadata and data synchronization. In the end we have the format/container. It is like a box filled inside with the stream components [165].

The codec has its origin in the association of two words: "coder - decoder" or "compress - decompress". The codec represents a device or a program itself, a software implementation that allows people to create video based material by choosing precise parameters with particular values [165], such as those shown in Table 3.2.

The bit rate refers to the number of bits stored in a unit of time when it is operating the audio-video recording process. The unit of measurement is bps - bits/second or multiples: Kbps - Kilobits/seconds, Mbps - Megabits/seconds.
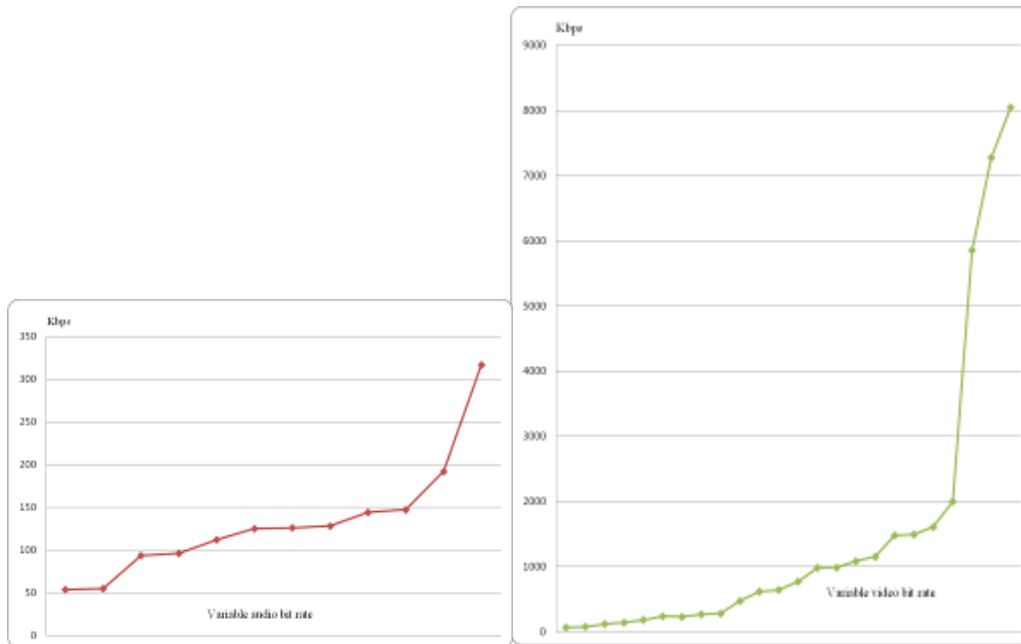
Figure 3.17. Audio and video bit rate variable values in MOOCs

A Video frame size or video resolution is a dimension in pixels for the video element, more accurate, a product between the number of horizontal pixels and vertical ones (e.g. 480 x 360, 640 x 360, 1280 x 720 and 1920 x 1080).
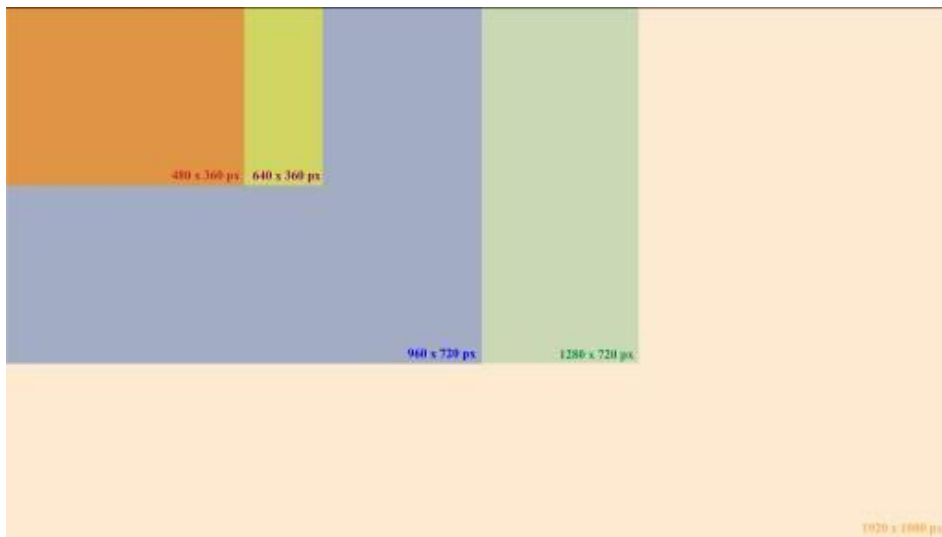
Figure 3.18. Most popular video frame size in MOOCs

The Aspect ratio for an image implies a ratio between the length and height of the screen (l/h) with 4/3 values in classical videos - standard definitions (SD) or 16/9 in high definition materials (HD).

The Video frame rate (the number of frames per second) appears in the temporal sampling process of moving pictures and is an important parameter because the larger this number is the better the quality of the video presentation becomes. For a (video) transmission to seem continuous, it is recommended the use of minimum 15 frames per second [165]. The unit of measurement is obviously fps - frame/second or Hertz (Hz). We found that usual values in MOOCs are 23.97 fps, 25 fps (PAL standard), 29.97 fps or 30 fps (NTSC standard).

The bit depth is the number of bits used to represent the smallest unit of image video information (samples, bytes or pixels) and is closely related to the quantization process. If the value is higher, then the quality of the sound and video is larger. The MOOCs video distribution platforms propose a value of 8 bits.

The number of audio channels differs in values. We can discuss about the mono sound (one channel), the stereo one - the most spread in MOOCs - (two channels), quadraphonic (four channels) and the surround one (six - eight channels).

The sampling rate is the number of samples taken from the audio signal to transform a continuous wave in discrete values. If the number of samples is greater, then the signal accuracy is better. The sampling rate is usually expressed in kilohertz (kHz) and familiar values for audio materials in MOOCs are 22.05 kHz, 44.1 kHz and 48 kHz.

Finally, the literature treats video length (duration) as a very important factor. Teaching Center [166] suggests that videos should have between 2 minutes and at most 9 minutes in length. Whatley and Ahmad [167] implicitly recognize limitation times and propose a 5 - 10 minutes videos. In Figure 3.19., we reveal our results:
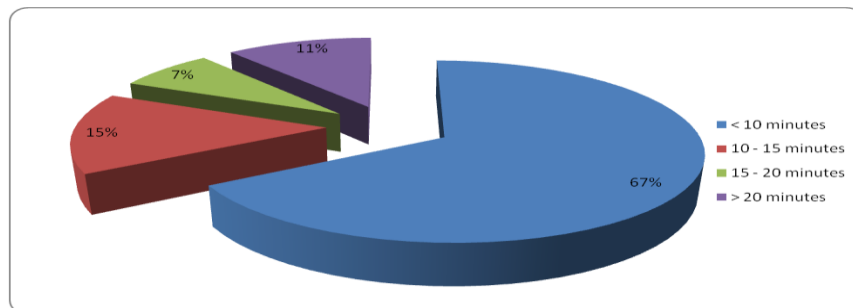
Figure 3.19. Video length (duration) in MOOCs

Based on our personal experience and on the results of the current study, we offer our recommendations for future creators of MOOCs. We suggest developers to choose between the scenarios for audio-video parameters, as depicted in Table 3.3. However, since the moment these particular results were obtained, it is possible that preferences and technologies modified, so one should carefully analyse the current state of the art.

Video frame size	Audio bit rate	Codec Audio	Video bit rate	Codec video	Container
240p **426 x 240**	64kbps 128kbps 196 kbps	MP3 Vorbis	700 Kbps 400 Kbps 300 Kbps	H.264 VP8	.mp4 .webm
360p **640 x 360**	64kbps 128kbps 196 kbps	AAC-LC Vorbis	1000 Kbps 750 Kbps 400 Kbps	H.264 VP8	.mp4 .webm
720p **1280 x 720**	128kbps 384kbps 512kbps	AAC-LC Vorbis	4000 Kbps 2500 Kbps 1500 Kbps	H.264 VP8	.mp4 .webm

Table 3.3. Our scenario proposals for audio-video parameters

3.6. Types of Video Lectures

A notable question was raised by Guo, Kim and Rubin [168] in their online article "MOOC Design Tips: Maximizing the Value of Video Lectures": which kind of videos lead to the best student learning outcomes in a MOOC? It is an important fact for development teams and instructors of MOOCs. It is an essential part from the financial point of view: MOOC video production can range from a few hundred euro/dollars and run up to the thousands [168]. It is significant for the learning process itself. To ensure content and a subject rigor to the classrooms lectures, Florida State University Academic and Professional Program Services [169] recommend that a video lecture must have a framework for lesson delivery that should consist of six parts:

- Gain the students' attention and establish expectations;
- Review relevant, previously learned material;
- Link the new information to previous one;
- Offer learning guidance or elaboration;
- Offer time for practice and feedback;
- Provide for spaced practice to enhance retention.

Video lectures became more and more portable, more and more focused on students' individual pace [170]. There are five broad types of MOOC students. Viewers "watch lectures, handing in few, if any, assignments." Solvers "hand in assignments for a grade, viewing few, if any, lectures." All-Rounders "balance the watching of lectures with the handing in of assignments". Collectors "primarily download lectures". And bystanders are "registered for the course, but their total activity is below a very low threshold" [123][93].

Our study identifies the most popular types of video lectures used in the MOOCs platforms and the results (Figure 3.20) include Lecture Capture, Voice over Presentation, Animated Instructional Video, Tutorial, Talking Head Video, Khan Style (Hand on Board) and Hybrid Video Lecture.
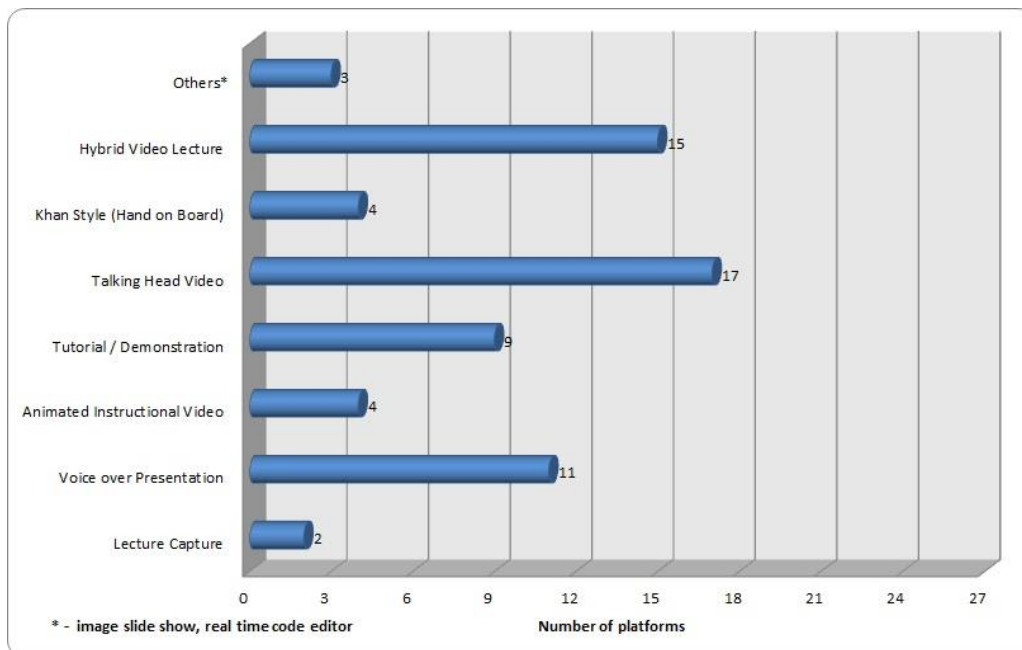
Figure 3.20. Types of video lectures

An explanation of each and a description of the pros and cons are mandatory.

Lecture Capture, also known as classroom lecture, represents the recording of a live lesson from a school or university [168]. To create a kind of video material is quite easy, at first sight. It is necessary to have a video camera (professional or non-professional) and to record one of the lectures. Live video capture preserves the classroom environment, the communication part between the teacher and his audience: questions from the students, the teacher's answer and the reaction to the new information. However, it offers no interactivity with the online student. Also, the quality of the video can be quite poor if the video recording equipment is not adequate to the classroom ambient [171]. In case of some technical difficulties, live capture does not allow to stop the teacher and to record again some parts of his speech. An action like this will generate a kind of chaos in the real classroom.

Talking Head video consists of close-up shots of the instructor. He speaks directly to the recording equipment (video camera, webcam) and is filmed at his office or in a studio with no audience, during which he talks on the subject matter [168]. The audio part lets the voice do the teaching [172]. Preparation of a talking head video includes the setting up of a camera and a script for the lecture. The recording process is flexible, breaks are allowed, unnecessary information can be cut out and fragments of speech can be recorded again. There is no interactivity: the script of such lecture must be presented in a manner that does not seem boring to the online students. The value of the teacher enthusiasm, humour, intonation, face language and articulation cannot be underestimated [173].

It is actually difficult to insert interactive material, like external links for example. The instructor may refer to a book, a website, but students will not be able to access these from the video [171]. Nevertheless, an aural experience

according to Udemy support [172] "can be useful to stimulate the imagination and promote independent visualization and knowledge association". Young [173] suggests that, although the Talking Head is a relatively passive use of video, if well designed and/or featuring a good performance, a virtual instructor can be surprisingly engaging.

Voice over Presentation includes a slides presentation, supplemented with a voice over that gives details/explains the slides. Technically speaking the slides are made in programs like PowerPoint or Keynote and voice over can be created with plenty of tools, either commercial or free [172]. The combination of visual information (text, graphics, diagram and images) with audio narration makes the learning operative. It allows the use of verbal skills to explain the subject reflected in the objects inserted in each slide. Such type of lecture knows certain limitations: interactive elements can be difficult to insert, the synchronization of audio records with the slides needs time and specific skills, the motivation for creating presentations over and over again can reflect badly in the quality of lectures that become inappropriate for the student's attention [171].

In a Khan Style video, the teacher's voice goes along with the "Freehand on a Digital Table". The video content focuses on what is being written or shown on the board [168]. The style is popularized by Khan Academy videos. Kaplan [174] highlights the characteristics of this type of video lecture with a consistent comment: "Khan Academy holds the promise of a virtual school: an educational transformation that de-emphasizes classrooms, campus and administrative infrastructure, and even brand-name instructors." On the other half in a Khan experience the face of the instructor never appears and viewers see only "the step-by-step doodles and diagrams on an electronic blackboard" [174], that can be inconvenient sometimes for a specific learners segment/niche.

A Tutorial/Demonstration proposes a video screen capture with the teacher's voice over, where the instructor demonstrates a concept, writes a code in a text editor or command - line prompt, using different programs or documents [168]. Software like TechSmith Camtasia®[2] or Adobe Captivate®[3] can be used, but the trainer must learn to use the program and then make the recording and the video lessons by himself. This is a mandatory technique for the teachers who want to explain the functionality of a program. The best examples are shown in one of the most popular online video tutorial platforms, Lynda[4].

Animated instructional video implies technical advanced skills for developing or learning commercial software (e.g. 87seconds.com, Video Scribe). We can classify this learning style in:

- Classic/Traditional Animation - like cartoons;
- Claymation, an animation process using clay or plasticised figures that are moved and filmed using stop-motion photography to create a lifelike look;
- 3D animation, totally computer-generated with the images being made and animated using 3-D design and animation software;
- Vector animation, where vectors (mathematical values) control art or motion rather than pixels.

With or without the voice recorded, in this type of material the face of the instructor never appears. It is a lecture type fitting to certain areas; not all teaching

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[2] http://www.techsmith.com

[3] http://www.adobe.com

[4] http://www.lynda.com

materials can be animated in a way that brings quality and efficiency to the online student. It will remain a challenge for the virtual instructors in the future.

Interactive Lecture represents one of the most complex types of online lecture videos. Interactivity has multiple ways to manifest: switching mode between slide and video modes, supplement video part with hyperlinks, resources and files, annotations, etc. [171]. The instructors can create the content in a way that allows students to choose segments of the video lectures they want to study. The video itself is divided into small segments that are played through an access-selection interface [170]. Zhang et al. [175] find that this direct choice and play interaction improves learning. Although the time and technical skills for developing are increasing, interactive video lectures can create a stunning presence effect for the students [171].

A Hybrid video lecture offers a combination of the lecture types listed above or particular teaching cases and can be identified as:

- Real live lecturer combined with a presentation or other multimedia materials;
- Instructor interviewing another expert or guest speaker [168];
- Instructor delivering lecture in another setting related to the course, (e.g. an art historian in a museum) [168];
- Panel Discussion of experts on specific course-related topic [168];
- Combination of Voice over Presentation and Talking Head Video;
- A Mashup, side-by-side video and presentation talk in a timed, sequenced fashion [172].

Does a good classroom lecture make a good video? What sort of interactive activities are most effective for learning? Moreover, looking longer term at teaching new topics on video, do we need to give lectures to focus groups before recording them? On the other hand, will online analytics give teachers better suggestions on how to improve their classes than puzzled looks across an auditorium? [176]. These are some subjects for future research.

3.7. Moodle

3.7.1. Introduction

Initially developed as a doctoral research of Martin Dougiamas [177], the Moodle system was officially launched as the 1.0 version on the 20th of August 2002. The latest release version of Moodle is 3.0.2 released on the 11th of January 2016 [178].

Moodle was initially created as an acronym for Modular Object Oriented Dynamic Learning Environment. The verb "to moodle" means to dawdle aimlessly, to idle time away, which could take the one doing that action to a creative realm.

The platform is available for free on the website of the organization [179], under an open source licence (GNU GPL). This allows the modification and adaptation of the software code according to the needs of the developer, and also the unlimited use of the platform without paying any licencing fee.

In order to use the platform, one needs to install this on a web server, the only additional requirements being the configuration of a PHP interpreter and a database management system based on the SQL language, such as MySQL for example.

According to the official statistics offered by Moodle, there are over 63.000 Moodle based platforms registered in 220 countries, hosting almost 9 million courses and serving almost 80 million users [180]. In Romania there are 241 platforms, of which 122 are private and not visible [181].

From the very beginning, the platform adhered to the pedagogical theory of "social constructivism", which could be explained through the following aspects:

- All the participants of the educational process have the potential to be both tutors and students – in a real collaborative environment, both options are simultaneously valid;
- The act of creation or self-expression in the presence of other users has a very good learning potential;
- It is easy to learn from simply observing others;
- Through acknowledging the context of the participants to the learning process, one can adapt the way of teaching to the needs of the participants (constructivism);
- The learning environment has to be flexible and adaptive, in order to answer in due time to the needs of the educational process participants. [182]

Here are some advantages of the Moodle platform, as seen by some:

- The open source aspect – this licencing type allows both the free use of the application and its adaptation according to the specific needs of each education scenario;
- The social-constructivism educational paradigm, on which the platform was based, and which focuses on the creation of new concepts and knowledge through active participation of all users involved in the learning process, no matter of the role they have in that process;
- The enthusiastic community who stands behind the platform and who ensure a rapid development of concepts and functionalities, as well as ensuring the quality of the platform through intensive testing and finding timely solutions to problems that might occur [182].

Finally, I point out that Moodle is a LCMS (Learning Content Management System) which means its main concern is the creation and delivery of educational content and could, or could not, contain the presentation of the material created for the final beneficiary – the student.

3.7.2. Moodle as a MOOC Platform

Moodle has been around for more than 10 years, and thanks to the effort of its official developers, and the support of all the different types of people using it – educators, students, administrators and free-thinkers alike – is currently serving the learning needs of almost 80 million users from all over the world [180]. The MOOC, on the other hand, is a relatively new concept, and takes a more liberal approach to learning, heavily relying on existing social media tools to enable learning through collaborative debates.

The correlation between a MOOC and a LCMS can be regarded as ancestral: MOOCs are the logical evolution of the virtual classroom of the 2000s, by achieving the latter's ideal of a learner centric virtual learning environment, but extended to a community driven learning process. In addition, Moodle, with its social constructivist philosophy, seems, at first glance, to meet only in part the requirements of a MOOC. The features that made Moodle such a success with learning administrators – detailed reports of student activity, a large array of closed resources, etc. – are

what MOOC adopters consider unsuitable for a massive online course, which should be transparent, accessible, open.

But according to Mathieu Plourde in his illustration gone viral [183], for MOOCs, "Every letter is negotiable".
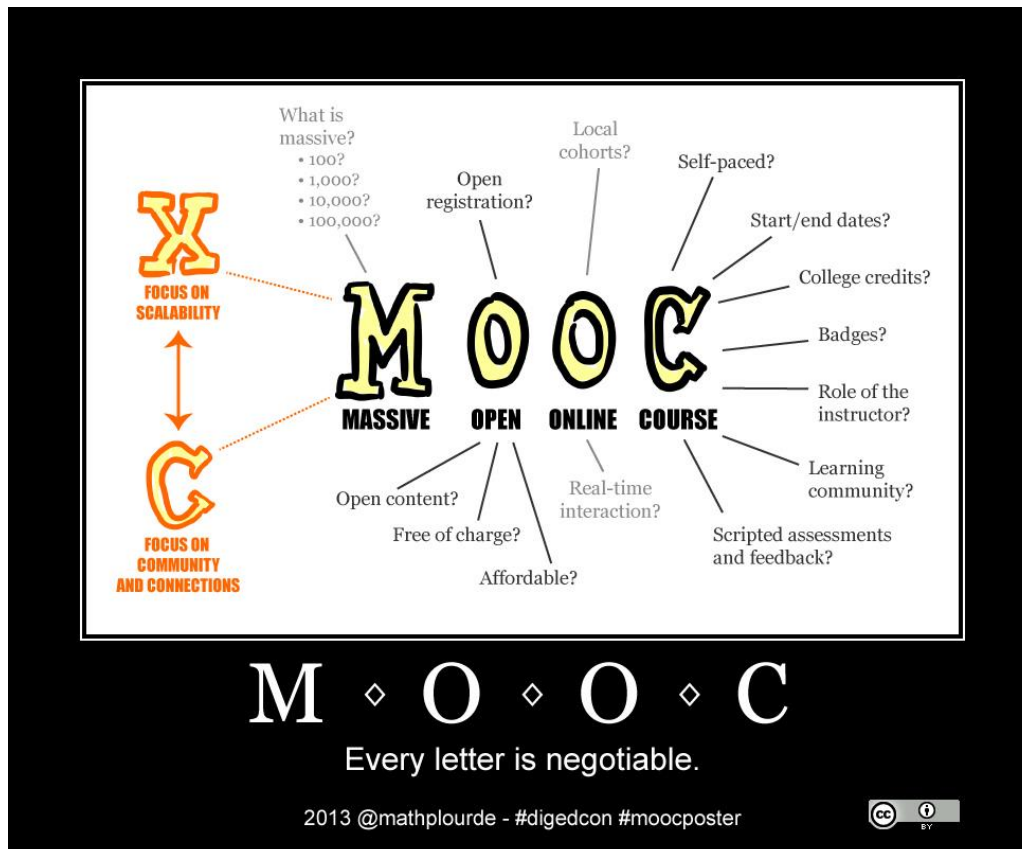
Figure 3.21. "Every letter is negotiable" – image by Mathieu Plourde [183], licensed as CC BY

This means that the concept of MOOC is still coalescing, with a definitive form, i.e. a clear set of specifications, still to be established. Therefore, every aspect generally considered to belong to MOOCs is debatable. Moreover, any system that aspires to the MOOC title needs to be adaptable enough in order to keep up with the trends.

Still, the main engine behind this concept remain higher education institutions who wish to provide open access to their educational resources for anyone interested, even though the industry has also taken an interest in the concept, as an affordable alternative to expensive corporate training for its employees.

And the trend is to complement already classical LCMS solutions (Moodle, BlackBoard, etc.), which are aimed at more traditional learning scenarios like blended-learning, with either a mix of already existing social networking solutions and tools, or dedicated solutions more-or-less appropriately referred to as MOOCs.

Some argue that MOOCs are going to irrevocably replace current virtual classrooms, mainly due to the economics concerned [184]. Indeed, the ratio of required trainers to trainees is usually superior in a classical e-Learning scenario compared to a MOOC. The inherent informal nature of the latter means that the community of learners is self-sufficient to a degree and the need for tutor guidance is reduced. Furthermore, the so-called cMOOCs rely heavily on the community to provide much of its instructional resources, the system providing mainly the environment for the exchange of ideas.

However, this informal nature of the whole learning process tends to alienate it from the higher education ecosystem whence it originated, a system with the need for a stricter control of the various stages of learning, as well as the following of a sometimes more strict or broader curricula.

There are some special cases where a MOOC is preferred over traditional e-Learning solutions, but they usually include special circumstances, such as the opportunity for learners from different educational institutions to access the same learning environment (for instance, in international academic cooperation), or even the possibility to allow anyone to access the materials and the discussions, regardless of their educational affiliations, with the purpose of bringing a fresh, outside perspective to the subject [185].

Still, these are usually only on-going experiments without definitive results. The recommended setting for a MOOC remains alongside academia, with the declared purpose of either providing the materials and activities already proven in a more formal learning scenario (the case of the universities which started the movement), or the accumulation of knowledge and training knowhow, in the community-driven MOOCs.

Moodle's open-source status has been considered by some as one of its main disadvantages, since the lack of an officially guaranteed support system means that administrators must rely on their own knowledge of the system, or on the community behind the software [186]. Still, the community of users and developers behind the platform is large and active enough to have transformed Moodle into one of today's major e-Learning platforms.

In addition, open-source means that any part or subsystem of the platform can be customized to meet the needs of most learning scenarios. On top of that, its adaptability allows it to reach a multitude of configurations, including that of a MOOC.

As stated previously, the main drive behind a MOOC is the community of learners. They need to be able to quickly access the provided information – such as it is – and discuss it freely using any means of communication.

Moodle provides all the tools needed to achieve this: it provides the framework for creating a large array of resource types, as well as multiple communication channels, asynchronous as well as real-time. It can even be configured to group all the activities in a course around a discussion forum – using the so-called Social Format.

Regarding the open character of a MOOC (the first "O" in the acronym), Moodle's authentication methods are flexible enough to allow self-registration and self-enrolment, while the recently introduced licensing mechanism allows all content creators to choose the appropriate license type for all the materials they bring to the system. Worth mentioning is also the possibility for each authenticated user on the platform to keep a personal blog, which can be configured to be accessed openly on the web.

Still, one of Moodle's shortcomings in this situation is its strong self-sufficiency, which makes it difficult to integrate with other systems. It is of course a side effect of the developers' efforts in attaining a high degree of security, but in the case of a MOOC, integration with social tools is paramount.

There have been some efforts from the community to create modules that connect with the main social platforms in use today (like the Twitter Search Block [187], the Twitter Feeder [188] or the Facebook Comments [189] blocks), but the results have been received with mixed reviews. And according to the *MOOC Guide* on Wikispaces, Twitter (or any other microblogging solution) is ideal for the quick exchange of ideas and the flexibility provided by the hashtag system, thus vital to any self-respecting MOOC [125].

Other items on the checklist from the aforementioned guide include collaborative activities (the wiki activity included in Moodle has been around since the beginning), cloud-based document sharing (greatly improved by the integration with Google Drive, since Moodle version 2.0) and synchronous communication (available in Moodle through pre-scheduled chat sessions, or even audio-video conferencing systems, through third party solutions such as WizzIq[5] and Big Blue Button[6]).

The use of Moodle as a MOOC is not really a new concept. Moodle Pty Ltd (the official body behind Moodle) launched an official MOOC with the aim of aiding new educators to use the platform, titled "Teaching with Moodle: An Introduction" [190]. The course was hosted on the official Moodle installation, and was attended by roughly 1800 participants from 200 countries, during its 4-week run.

Also, one of the first Romanian MOOC platforms, mooc.ro is developed by Moodle Romania, on a Moodle platform together with a first course in Romanian into how to use Moodle[7].

Of course, the developers of Moodle are not the only ones to use the platform as the basis for a MOOC. John Swope from EdTECH created a table comparing existing free solutions for platforms used in MOOCs [192], which together with Andrei Ternauciuc we reproduced in Table 3.4.

	Max.Participants	Brandable	Custom Analytics	Monetization	Mobile	Hosting
edX	300,000	✓	✓	✓	✓	Self-hosted
Moodle	10,000	✓	✓	✓	✓	Self-hosted or 3rd party
courseSites (from Blackboard)	unlimited	✗	✓	✗	✓	Hosted
udemy (free version)	unlimited	✗	✗	✓	✓	Hosted
versal (free version)	unlimited	✗	✗	✗	✓	Hosted

Table 3.4. Comparison of free platforms for MOOCs

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[5] https://www.wiziq.com/moodle/

[6] http://bigbluebutton.org/open-source-integrations/

[7] http://mooc.ro/

As edX and udemy have already been presented in previous chapters of this thesis, I am going to briefly describe CourseSites and Versal. CourseSites is a free, hosted online course creation and facilitation service that offers tutors the possibility of adding a web-based component to their courses or even hosting an entire course online. CourseSites uses the latest technologies from Blackboard Inc., one of the biggest educational technology companies in the world. Versal is another educational online platform that enables teachers to share their knowledge and create online courses. It offers the possibility of embedding the materials created anywhere on the web.

The only technical limitation of Moodle as a MOOC (according to the indicators evaluated), is, arguably, the small number of possible participants. Nevertheless, as stated earlier, the term Massive is negotiable, so this limitation is only applicable in certain scenarios.

The comparison table also emphasizes another advantage of Moodle over some of its competitors: it facilitates payment opportunities, if this feature is desired.

Overall, there is no insurmountable obstacle in using Moodle to provide content and learning opportunities to a large community of users, in concordance with the MOOC philosophy. All it takes is the proper configuration of the platform, integration with a series of social tools, and maybe a shift in the perception of Moodle as a closed learning system.

3.7.3. Configuring Moodle for MOOC

A few steps are required in order to prepare a fresh Moodle installation for hosting MOOCs.

First, the appropriate authentication mechanisms need to be activated. Usually, this means activating the email-based self-registration, as well as permitting guest access to the platform, in order to allow potential members to review at least parts of the platforms without the need for authentication. A community-developed authentication plugin can allow the creation of an account using OpenID [193].

Then, all the appropriate external repositories need to be activated. There are many available, including Google Drive, Box.net, Dropbox, Flickr, Picasa, Wikimedia, YouTube, etc. These will allow access to the personal files and resources of the participants, directly inside Moodle.

Next, the already mentioned blocks for access to the social networks need to be installed, customized, or even redeveloped.

Finally, the courses need to be created, using the special Course Format, which centres all the activity inside that course on a discussion forum.

A relatively new mechanism inside Moodle is the Badges system [194]. Introduced in Moodle version 2.5, they are a method of rewarding special achievements on a course or site level. Badges are an excellent method to certify a skill acquired in a course or part of a course, and has the added benefit of being easily verifiable [195]. The awarding of badges should also be considered when discussing the attestation strategy.

Of course, many intermediary steps were omitted, like the interface, the branding and other administrative decisions, such as potential methods of payment.

The steps described above represent only a rough draft for anyone studying the possibility of using Moodle as a MOOC serving platform. Future research and development will require a more detailed analysis of this aspect.

3.8.   Conclusion

I presented a series of technologies currently used in MOOCs, based on the affirmation that MOOCs are participatory platforms and technologies. Therefore, it is necessary to have a series of social media technologies embedded in MOOCs, such as social networks, blogging and micro-blogging plugins, wikis, document collaboration apps, just to name a few.

Then, I presented existing web 2.0 and web 3.0 technologies already analysed in the literature which are used in existing platforms and also potential candidates for the future of the industry.

There is no denying that a central part of any MOOC is represented by the use of social media with the purpose of freely discussing any parts of the subject of study. These informal and often unmediated discussions represent the drive behind the collaborative learning process. Still, a certain level of control and some general statistics are needed in order to improve the system and for evaluation/ certification purposes.

The technological profile of MOOCs offers an overall view about the technologies that compose the infrastructure of a MOOC platform. The MOOC platforms offer diversity from all perspectives, but I also identified some common areas.

Together with Mihai Oniţa [154], we found that concerning the server applications the market is almost equally divided between Apache and nginx (Figure 3.7). The most used DNS is Amazon Route 53 (Figure 3.8), Amazon being also the main provider of web hosting (Figure 3.9). Wordpress is the CMS responsible for almost half of the MOOCs we analysed, but Drupal and proprietary solutions are popular as well (Figure 3.10). Akamai and Amazon Cloud Front are the main choices for a CDN (Figure 3.11). In the next paragraphs, we underlined some key findings of our study, regarding our focus, distribution video platforms, audio-video parameters and the type of the video lecture together with our suggestions.

1. For the instructor it is important to identify the type of video lectures depending on the domain, course objectives and the goals that he wants to achieve. He has to plan each lecture for the MOOC format and its potential students. It is necessary to consider the copyright terms for multimedia elements used in videos and slides. The instructor needs to plan ahead by selecting appropriate multimedia elements, free from copyright during the planning phase or to request copyright permissions;
2. Engagement patterns differ between the lecture formats. The engagement is higher with the talking head, voice over presentations and hybrid which researchers suggest that are due to more "intimate and personal feel" [168]. Moreover, interactive materials become important, although you need supplementary skills for developing them (Figure 3.20);
3. Shorter videos are more engaging. Student engagement levels drop sharply after maximum ten minutes (Figure 3.19);
4. Invest in the pre-production planning phase. Segment the course content into chunks, using six-ten minutes per video as a guideline. Identify a purpose for each video lecture, and key content points to deliver within each. Write a script for each [lecture video format] and have the instructor practice before filming; this reduces filming and editing time. Video producers and edX design teams determined that pre-production planning had the largest impact on the engagement effect of the videos. Researchers used a data set within the study to test this idea [168].

5. For tutorial/demonstration videos introduce motion and continuous visual flow into tutorials, along with extemporaneous speaking so that students can follow along with the instructor's thought process. Complete basic outline of the video beforehand, not a full script to be read word-for-word. For tutorial/demonstration videos, the Khan-style format where the instructor draws on a table and narrates was found to engage students more effectively than screen casts. A contributing factor is the instructor's ability to situate himself "on the same level" as the student.
6. Choose between vimeo.com, youtube.com or a proprietary solution for the hosting of your videos.
7. Choose between the scenarios shown in Table 3.3 for audio-video parameters.
8. Provide more personal feel to your videos. Coach instructors to use humour, personal stories and convey enthusiasm where possible.
9. There are many providers for the different technologies you need for developing and running a MOOC, and depending on your requirements, you can choose which of them you will turn to. We presented how the most important platforms are doing it and we offered some reasons regarding why they are doing it like this. Further research should analyse the importance of technology, by applying our conclusions for a new developed MOOC platform and seeing the impact it has.

Finally, I presented Moodle as a potential platform on which to base a MOOC. General information about Moodle was offered, together with arguments in favour of this choice. Some steps required in order to configure Moodle for MOOC use, were pinpointed, the list not being exhaustive.

Using an existing platform, which already meets the access control and analytics requirements, is one way to obtain an effective delivery system for MOOCs. As I have underlined, social media is a powerful tool when working with MOOCs, and Moodle integrates most of these recommended tools. With the appropriate configurations and tweaks, and with a minimal integration with some of the most popular social networking platforms in use today, Moodle can successfully play the role of a MOOC platform.

The main disadvantage –aside from mild technical limitations– is the need to familiarize a large audience with a relatively complex learning content delivery system. Nevertheless, with a minimal training and a change in perspective, I believe that Moodle can successfully provide the basis for an efficient MOOC platform.

This chapter represents also a part of my theoretical contribution as I realised a thorough analysis of technologies used in existing MOOCs, I presented the infrastructure that stands behind a MOOC platform, usually not seen by the learners' eyes and presented a series of arguments into using the Moodle platform as the basis for a Romanian MOOC. Another important theoretical contribution is my critical analysis of video related aspects in MOOCs.

Some results presented in this chapter have been published in [127], [154], [196] and [197].

4. RESEARCH IN MOOCS

In this chapter I describe the existing research in MOOCs and, in particular, the methodologies used in this research. Then, I evaluate the different types of methodologies and offer my explanation about why research underwent this means of investigation. The research methodology chosen by me in this thesis is described. The chapter ends with an analysis of a Word Cloud constructed around over 1000 MOOC articles which gives a statistical overview of the subject.

4.1.   Methodologies Used in Research

The first years of MOOC research consisted of analyses of different courses ran as MOOCs, analyses made either by course creators or course participants. These papers were created as reports for early projects [6], [198] or centred around the experience of learners [199], [200], [201].

The first impactful researcher of MOOCs was Antonio Fini with his paper from 2009 [92]. He analysed a survey designed for participants of the CCK08 course [1] divided in three sections: personal information, general information about the CCK08 course and the opinions about the tools available and detailed questions on each tool used in the course. The survey included a number of open-ended questions in order to gather detailed comments and opinions. He used tag cloud visualization in order to represent the variety of answers received.

One of the most popular approaches to MOOC research was Katy Jordan's thorough summary of MOOC completion rates [91]. Her Ph.D. focus was on online academic social networks and she tracked information of the percentage of students completing over 30 MOOCs. Her results showed the alarming (for some) completion rates of only 6.8 %, with a high of 19.2 % for a course from Switzerland's École Polytechnique Fédérale de Lausanne and a low of 0.8% for a course offered by Princeton University [91].

Worth mentioning is the MOOC Research Initiative (MRI) funded by the Bill & Melinda Gates Foundation, which focuses on: student experiences and outcomes; cost, performance metrics and learner analytics; MOOCs policy and systemic impact; and alternative MOOC formats [202].

The analysis of MIT's course 6.002x, Circuits and Electronics of Anant Agarwal, was an important one, as there were over 155,000 registrations. The background of the students was pointed out as they came from 160 countries, with the US, India and the UK accounting for the majority of the traffic and Columbia, Spain, Pakistan, Canada, Brazil, Greece and Mexico rounding out the top ten. Of these 155,000 learners, 23,000 tried the first problem set, 9,000 passed the mid-term and 7,157 passed the course as a whole. 340 students, including a 15-year-old Mongolian, got a perfect score on the final exam, qualified by Anant Agrawal, who heads what has now become the edX initiative, as 'very hard'. Commenting in MIT news [203], Agrawal noted that while the rate of attrition may seem high, 'if you look at the number in absolute terms, it's as many students as might take the course in 40 years at MIT' [28].

Another study, conducted about who the "MOOCers" are, found that across all Coursera courses, 74 percent of registrants reside outside the United States. The biggest foreign markets have been Brazil, Britain, India and Russia, according to Andrew Ng, founder of Coursera [204].

Surveys conducted by researchers at Duke University show that student motivations typically fell into one of four categories [198]:

- To support lifelong learning or gain an understanding of the subject matter, with no particular expectations for completion or achievement;
- For fun, entertainment, social experience and intellectual stimulation;
- Convenience, often in conjunction with barriers to traditional education options;
- To experience or explore online education.

I have already mentioned the research conducted by a team of researchers [133] about the behaviour in online discussion forums of over 100,000 students taking MOOCs. Another study is Jiang's [136] descriptive statistics of discussion forums, also mentioned before.

According to a Babson Research Group survey from 2013, institutional decision makers have yet to be convinced of the value of MOOCs. Although not specifically attributing their scepticism to the perceived quality of MOOCs, the report finds that only 28 percent of chief academic officers believe that they are a sustainable method for offering courses [205], [206].

Hollands and Tirthali [207] asked 39 universities and colleges why they engage in MOOCs. They identified extending reach and access as the most important motivation, mentioned by about two thirds of the universities. Further, building and maintaining brand, improving economics, improving educational outcomes and innovation were all mentioned by more than one third of the universities. Finally, research on teaching and learning was mentioned by a bit less than one third.

In the study conducted by Allen and Seaman [206], increased visibility ranked highest, followed by drive student recruitment, and innovative pedagogy or flexible learning opportunities.

Sandeen and Jarratt [208] interviewed administrators and MOOC teachers about their motivations for engaging in MOOCs development. They conclude that both administrators and faculty see sharing knowledge more broadly, advancing pedagogical development and enhancing the on-campus education as key motivations. In line with Allen and Seaman, they found financial questions of revenues or cost savings do not constitute primary objectives.

Kolowich [209] presents the MOOCs from the perspective of the professors that create them, after a survey conducted by "The Chronicle", on which 103

teachers responded. Usually a teacher spent over 100 hours on his MOOC before it even started, by recording online lecture videos and working on the course material. Others managed to do that work in some dozen hours. During the time the course was running, teachers usually spent eight to ten hours each week on maintenance. Most professors managed to receive only a limited amount of messages from their MOOC students but it happened many times that a professor would be engaged in the discussion forums. Participation in those forums varied, but the majority of teachers posted at least once or twice each week, and some of them posted at least once each day. As far as awarding formal credit is concerned, most professors do not think their MOOCs are ready for prime time. Asked if students who succeed in their MOOCs deserve to get course credit from their home institutions, 72 percent said no.

In a later article [210], Kolowich presented the 5 things that the researchers from the MOOC Research Initiative found from another study:

1. If you are isolated, poor, and enamoured of the prestigious university offering the MOOC you are taking, you are less likely to complete it.
2. Coaching students to have a healthier mind-set about learning may not help in a MOOC.
3. Paired with the right incentives, MOOCs can help prepare at-risk students for college-level work.
4. Discussion forums in MOOCs are healthy places for the few students who use them.
5. We still do not know if doing well in MOOCs will help underprivileged learners become upwardly mobile.

Studies about the drop-out rates and the instructional problems that appear in MOOCs have been analysed in previous chapters.

There are researchers that raise different questions for MOOC facilitators, creators and institutions.

Byerly [211] raises some questions for universities that are thinking of building a MOOC.

1. Do you see offering MOOCs primarily as a public good, or as an opportunity to enhance your institution's position?
2. Will your MOOC curriculum parallel the aims – whether liberal arts, professional, or vocational – of your existing curriculum?
3. Can MOOCs fit into your college's financial model?

Gaebel [212] raised the question if any university can have a MOOC. "Will MOOCs in their present form come to constitute a specific model of education that can be made sustainable and be replicated by other universities, and if so, under which conditions:

- The popularity that these courses enjoy and the high number of enrolments are due at present to the fact that they are online, have no formal educational requirements, and are free of charge.
- The fact that they are offered by rather prominent and exclusive universities enhances their attractiveness.
- If funding were to come from student fees this might weaken the popularity of the approach, and result in much lower participation. The introduction of tuition fees would also require institutions to award credits.
- Companies such as Google, Facebook, etc. have an interest in MOOCs, but will this interest persist in the future, and under what conditions? And would they partner with just any university? Would this result in further commodification of Higher Education?

- The 2012 Survey of Online Learning in the US mentions that academic leaders "remain unconvinced that MOOCs represent a sustainable method for offering online courses, but do believe that they provide an important means for institutions to learn about online pedagogy".

The CIOs at the Committee on Institutional Cooperation have recommended that the leaders of their member institutions consider several near-term actions:

- ✓ Engage purposefully in trials of MOOCs, adaptive learning systems, and emerging technologies to develop institutional understanding. Formulate a long-term strategy for professional development, MOOCs, courses for credit, and full degree programs.
- ✓ Carefully analyse emerging business models for revenue-generating, free and partnered courses. Incorporate costs for campus services and systems.
- ✓ Ramp up institutional capacity for online course production and increase resources to support instructional design, media development, assessment, and analytics.
- ✓ Develop IT system readiness to integrate with a range of educational software that may need to link to campus information systems in ways that are legal, secure, and compliant with campus policies [76].

Other studies focus on the development of the platforms and courses. In 2014, the number of massive open online courses offered rose to 2,400 and universities offering MOOCs rose to more than 400, or double that of 2013, EdSurge reported [17], [213].

Coursera offered the most MOOCs, twice as many as the No. 2 provider, edX, which has nearly 400 courses. But Coursera's market share shrunk to one-third in 2014 from nearly half in 2013.

The top three MOOC subjects were the same in 2014 as in 2013: humanities, computer science and programming, and business and management.

Measured by student numbers, the top five MOOC providers are Coursera with 10.5 million registered students, edX with 3 million, Udacity with 1.5 million, the Spanish-speaking MiriadaX at 1 million, and UK-based FutureLearn with 800,000 students. Measured by course distribution, the top MOOC providers in 2014 were Coursera, edX, Canvas Network, MiriadaX, FutureLearn, Udacity, CourseSites, iversity, Open2Study, and NovoEd. While 80% of the MOOCs were taught in English in 2014, they were also taught in 12 other languages. Schools offering MOOCs included 22 of the U.S News & World Report's top 25 universities [17], [213].

The literature on learner experiences in MOOCs has also shown that digital literacy, English language proficiency, structure of learning, the delivery environment, the perceived value of learning and critical literacies to efficiently evaluate large quantities of information play a key part in shaping a learner's MOOC experience [92][214][215][216].

4.2. Evaluating the Research

The impact MOOCs are having in the last years over the academic and scientific fields is undeniable. Some thousands of scientific papers, opinions, analyses, media coverages, blog posts, news items, books, conferences and other work related to MOOCs quantify the important role they bring into education, and in particular to HE.

The first years of MOOC research brought an overview over the first MOOC experiences and over the first courses offered as MOOCs. That research was mainly

conducted by people who constructed the courses or people who attended the courses. A series of pro and con opinions emerged, with some referring to MOOCs in exaggerated tones: tsunami, revolution, massive disruption, end of brick and mortar institutions or even education apocalypse. Since the autumn of 2013 it became more and more clear that even if MOOCs brought a massive discussion into educational paradigms and the actual role of education, the so called revolution had yet to come.

Research around the demographics of people attending MOOCs offered a more comprehensive image of whose needs MOOCs serve better. On the other side, research around the creators of MOOCs (institutions and professors) showed the difficulties and challenges faced during the construction of a simple course.

The most debated issues of MOOCs have their fair share of scientific literature as researchers focused on the economic models of MOOCs, the high drop-out rates, the lack of educational quality in many courses, the accreditation issues or the lack of real openness.

Specialists determined MOOCs to be divided in more categories, the most used being cMOOCs (connectivist pedagogy) and xMOOCs (behavioural pedagogy, content based pedagogy). Another important classification has been about the destination of MOOCs: for HE, independent MOOCs, for informal learning, corporate designed.

The technologies behind MOOCs have been deconstructed in their smaller components and analysed thoroughly. Most of the popular platforms had dedicated papers and analyses and an overview of most MOOCed domains has been provided.

One very interesting and innovative way of analysis has been strongly related to the massiveness of the MOOCs, namely the machine learning and learning analytics emerged from the thousands of MOOC users. However, we have yet to arrive at a satisfactory and comprehensive understanding of this type of massive data sets analysis. It is fair to mention that learning analytics were used before MOOCs, and sometimes even for a large number of samples, the only difference now is that one can analyse the same large number of samples but in relation to one course or one lesson in particular.

The most used methods of research have been both qualitative and quantitative: interviews, surveys, sampling, study-cases, critical analysis. Next, I am going to present some of these methods.

4.2.1. Interviews and Focus Groups

They allow face to face interaction and discussion, mostly with the creators of MOOC platforms and courses, or with policy makers. There are mainly two types that are practiced, which can be intertwined as well: use of open questions or use of closed questions.

A very essential factor in these types of methods is the skill of the interviewer, as he needs to identify experience with authenticity, in order to call upon interviewees' experiences and produce authentic accounts of social worlds [217].

A list of examples of such method being used in MOOC researches includes [4], [218], [219], [198], [214] and [220].

4.2.2. Case Studies

The case study research excels at bringing us to an understanding of a complex issue and can extend experience or add strength to what is already known

through previous research [221]. Some dismiss case study research as useful only as an exploratory tool. However, I considered them to be useful in emphasising some aspects of the research that I already discovered through the content analysis.

The case study approach usually consists of six steps:

1. Determine and define the research questions;
2. Select the cases and determine data gathering and analysis techniques;
3. Prepare to collect de data;
4. Collect data in the field;
5. Evaluate and analyse the data;
6. Prepare the report [222].

Examples of case study research in MOOCs consist of [92], [223], [198], [224], [218], [225] and [226].

4.2.3. Online Survey

Researchers in a variety of disciplines may find the Internet a fruitful area for conducting survey research. One advantage of online survey research is that it takes advantage of the ability of the Internet to provide access to groups and individuals who would be difficult, if not impossible, to reach through other channels. A second advantage is that Internet-based survey research may save time for researchers. Online survey researchers can also save money by moving to an electronic medium from a paper format. However, there are also disadvantages that should be considered by researchers contemplating using online survey methodology. When conducting online research, investigators can encounter problems regarding sampling, as results could be biased [227], [228].

Each of the online survey products reviewed offered some type of online form to collect data from participants. A "form" is an interactive type of web page that allows Internet users to send information across computer networks. After completing an online survey, participants click on a "submit" button on the webpage. This transmits the survey responses to the researcher. Online survey questions are the same types as on a traditional paper/pencil questionnaire, only the participants submit the information over the Internet rather than return questionnaires in person or by mail [228].

Online surveys can be found in the research of [129], [229], [209], [225], [4], [199], [230] and [231].

4.2.4. Content Analysis

Qualitative content analysis is one of numerous research methods used to analyse text data. Other methods include ethnography, grounded theory, phenomenology, and historical research. Research using qualitative content analysis focuses on the characteristics of language as communication with attention to the content or contextual meaning of the text.

The question of whether a study needs to use a conventional, directed, or summative approach to content analysis can be answered by matching the specific research purpose and the state of science in the area of interest with the appropriate analysis technique [232].

This type of research was conducted by [200], [233], [234] and [202].

4.3.   Research Methodology

As I pointed out when explaining my motivation for this thesis, I arrived at the conclusion that, there could be two main directions for MOOC development in Romania. The first direction would be the integration of existing MOOCs into traditional and current courses, which can be seen in chapters 5 and 6 of this thesis. The second direction is the creation of an independent MOOC platform, custom designed and created for Romanian students, which can be seen in chapters 7 and 8 of this thesis.

A model which applies in particular to the first direction but could easily be implemented in the second as well is the flipped classroom concept. In the "flipped" approach what is normally done in class and what is normally done as homework is switched or flipped. Therefore, students read lectures or watch videos with the lecture at home or in their spare time, and in class they engage in active learning using study cases, labs, games, simulations or experiments [235][236].

In order to better understand the two directions of MOOC development and use in Romania, several methodologies had to be implemented in this thesis.

The first was the text and content analysis of existing literature on the subject and existing platforms and courses. This qualitative research is useful for substantiating the understanding of MOOCs with focus on their history, development, the needs they are based on, the technologies, the advantages and the problems.

I have also analysed different case studies of good practices and use of MOOCs in the actual Romanian educational system and in the HE in particular. Even if case studies could be a quantitative research method, the data gathered for this thesis makes them only qualitative for this research. I followed and presented the work of Romanian educators with MOOCs. More closely, I have analysed the integration of MOOCs in two master courses from the Multimedia Technologies program, ran inside my university, UPT.

As quantitative research, I decided to use an online survey, in order to get a 'massive' data set of hundreds of answers. The questionnaires were constructed with both closed and open questions, and consisted in two main parts: online educational resources and MOOCs. These questionnaires were designed differently for students and for teachers. As a deployment medium, I have opted for sending it via the Virtual Campus of my university, email and social media.

Finally, focus groups with students and interviews with experts in education and learnability were conducted, in order to get a more critical analysis over the implemented platform. After the platform is functional and we have an appropriate amount of students registered and following courses, a quantitative research of data sets is in order. As I pointed out before, data analysis, learning analytics and machine learning will be very useful into understanding how to massively customize MOOCs.

4.4.   Word Cloud of MOOC Research

After four years of research related to Massive Open Online Courses, I was curious about an overview of other people's studies in this field. For this, I have created a word cloud from over 1000 paper titles, related to MOOCs. These papers include scientific articles, blog articles, books or book chapters, conference proceedings, presentations or press releases.
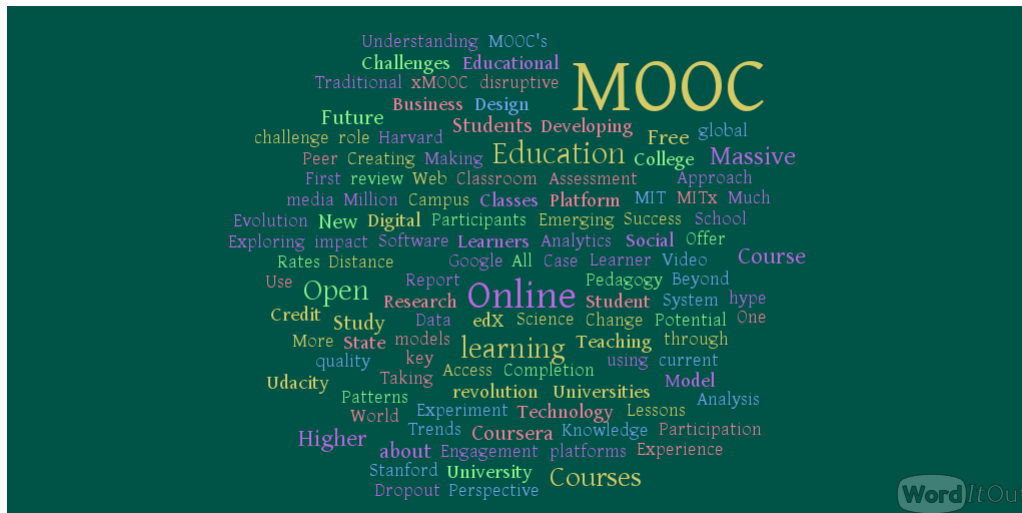
Figure 4.1. Preliminary MOOC Articles' Titles Word Cloud

Others have demonstrated that word clouds can allow researchers to quickly visualize some general patterns in text [237] and perceive much faster, which words in a document or text distinguish its content [238].

For this word cloud, after carefully analysing the available tools, I chose to use WordItOut[8]. The first result that I got, which can be seen in Figure 4.1, made me realise that these results are not 100% accurate. I obtained 1787 independent words, without the majority of linkers which were automatically deleted by the platform WordItOut. However, I saw that expressions like "Massive Open Online Courses" or "Higher Education" were taken as separate words. Other problems were that the platform does not make the difference between singular, plural, articulated words, etc., even if they mean the same thing for my report. Furthermore, there are many synonyms, for example big-large-great or attack-beat-assault, which should be grouped together, in my opinion.

For that reason, the next step I took was to group together the same word written in different forms (plural, articulated, etc.). Also, I grouped expressions like the ones mentioned above, so that the platform acknowledges them as a whole. The result was a list of 1152 independent words, 35% less than at the start. The next step was to eliminate words that were non-important to my research (out of context) and group together synonyms. A remaining list of only 263 words emerged, only 15% from the first total. After eliminating other words that I have considered not to be relevant to the study, a final number of 226 words remained.

Next, I present a tabular presentation of the findings, in Tables 4.1 and 4.2.

Finding	Number	Percentage
Total number of words	1787	100%
Total after linkage of expressions and grouping family of the word	1152	65%

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[8] http://worditout.com/

Total after eliminating non-important words and grouping synonyms	263	15%
Final number of relevant words	226	13%

Table 4.1. Step-by-step total number of relevant words

Finding	Number	Percentage
Number of relevant words and expressions	226	100%
Words with frequency >=10	162	72%
Words with frequency >=25	55	24%
Words with frequency >=50	12	5%
Words with frequency >=100	4	1.7%

Table 4.2. Word frequency statistics in MOOC research titles

The final word cloud can be seen in Figure 4.2.
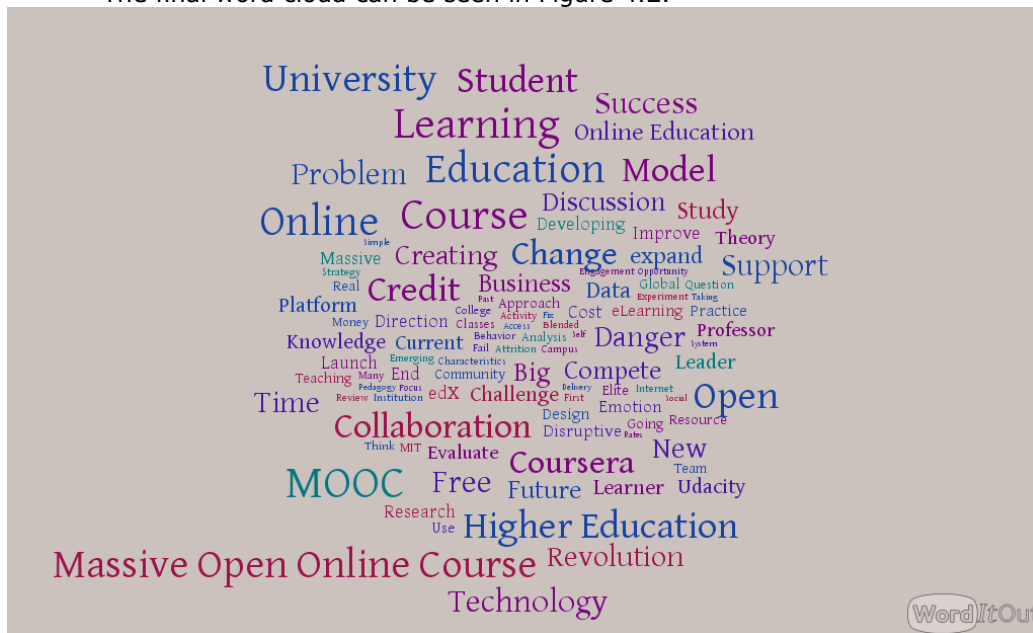
Figure 4.2. Final MOOC Articles' Titles Word Cloud

Next, I am going to explain why I believe these words are the most used in the research that is done regarding MOOCs. A tabular version of these words can be observed in Annex 1.

1. MOOC – the acronym and name of the concept.
2. Learning – the scientific field of MOOCs, the area that they influence. It is the knowledge acquired through study, experience, or being taught. It refers also to the action of learning, conducted by students.
3. Course – it means the lessons that are being promoted through MOOCs, and the last word of the acronym.

4. Online – the third word of the acronym and the medium where MOOCs take place.
5. Education – the theory and practice of teaching. MOOC is a part of education, especially Higher Education.
6. Massive Open Online Course – the name of the concept.
7. University – the institution where MOOCs are mainly used and where the main research is being conducted. Also, universities are the ones responsible for creating most of the MOOCs.
8. Open – the second word of the acronym. It refers to the elimination of barriers that appear in education, the access to open educational resources (OER). It is one of the biggest discussions surrounding MOOCs, as many researchers feel that MOOCs lack the openness, as first understood in the OpenCourseWare movement.
9. Higher Education – the studies that take place after one finishes the high school, mainly the university. It is the main area in education that MOOCs influence, and which, some researchers think, MOOCs will change.
10. Student – the main "actor" of MOOCs. He is the beneficiary of Massive Open Online Courses. Every user that learns is considered to be a student.
11. Credit – another major discussion regarding MOOCs is about accreditation. Some feel that MOOCs should be recognized as valid credits, by universities. On the other hand, others believe that the quality of MOOCs is lower than the one present in traditional higher education, ergo, they should not be recognized.
12. Model – since MOOCs are still in their infancy, there are a lot of models presented, trying to find the best structure to fit the needs of the students.
13. Collaboration – fostered massively by MOOCs, especially connectivist ones, collaboration refers to the cooperation of students, working together, solving together assignments, helping each other out.
14. Change – one thing is certain. MOOCs bring change. We are still to see the level and sort of change that will happen inside education.
15. Coursera – one of the major MOOC players; developed by Daphne Koller and Andrew Ng, both from Stanford; based on venture capitalist funding.
16. Free – another big topic for debate: does open mean free? MOOCs started as free courses and most of them still are that way, but slowly, more and more ways of asking for money have appeared, since the actual models of MOOCs are not yet economically sustainable.
17. Problem – every new innovation comes with pros and cons. Problems refer to the past and present but solutions are being sought for the future.
18. Success – the boom that followed the appearance of MOOCs brought the conclusion that this was a real success. The word refers also to the success that students have in completing the courses, which is not that big.
19. Technology – MOOCs are based on technology, they are a mixture between technology and education.
20. Support – as MOOCs are a new appearance, users need guidance and help into using them. It means also the support that teachers are offering to students during the online education experience and even to the support that students offer each other.
21. Danger – the debate is high regarding the benefits and problems of MOOCs and some people see them as a danger to the stability and quality of higher education.

22. Time – time references are present, as MOOCs are a technology of our times, they will probably last in time and make a progressive change in the near future.
23. New – it refers to the freshness of the idea of MOOCs.
24. Revolution – many people called MOOCs a tsunami, an earthquake, an avalanche or a revolution. Because things are changing and they might be doing so in a forcible way.
25. Creating – The creation of course material is an important topic, as the whole process of learning revolves around the material, especially the videos.
26. Discussion – Discussion is highly encouraged in Massive Open Online Courses. Discussion Forums and Boards are a constant presence in all existing MOOC platforms and are actively and intensively used by students and teachers alike.
27. Big – smaller than massive, but still referring to the large number of people that are influenced by MOOCs, either if they are faculty, students, policy makers or investors.
28. Business – MOOCs are a business in some ways. Some companies are interested in investing in MOOCs. Others are interested in getting personalized training for their employees.
29. Compete – there is a big competition between MOOC platforms, between universities, between teachers, between students and between traditional and modern education.
30. Future – there are many predictions about what the future will bring to education, now that MOOCs are involved.
31. Study – the process of studying is very important. In MOOCs students study in their own rhythm, whenever and wherever they want.
32. Online Education – education that takes place online
33. Data – large amounts of data are being collected and analysed by MOOC platforms. Data mining and data analytics are believed to be the future in determining the behavioural patterns of users and the ways in which to offer the perfect personalized experience.
34. Expand – the whole online education movement expanded massively in the past years. The expansion of education to a global scale is also taken into consideration.
35. Learner – similar to the student, the one that studies the courses.
36. Challenge – as there are a lot of detractors, problems and questions, the challenge of overcoming them is high.
37. Current – MOOCs are a current subject, which appeared freshly and is on everyone's mouths.
38. Knowledge – what is gained by studying.
39. Leader – many of the decisions that were taken or which are expected to be taken are those of leaders, CEOs, presidents, administrators or university heads.
40. Platform – MOOCs are present on different platforms.
41. Udacity – one of the first and major MOOC platforms; started by former Stanford professor, Sebastian Thrun; based on venture capitalist funding; has repositioned its main focus on corporate training since November 2014.
42. Evaluate – Many of the research is being conducted into evaluating the quality of the platforms and of the courses. Also, a part of the researchers are evaluating the impact MOOCs have over students and education.

43. Professor – a key role in MOOCs is played by the professor, the one that builds the course and conducts the learning process in a blended way.
44. Theory – Set of principles on which the practice of an activity is based. Here, the activity is education. There has been a lot of talk about the theories behind MOOCs, education and e-Learning.
45. Cost – the cost of developing both a MOOC course and a platform are a big discussion, as the majority of them have very high development costs, making MOOCs unsustainable from an economical point of view.
46. EdX – one of the major MOOC platforms; a joint venture between MIT and Harvard, that were joined afterwards by other universities; Built on the skeleton of MITx and OpenCourseWare; lead by MIT's Anant Agarwal.
47. Improve – mention of the improvements that people think MOOCs bring to Higher Education.
48. Launch – a lot of new platforms and courses were started and launched in the past years.
49. Massive – the first word of the acronym. It means the large amount of students that have access to MOOCs and that enrol in MOOCs.
50. Developing – MOOCs are in a constant development, as new technologies, models and courses are being constructed or developed every day.
51. Direction – remark about the direction into which MOOCs and Higher Education are going.
52. End – some people believe that MOOCs will bring an end to education as we know it.
53. Research – mention of the research that is being conducted.
54. Disruptive – can be understood either as innovative/ground-breaking or as a disturbance or problem in the educational system.
55. Emotion – emotions are involved in the educational process.
56. Design – reference to how the platforms and courses are built and structured.
57. e-Learning – electronic learning; it means learning via electronic media, typically on the Internet.
58. Practice – the actual application or use of an idea, belief, or method, as opposed to the theories mentioned above.
59. Use – Mention of how MOOCs are being used in serving education. Another discussion is about the usability of MOOCs.
60. Approach – there are more than one ways to deal with MOOCs and the problems that appear.
61. Community – fostered through collaboration and communication. The community of learners developed by MOOCs is bigger than ever.
62. Elite – a reference to the Ivy League institutions that first developed the xMOOCs. Some say that elite universities will be the only ones to stand in the future, as a result of MOOC disruption of Higher Education.
63. Global – It suggests the global reach of MOOCs, which offer open education to the whole world. The example of the Mongolian kid who got brilliant results at the Circuits and Electronics course of Anant Agarwal from EdX is one of the most famous ones.
64. Going – a word that means evolution, going on, moving forward. It means activity and emergence.
65. Real – allusion to the virtual side of online learning, as opposed to the real on-campus experience.

66. Resource – there are a lot of resources put into developing MOOCs. Also, a lot of resources are offered for students as material to be learned in MOOCs.
67. Teaching – MOOCs are based on teaching methods developed for e-Learning. One of these methods is Flipped Teaching, where students study the materials at home and pose questions in the classroom, discuss more thoroughly or do exercises.
68. Team – built on the basis of collaboration and communication, teams built furthermore, communities.
69. Analysis – researchers analyse the big amount of data collected.
70. Classes – parallel to the traditional classes developed in on-ground campuses.
71. MIT – one of the institutions most involved in online education, and one of the founders of EdX.
72. Money – a big influencer of any venture. The debate about economic sustainability of MOOCs is very hot.
73. Question – as this technology is still at its beginning, there are still many questions that need to be answered.
74. College – it means an educational institution, not necessarily a university.
75. Think – MOOCs have generated a lot of thinking about education and its future.
76. Activity – activities developed for MOOC classes are very important for stimulating the creativity of students and for keeping them connected and motivated.
77. Attrition – the process of reducing something's strength or effectiveness. A reference to the low number of students who complete the MOOCs.
78. Behaviour – Student behave in different ways and researchers try to find how the human mind of the learner works. Massive amount of data that is being collected during MOOCs is a big help for determining behavioural patterns.
79. Campus – A reference to the brick and mortar institutions and to the on-ground experience that students get in traditional education but not in online education.
80. Characteristics – a lot of the discussion conducted revolves around the particularities and characteristics of massive open online courses.
81. Emerging – from a few references in 2008, MOOCs emerged into a global phenomenon
82. Fail – some of the experiments that were done so far have failed (San Jose State University, for example). Some people fear that MOOCs will fail to bring pedagogical improvements into education. A discussion about the big number of failing students is also undergoing.
83. First – there were and are a lot of innovations, novelties and firsts in the MOOC field.
84. Institution – Mention of a lot of institutions involved in the movement.
85. Internet – the medium on which MOOCs take place.
86. Many – similar to massive and big, it means the large amount of people involved in MOOCs.
87. Review – researchers and academia are analysing and reviewing the existing courses, platforms and the results they foster, in order to find the best practices for education.
88. Strategy – each player involved in MOOC has developed a strategy for his platform or institution.

89. Access – one of the biggest promises of MOOCs is access to elite education to the less fortunate people.
90. Blended – it refers to the mixture between traditional campus learning and online education.
91. Engagement – Many universities and students are engaged in MOOCs.
92. Experiment – Together with the new models that are being developed, a lot of experiments are being conducted in order to find the best way of MOOC deployment.
93. Focus – MOOCs have been the centre of interest in education in the last years.
94. Opportunity – Some people think that MOOCs are an opportunity for traditional education to finally think about its issue and change into better.
95. Delivery – mention of the delivery of courses that is expected from most universities.
96. Fix – it means the settlement of MOOCs into the bigger picture of Higher Education.
97. Past – the time reference to the development of online education, MOOCs and former ventures that have failed.
98. Pedagogy – the method and practice of teaching, especially as an academic subject or theoretical concept. Many researchers fear that even if MOOCs bring change, pedagogy is not affected and therefore problems arise. Others think that pedagogy is damaged by online education.
99. Rates – big debates around the rates of completion.
100. Self – allusion to the fact that students learn on their own. The process of education in MOOCs is many times a one centred only on the person studying, even if collaboration is encouraged.
101. Simple – MOOC platforms are very attractive through the fact that they are very simple and easy to use.
102. Social – MOOCs are social as they foster communication and collaboration. Social Media applications are such inclusions of these platforms.
103. System – the systems behind MOOC platforms are of great interest for those who want to see what is inside the infrastructure.
104. Taking – many students are taking MOOCs.

Word clouds can be useful into gaining more focus over those words that are most used in a certain text. The case here regards the titles of research that has been done around the MOOC area. I used different methods in order to obtain the most relevant words or groups of words found in the existing literature. Then, I have presented our findings offering some explanations about the meaning of these findings. I observed that the words revolve around certain topics such as education, change, future, collaboration, discussion or economy.

I insist on the fact that a more accurate research would be the analysis of word clouds regarding the whole articles or at least the abstracts or summaries. However, this type of analysis would require either the use of a commercial solution instead of a free one or a large increase in time or human power dedicated to such sort of analysis.

4.5. Conclusion

Predictions made in 2012 that MOOCs would totally disrupt the existing higher education model were certainly exaggerated. Nevertheless, that does not mean that MOOCs will not have a profound impact on the future of higher education [102].

The flood of popularity that came over MOOCs determines more and more research about them. Most of this research is concerned about the impact MOOCs have over HE, usability and copyright aspects or the business MOOCs generate. I chose to analyse the technologies that stand behind MOOCs and offer some suggestions regarding the findings I presented in the chapters above.

When trying to analyse MOOCs we need to ask the right questions. How much are MOOC students actually learning? What makes a course the most engaging? What assessment types promote learning? Do different disciplines benefit from different styles of online teaching? How does the type of content (e.g. text vs. video) affect learning? How does user experience and the production value of videos impact student retention and learning? What types of student interactions promote learning and retention? Can instruction be personalized in a way that promotes learning [239]?

The word cloud of MOOC articles' titles offers a better understanding of the direction in which MOOC research is going. Further research in this direction could be made analysing the whole texts, or abstracts of analysed documents. Another interesting aspect would be seeing a display of word clouds per year and to understand the evolution of research regarding MOOCs.

My theoretical contributions to the thesis, pointed out in this chapter are the analysis of different types of research methodologies presented in existing literature and the creation and interpretation of a word cloud around the titles of MOOC related articles.

Some results presented in this chapter have been published in [240].

5. MOOCS IN ROMANIAN HIGHER EDUCATION

5.1. Open Educational Resources in Romania

In 23 April 2013, partners in 11 countries have joined forces to launch the first pan-European MOOC initiative, with the support of the European Commission. Androulla Vassiliou, European Commissioner for Education, Culture, Multilingualism and Youth welcomed the new initiative: "This is an exciting development and I hope it will open up education to tens of thousands of students and trigger our schools and universities to adopt more innovative and flexible teaching methods. […] It reflects European values such as equity, quality and diversity and the partners involved are a guarantee for high-quality learning" [241].

At this point, Open Educational Resources (OER) exist in Romania, but they are at an incipient level. Most of the Romanian Universities are offering at least some courses online, but only after logging in with an affiliate student or teacher account.

A clear and comprehensive overview of projects and initiatives aimed at integrating ICT and e-Learning at all levels of education is provided by the paper "E-Learning in Romania: the State of the Art" [242], which however dates back to 2007, thus referring mostly to closed projects. In recent years it has been noticed a general trend shifting from the access to technology (equipping schools with ICT tools) to the access to quality eContent and to virtual learning spaces.

The e-Learning Romania programme is an initiative of different Romanian civil society institutions to support e-Learning development and innovation in Romania. Decision makers, academics, researchers, practitioners, opinion leaders and educational software developers are involved since 2006 within a community

meant to share resources. Other institutions from the private sector support this initiative. The e-Learning Romania programme aims to raise the quality and the efficiency of the computer-assisted education area, through offering theoretical support, disseminating best practices and significant local e-Learning experiences, providing continuous informing regarding events and relevant announcements, promoting available solutions and systems and services for e-Learning.

In April 2014, the Politehnica University of Timişoara came with the initiative to create and offer the first Romanian MOOC, in partnership with other Romanian universities. The initiative received the name of UniCampus.

Since the partners decided for a MOOC platform developed internally, a proposal for a structure and methodology had to be presented. A first version of this proposal is presented below.

As for the implementation of this platform, I chose to use a LCMS, and opted for Moodle. As presented earlier in this thesis, I have argued my choice mentioning Moodle's integration of learning analytics and social media. Using an existing platform, which already meets the access control and analytics requirements, is one way to obtain an effective delivery system for MOOCs. As I have shown, social media is a powerful tool when working with MOOCs, and Moodle integrates most of these recommended tools. With the appropriate configurations and tweaks, and with a minimal integration with some of the most popular social networking platforms in use today, Moodle can successfully play the role [196].

5.2.   Literature Review for Romania

Even if MOOCs have been an integral part of the educational research of the last few years, Romanian researchers of the topic are very few. I am not going to include myself in this list, as most of my work has been included in the current thesis. However, there are some other papers worth mentioning.

In 2015, the concept of MOOC activist has been defined [243] with the following particularities:
- ✓ He/she participates in MOOCs as a continuous learner (for personal and professional development).
- ✓ He/she integrates MOOCs in his/her own courses.
- ✓ He/she encourages his/her peers and students to enrol in MOOCs, by recommending specific resources connected to their fields of interest.
- ✓ He/she organizes academic events aiming to inform educational actors about specific MOOCs.
- ✓ He/she adapts contexts from other MOOCs to his/her educational environment.
- ✓ He/she is a MOOC curator.
- ✓ He/she acts as an informed advocate for the MOOC trend [243] .

Amongst the recognized MOOC initiatives I enumerate:
- ➢ UniCampus – the platform proposed in this thesis;
- ➢ UniBuc Virtual – three courses developed by the Department of Distance Learning from the Bucharest University;
- ➢ "Vasile Goldis" University from Arad will offer MOOCs in a partnership realised with Fédération Européenne des Écoles;
- ➢ The *Critical Thinking MOOC* developed and ran by the Maastricht School of Management Romania on Iversity, with a Romanian tutor.

> ➢ mooc.ro, the initiative of Moodle Romania, mentioned in Chapter 3.7.2.

MOOCs are becoming a way of responding to the actual trends in education and learning: increase of the use of online learning, delivery of shorter courses, creation of new awarding schemes and increase of partnership in building new curricula. One of the problems with all these trends is to integrate them into the national and international legislation regarding the quality of education, assessment of knowledge and award of educational degrees.

As Vasiu and Andone said, "the Romanian legislation for education is quite a contradictory one. On one hand, it declares the teaching programs as being student centred, but on the other hand it allows relatively small possibilities to the students to create their own curricula by selecting between optional courses (that are many times less than expected due to under-financing of the higher education)" [244]. The legislation states distance education, online learning and blended-learning as modern teaching technologies (see art. 139.c of the Law of education, no 1/2011: "distance education: characterized by the use of electronic, information and communication resources, self-learning and self-assessment activities, supported by tutoring specific activities" [245]), but at the same time it states that master degrees cannot be obtained through distance learning". Also, the legislation declares national and international cooperation and joint-degree courses between the priorities in increasing the international visibility of the universities, but at the same time the quality criteria imposed for accreditation by ARACIS (the Romanian Agency for Quality Assurance in Higher Education) are asking that a minimum of 80% of the academic staff to be working full-time in the university looking for accreditation – which means that other national or international universities' staff, or independent experts involved in developing and delivering the joint curricula should be a maximum of 20% of the total staff" [244].

In Table 5.1., I present a systematic view of different possibilities for blending MOOC in courses, one dimension being the synchronicity between MOOC and the course, and one the portion/numbers of MOOCs to be integrated, from a 2014 paper [246].

		MOOC(s) integrated in blended courses		
		Part of a MOOC	An entire MOOC	Multiple MOOCs
Synchronization between the blended course and MOOC(s)	No synchronization	The content (some modules) of a number of MOOCs is used just as (additional) digital resources. Learners study the MOOC's content, but the assignments, discussions and evaluations are integrated parts of the blended course.		
	Synchronization	In the MOOC's area, learners study the materials and also participate effectively in the social activities: assignments solving, forum discussions, peer-assessment; the in-class teacher supports them with feedback; additional materials and resources, evaluation; communication with the local learning community for thoroughing the subject and group projects.		

Table 5.1. Versions of blending MOOCs in university courses. Adapted from [246].

The same authors presented the benefits of different activities used by students that underwent a study of blended learning inside the Politehnica University of Timişoara, which are summarized in the table 5.2.

	Activities in blended courses	Pedagogical benefits
Face-to-face activities	Discussion for a deeper understanding of the course topics/requirements	Learner-centric teaching
	Feedback on assignments	
Online activities on 'Cirip' group	Follow multimedia course materials posted in the group section	Self-paced study for different learning styles, enhanced focus and attention
	Discussion/evaluation of OER projects/initiatives and CC licenses (#oer)	Openness to/culture of knowledge-sharing and re-use, exploitation of the OER movement benefits, critical thinking
	Discussion/evaluation of free tools/collaborative platforms for learning (#mytools)	
	Post collaborative work results on SM platforms as small OER (#project)	
	Posting multimedia notes with comments, feedback, new resources for course topics	Collaboration in local learning communities, peer assistance
	Post evaluation of additional resources, follow/interact with external users/practitioners, monitor RSS feeds	PLE building
Group work	Group project (#project)	Skills for collaborative work: challenge assumptions, delegate roles and responsibilities, share diverse perspectives, find effective peers to emulate, collaborative tools usage
MOOC	Study MOOC materials (short videos, podcasts, presentations) and answer to corresponding quizzes	Self-paced/ active learning
	Solve assessments	Retrieval learning, gamification
	Evaluation of peer assignments	Peer-assessment, assuming objectivity and responsibility
	Discussion/feedback in MOOCs' forums	Participation in global learning communities, instant feedback
	MOOCs selection (#mooc)	Skills for learning continuity and autonomy, self-assessment of learning objectives

Table 5.2. Blended course activities and pedagogical benefits. Adapted from [246].

If we admit that learning today happens everywhere, we also have to admit that it is very difficult to get recognition for skills that are obtained online or out of the university. Some countries are more flexible in recognizing different skills, independently on how those skills have been obtained, based on prior learning assessment through competence testing. Some other countries (including Romania) are declarative open recognizing those skills, but in practice make it almost impossible to be implemented, under the very inflexible quality assurance rules and laws.

My conclusion is that it is still a very long way, and a lot of work to be done, until implementing a real open educational system throughout Europe and this is very much depending on political willingness in adapting legislation to today's practical needs and on the decision makers' mentality regarding open and flexible education.

5.3. Students Survey Analysis for Online Educational Resources and MOOCs

5.3.1. Methodology and Research Questions

In order to see the relevance of future work regarding Online Educational Resources (OnERs) and MOOCs in our university, together with my colleagues we have developed and ran two separate surveys designed to be answered by students. The purpose of this effort was to answer some questions, which were expressed literally, or not, in the survey:

- Have Romanian students used Online Educational Resources? In what way have they used them? What is their opinion about them?
- What are the strong and weak aspects of Online Educational Resources?
- Have Romanian students used MOOCs? What type of MOOCs?
- What is their opinion about MOOCs in respect to their structure, design and educational aspect?
- What types of video lectures do they embrace?
- Have Romanian students a predilection for technical aspects of videos in MOOCs (e.g., video length, video frame size - resolution)?
- What is their opinion about interactive video materials?
- Have they any desires for some items in a course page interface?
- What are the advantages and disadvantages of MOOCs?

The final goal was to determine if the future development of OnERs and MOOCs would be beneficial to and required by the Politehnica University of Timişoara students.

Even though the main market targets for our survey were students from our institution, we have also included students from the other main higher education centres of Romania. The survey was distributed via the educational platform of our institution, the Virtual Campus (https://cv.upt.ro), e-mail and social networks, in the period of February-November 2015.

We used Google Forms to create the survey, which consisted of two distinct parts:
1) Online Education & MOOCs theoretical approaches and
2) Video (interactive) technical environment.
We have built different types of questions:

- Single choice - the participant can only pick a single predefined answer option;
- Multiple choice, in order to collect the input of multiple selections through checkboxes, also offering the possibility of a custom answer through a text field;
- Choice from a drop down list offered by us;
- Text field - students completed their own answers;
- Scale, grid - students must rate from a minimum to a maximum value.

Figure 5.1. Student survey - online form

Figure 5.2. Multiple choice question example

We have addressed the students the following instructions and copyright agreement before completing the survey:

"This questionnaire is referring to the use of Online Educational Resources. These are all those resources facilitated by information and communication technologies, for consulting, use, and, if open, adaptation. Examples: online files (pdf, doc, ppt), html pages with educational content, educational videos, educational podcasts, virtual laboratories, etc." "The survey aims to evaluate the (interactive) video in educational platforms in the Politehnica University of Timişoara Virtual Campus (https://cv.upt.ro)." "By completing this form you agree to the use of anonymous responses in future papers or publications".

5.3.2. Respondents' Background

This study is based on answers of around 450 persons. As in most of the world, this type of educational resources seem to be interesting for already educated people, as 41% of our respondents are currently undergoing a master's education program, 27% being graduates and 4% undergoing a doctoral or postdoctoral program. This sums to a total of 72% of respondents that are having a form of higher education diploma. As expected, there is a shared interest of online education for students undergoing a distance education program, 15% of the respondents being from this category. Undergraduates represent only 12% of our respondents, divided into higher education students, 5%, and high school students, 7%. There could be some sort of bias to the relevance of the study, as our online educational platform is not as used by Bachelor programs students as by the rest of our students, as most of the courses offered are for Master students and Distance Education students.

In which the age of the participants is concerned, a majority of 43% is in the 23-27 years old range, followed by 17% in the 27-30 years old range and 14% in the 30-40 years old range. There were also 12% people in the 19-23 years old range, 7% in the 41-60 years old category and 5% under-aged participants. 2% of our respondents were over 60 years old.

Another similarity to the universal model is the sex-related issue; the majority of our respondents were male, 58%, manifesting more interest towards this inquiry of ours, and only 42% were female.

Our respondents were, as we mentioned, mainly from our home city of Timişoara, 66% of them, to be exact. Other cities well represented in our study are Bucharest, with 7% of the respondents, Alba Iulia, Arad, Cluj-Napoca, Iaşi, Oradea, Râmnicu-Vâlcea, Reşiţa, Sibiu, Suceava, and Târgu Jiu each with up to 5% of the respondents.
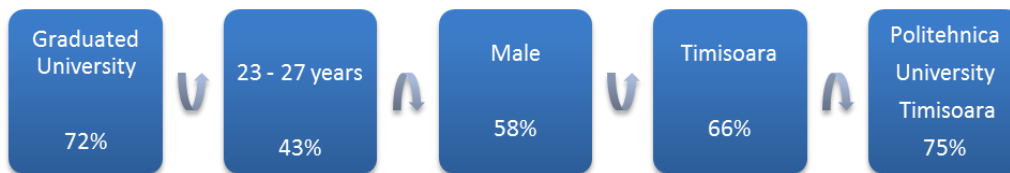
Figure 5.3. Respondents' background - relevant numbers

The Alma mater of our participants is, in a vast majority of 75%, our institution, Politehnica University of Timişoara. Another 6% is associated with the

West University of Timişoara and 2% with the University of Medicine and Pharmacy Victor Babeş Timişoara.

5.3.3. Online Educational Resources

When asked if they have ever used online educational resources, our participants answered with "yes" in a 91% proportion, almost half of which have used them as offered by their educational institution. Only 8% have not used them and only 1% had not heard of OnERs before. These results point out the high level of online educational resources literacy present in Romania at this time. When we looked at age related differences, we found out that over 90% of the people between 18 and 40 years old have used OnERs and around 80% of the people younger or older than the above numbers did use them as well.

Next, I asked our respondents to rate the usefulness of OnERs from their point of view, on a scale from 1 to 5, 1 meaning not very useful, and 5 meaning very useful. The majority, 48%, opted for 5. However, in total, 80% of the participants rated OnER at least useful, which reflects a general accepted fact that OnERs are indeed useful in our education. I tried to see if there are differences between men and women but could not find any for these first two questions of this section.

Further, we inquired about the role OnERs should have in our educational system. A big number of 87% of our participants indicated that these resources should coexist and complete the existing traditional and current ways of teaching. However, 8% of our respondents would opt for OnERs replacing the current ways of teaching, and 4% of the people that answered chose to use them only optional. Only 1% of the respondents said that OnERs should not make our lives harder. In my opinion, this is a very important argument for continuing the further development of educational technologies, as many of the people who are opposing them believe these technologies will replace the old traditional methods of education. However, I believe that there should be a symbiosis created between the new and the old.

Interesting feedback was received asking what parts of the educational system could happen online. The respondents were able to choose one or more of the following items: theoretical courses, laboratories and practical seminaries, supplementary study, study groups, consulting and private tutoring, independent verification of knowledge, exams or other. 82% of the people think that the extra study can happen online and 71% of them think that the theoretical lectures could take place there. Also, an important number of participants, 67% stated they can self-asses themselves online. Around 40% of our respondents think that learning groups and extra tutoring/consults can happen online. Only a quarter of our participants thinks that practical laboratories can happen online and only 23% think that the official examination could go on there. Interesting extra suggestions by respondents were "team-work for homework solving" and "dissemination of information and resources". I noticed some differences in the preferences of different genders, the biggest being that female respondents feel that laboratories should happen online, in a proportion of 57%. I think these results are as such because, in my opinion, men tend to gain more pleasure by solving practical technological experiments, and have in their genes the hands-on approach.

We also asked people what online resources they are interested in, again giving them the possibility to choose more than one option: text, audio, video,

slides, images, graphs and schemes, virtual laboratories, glossary, test, neither or other. I show the results in Figure 5.4.
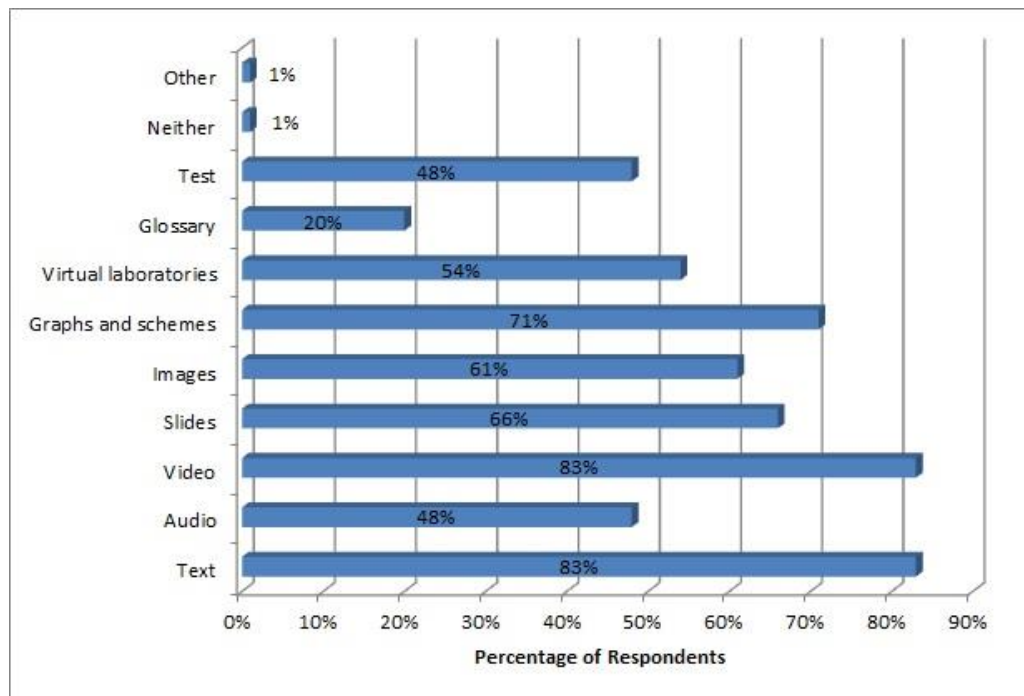
Figure 5.4. Student Survey Results – online resources of interest

Other answers included "graphic representation of datasets". The paradox that I saw was that, even if at the previous question women chose in, a big proportion, laboratories to happen online, here only 39% of them said that they are interested in virtual laboratories. Therefore, these results show that an appropriate course for the majority of our students should be a mixture of video, text and graphics, with some slides and images and a practical laboratory.

Next, people were asked about the advantages of online educational resources: easy to access, free, access anytime, access anywhere, easier to understand than traditional ones, no pressure from the tutor, learn in one's own rhythm, easier to communicate with virtual colleagues, the course materials, the video materials or other. The most chosen options were 84%, easy to access, 81% you can access them anytime and 78% you can access them anywhere. 62% of the respondents pointed out as an advantage the fact that you can study in your own pace and 53% think that the fact that these resources are free is also a good advantage. The video resources are considered to be an advantage by 51% and the course resources overall are considered also by 51% as an advantage. Only 32% of our respondents think that the fact that you can easily communicate with other virtual students is an advantage and only 25% think that the lack of pressure from the teacher is an advantage. Finally, the less chose option as an advantage was that these online educational resources are easier to understand than traditional ones, chose by only 20% of the participants in the survey. I conclude after these numbers

that students prefer to create their own learning environment and habits (easy access anytime, anywhere and in your own rhythm).

We also inquired about the disadvantages of online educational resources (hard to access, the price, harder to understand than traditional ones, difficult to communicate with the tutor, lack of motivation for self-learning, lack of interaction with peers, difficult activities or other) and got some interesting answers. 61% of the respondents said that they do not like the lack of interaction with other students and 58% of them stated that they miss the interaction with the teacher. 27% of our participants think that they cannot motivate themselves to study alone. 16% of the respondents stated that the price is a disadvantage and 15% mentioned the higher level of difficulty of online education in comparison to traditional education. The less important disadvantages for our respondents were the difficulty of access (4%) and the difficulty of the activities (6%). Other responses included as disadvantages: "finding relevant information" (1% of responses) and the "lack of hardware for some cases". Interesting is that, even though I did not include the "no disadvantages" answer, there were 2% of the participants that wrote this down. What I found here is that the millennial "clash" between teachers and students is actually a beneficial one, with the students missing this interaction as much as the interaction with their peers. The impersonal aspect of online learning is being singled out here as its biggest disadvantage.

5.3.4. MOOCs

We wanted to be more specific and find out the relationship of our students with Massive Open Online Courses (MOOCs). Around a third of our respondents (28%) have used a MOOC at least once and almost half of them (48%) would want to use one. Only 18% of our participants did not know what a MOOC is and a fewer 6% said that they are not interested about MOOCs. We found that the number of male participants that followed a MOOC is around double the number of females. We also looked for age differences and we found that 40% of the respondents aged lower than 18 do not know what a MOOC is. This percentage is around 15-25% for the rest of the age segments with inconclusive differences. Only 6% of under-aged respondents have used a MOOC, 23% of people aged 19-27, 29% of people aged 27-30, a large number of 48% of those having between 30 and 40 years old and 18% of people who are over 40. Moreover, I can try to sketch the portrait of a most likely MOOC user from our respondents as an educated male, aged between 30 and 40 years old.

We asked the ones who used MOOCs about the platforms they used and got the following results. A majority of 65% of our respondents have used a MOOC on Coursera. 25% of them have followed a MOOC on EdX and 18% of them on Udacity. Next in popularity of use were Udemy (11%), FutureLearn (10%), iversity (9%) and MiriadaX (5%). Other platforms mentioned were codecademy (3%), CBTNuggets, Oracle, SkillSoft, TutsPlus, Lynda, PluralSight (3%), Pearson, MSPress, SSWUG, Khan Academy, Moodle and Open2Study. 39% of the people who undertook a MOOC have accessed at least two different MOOC platforms. These results show to us our students' familiarity with all the major MOOC platforms.

Next, we wanted to know what the areas our respondents followed MOOCs in were. A majority of 60% of our participants followed MOOCs in the Engineering field, as long as 32% of them took a MOOC about Personal Development. 27% of our respondents said that they took a MOOC in Socio-human areas and 13% followed a MOOC in the Economy field. Other answers included Mathematics (2%),

Design (1%) and Law studies (1%). However, I believe this result to be somewhat biased by the engineering profile of the majority of our respondents, as our university, the focus of the survey, is an engineering university.

We also inquired about the level of course completion for the persons who undertook MOOCs. We found out that half (50%) of the people who took a MOOC also finished it, but only 10% paid for a recognized certificate. This total percentage of 50% of course completion is much higher than the universal ones of between 5 and 15% [28], [89], [90]. Are Romanians who participate in MOOCs more involved than other people are, or was our survey biased? Further research about this aspect is surely needed. 16% of our participants completed more than half of a MOOC as long as 20% of them followed less than half of the activities. 13% of the respondents admitted only to have skimmed the MOOC.
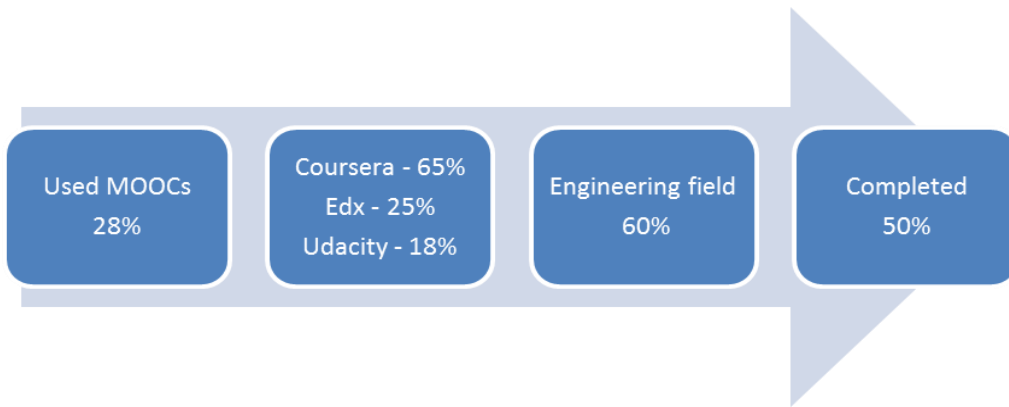
Figure 5.5. MOOCs overview - relevant numbers

Our next step in the research was to find out how much did the students appreciate different aspects of the online course that they followed on the MOOC platform. We asked them to rate from one (not good) to five (very good) a list of particularities of an online course. I present the results in Table 5.3.

	1 (low)	2	3	4	5 (high)
Easy to access	1,6%	2,2%	8,7%	27,9%	59,6%
Free	3,4%	4,5%	14,8%	22,2%	55,1%
Learn anytime	0,6%	1,7%	10,1%	24%	63,7%
Learn anywhere	0,6%	2,3%	12,4%	28,2%	56,5%
Course topic	2,3%	2,9%	19%	36,8%	39,1%
Easy communication	4,8%	11,4%	30,5%	28,7%	24,6%
Video content	2,3%	6,3%	12,5%	29%	50%
Other content	2,3%	5,2%	11,6%	30,2%	50,6%
Lack of pressure	5,8%	9,2%	19,1%	23,7%	42,2%

Table 5.3. Student survey results – rate aspects of a MOOC course

What I manage to observe after these results is a similarity of responses with the online resources section, the students preferring MOOCs because they are able to create their own learning habits. An important factor is the quality of the video and course resources offered. What they find the least appealing are the communication difficulties that appear in such an environment.

We were also interested about the opinion of our respondents regarding the structure of the platforms that they followed MOOCs on. Again, we asked them to scale from 1 to 5. The results can be observed in Table 5.4.

	1 (low)	2	3	4	5 (high)
Design	1,3%	7%	28,7%	32,5%	30,6%
Platform structure	0,6%	7,7%	21,9%	38,7%	31%
Navigation	0%	7,1%	21,3%	38,1%	33,5%
Topic identification	0%	2,6%	23,4%	38,3%	35,7%
Interactivity	0,7%	15%	34%	31,4%	19%
Peer communication	11,8%	24,3%	34,2%	16,4%	13,2%
Teacher communication	11,8%	20,9%	35,9%	17,6%	13,7%
Video content	7,2%	11,1%	15%	30,1%	36,6%
Text content	2%	5,9%	18,3%	37,3%	36,6%
Other content	6,2%	11,7%	33,8%	27,6%	20,7%
Forum	7,4%	17,4%	33,6%	25,5%	16,1%
Other social tools	11,6%	15,8%	37%	26,7%	8,9%
Activities	8,3%	14,5%	36,6%	28,3%	12,4%
Homework	2,1%	12,3%	33,6%	31,5%	20,5%
Periodical tests	6,8%	8,8%	26,4%	34,5%	23,6%
Exam	9,7%	7,6%	33,1%	22,8%	26,9%

Table 5.4. Student survey results – rate a MOOC platform

Trying to analyse the numbers from above, I found our students mostly enjoy the resources, especially the video ones, from the platforms that they study on. They have identified problems in communication and interactivity and are not very interested in the examining part of the courses.

After rating things that are already on a MOOC, we asked our survey participants to tell us what they would like to find more on a MOOC. 61% said that they want more interactivity with the teacher and 40% want more interactivity with the fellow students. 46% of the respondents want more video materials and the same amount wants more correct and up-to-date information. 40% of the participants want more resources and extra information and also 40% want more activities. 27% want more connections to social media and another 27% want more text resources. 21% of our participants want other courses and topics and a minority of 15% want to better know their peers. There were some extra

suggestions, such as "office hours online" when the teacher should be present and "Projects with tutorial and source code to improve skills" for programming courses.

These results point out the need for interaction between both tutor-student and student-student, without the social part of knowing each other better. The video resources are the most appreciated and it is interesting that many students feel that the quality of the material on MOOCs should be improved. These findings are not revolutionary, as similar results were already presented at a global scale.
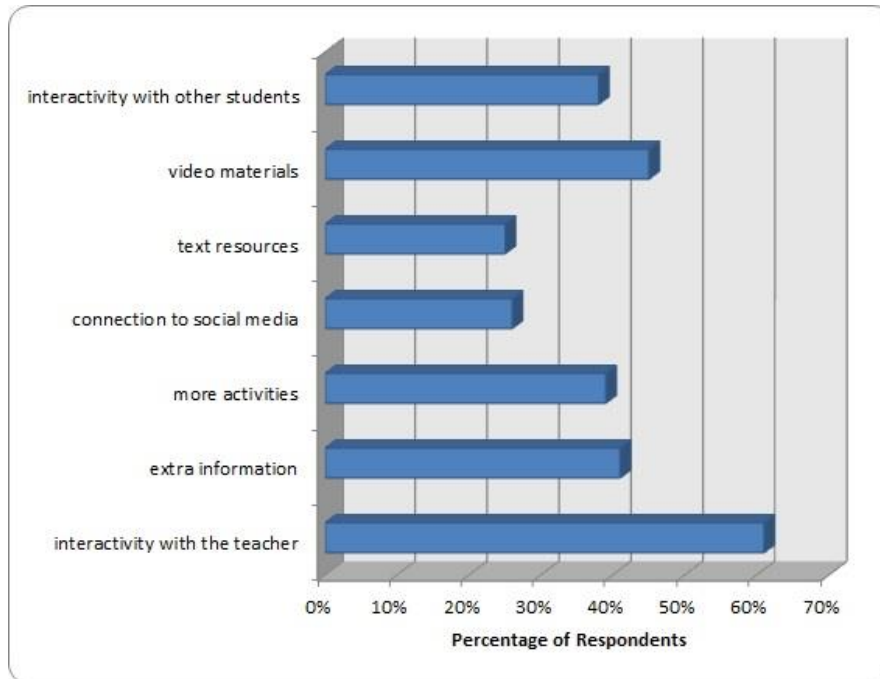
Figure 5.6. What do students want more on MOOCs?

As MOOCs in the Romanian language are concerned, 71% of our participants would like to follow such a MOOC, 19% are not decided and only 10% are not interested in such a project. The topics of interest for a Romanian MOOC were found to be Engineering (66%), Personal Development (49%), Social Sciences (30%) and Economics (25%), Medicine (3%), Design (1%). The interest for future development is therefore high.

5.3.5. Factors Related to Video Content, Length and Resolution

Norin Michelle, CIO, University of Arizona said that, "Video is one of those explosive areas of instructional technology - once people figure it out, everyone will want to use it" [247]. Does this perspective line up with the views of UPT students? It sure appears to be so, as it was shown in the previous chapters of this thesis. Going further, we were also interested about the opinion of our respondents regarding the video lectures they preferred. The literature proposes eight types of video content categories which are listed below [154]:
- Lecture capture (recording of a live lesson from a school or university);

- Talking head video (close-up shots of the instructor at his office or in a studio with no audience);
- Voice over presentation (a slides presentation, supplemented with a voice over);
- Khan Style (freehand on a digital table);
- Tutorial/Demonstration (video screen capture with the teacher's voice over);
- Animated instructional video (e.g., traditional animation - like cartoons, vector and 3D animation, Claymation);
- Interactive lecture (slide and video mode supplemented with hyperlinks, resource and files, annotations, etc.)[248];
- Hybrid video lecture (combination of the lecture types from above).

We focused on talking head video, voice over presentation, animated instructional video and interactive lecture as both we and other previous researchers found these to be the most used. We have developed the same educational material in these four video category types and disseminated them to the students. Based on the survey results we have noticed that 66% of the students prefer the interactive lectures. We have built the interactive lecture using the HTML 5 language and it contains the following components: slides with voice over, self-assessment quiz, table of contents, hotspots - hyperlinks to external text & video resources, animation graphics. Students completed the scenario and their preferences were as follows: 24% animated instructional video (developed with Sparkol Video Scribe ®, EDU license on a yearly subscription), 17% voice over presentation, 5% talking head video and 6% hybrid video (combination of listed lectures).
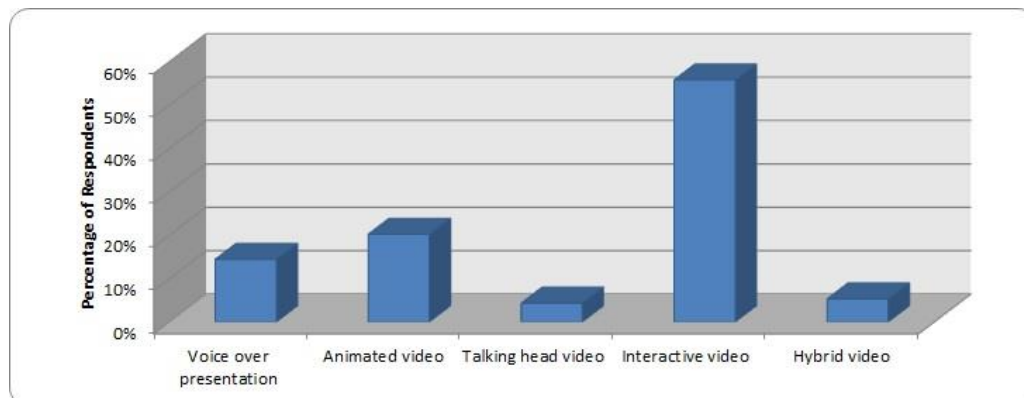
Figure 5.7. Video lecture category types

Interactive video lectures give students control over the lecture. They can replay segments and pause the lecture. They can skip the segments that they already understand and they can test themselves. We expect students who have access to quizzes, including appropriate feedback, to perform better than students who do not have access to these quizzes. They can read more and more about the subject. They can navigate between basic information and extra additional ones, which provides to them two levels of knowledge.

On the other hand, video length (duration) is a very important aspect, that we have tried to analyse. Teaching Center [166] suggests that videos should have between 2 minutes and, at most, 9 minutes in length. Whatley and Ahmad [167] implicitly recognize limitation times and propose a 5 - 10 minutes video. An earlier

study made by us on 30 MOOC platforms confirms the choice of less than 10 minutes per video, in 67% of the cases [154]. However, our current survey target group exposes an interesting point of view. Only 10% of them chose the under ten minutes video, the higher percent 46% inclining towards the 10-15 minutes duration. A large proportion of our respondents, 43% preferred the 15-20 minutes long videos and 6% like the videos that are more than 20 minutes in length.
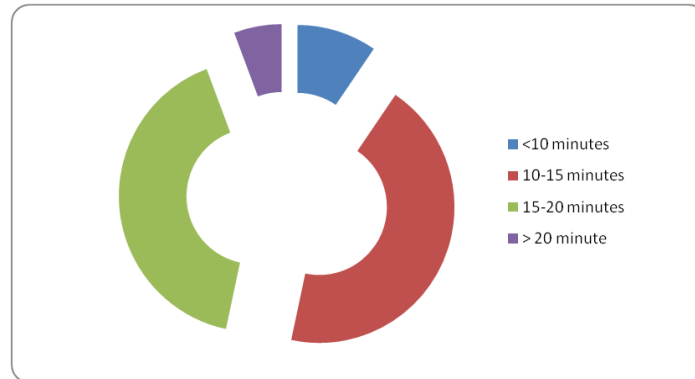
Figure 5.8. MOOC Video length

Resolution, also known as video frame size (a product between horizontal and vertical pixels), is a primordial element regarding the technical quality of the video itself. Other important parameters include audio-video container and codec, audio-video bit rate, aspect ratio, frame rate, colour space, bit depth, and scan type, sampling rate or number of audio channels. Based on the current study, as we have expected (because of the spread of mobile devices), 55% of the students chose the scalable option. It is an expected thing to choose a resolution that fits any device. The disadvantages consist in some video artefacts and a supplementary editing and developing work. From the results, we also extracted the idea of using devices with high resolutions by users. The proof consists in the 720p, 1280 x 720 choice of 29% respondents and 1080p, 1920 x 1080, the choice of 18% respondents.
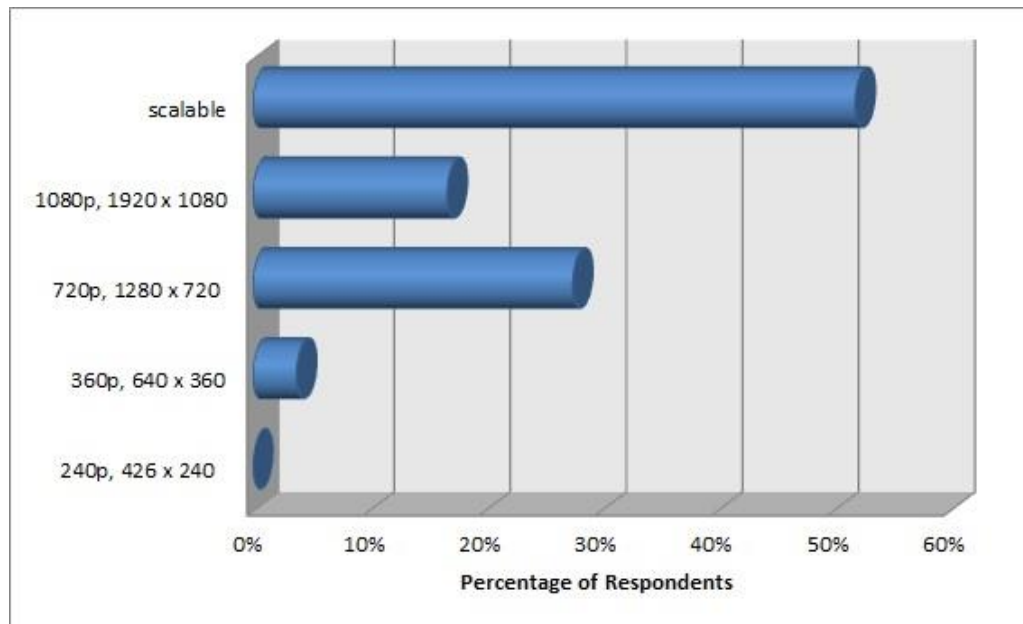
Figure 5.9. Video frame size

5.3.6. Interactive Video Environment

The interactive materials became an important factor for the present and the future of video educational content. From our target group, in addition to the 55% respondents who chose the interactive video (as seen in Figure 5.7.) we got a large 88% "yes" answer for the specific question "Do you consider that the video annotation (hyperlinks to additional multimedia resources) is "a must" for educational content in our days?" Therefore, I want to highlight two issues:

- The fact that interactive elements are preferred inside a video;
- The elements preferred inserted in a web video educational interface, besides those mentioned in the MOOCs section.

When asked "What way of interactivity do you prefer in a video?", the answers offered diversity and some close percentages (overlay materials - 38%, external links - 55%, speech download - 53%, table of contents - 49%, quiz - 43%), with a considerable decrease of percentage in the multi-clip video choice - 9%.
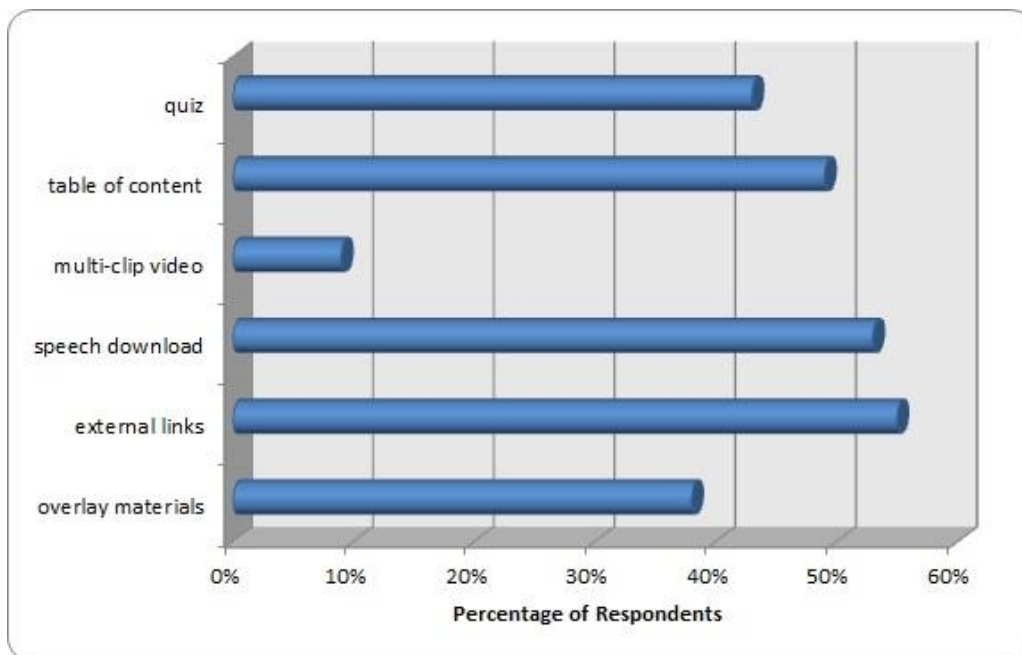
Figure 5.10. Interactive part of a video

Overlay materials refer to the action of accessing additional information (text, images and videos) superimposed over the current video [249]. External links allow finding new information regarding the subject in external places: video platforms, web sites, eBooks, scientific papers, etc. The speech download section offers a link to a '.pdf' file that contains the tutor's speech in text format. Multi-clip brings into discussion the concept of a video content with multiple acting scenarios with obvious applications in entertainment, though less so in education for the moment. The built-in table of contents (on the right of the video frame) allows users to select some important sections (we call them subchapters) of the learning material. The final item proposes a quiz for the self-assessment and maybe with some homework, recommended but not mandatory. The users prefer a complex video, the possibility to choose extra material, to find information in a faster manner; student attentiveness and engagement in studying is sensitive to the videos' learning environment. The next question strengthens this idea:

"What elements must a web video interface (with interactive parts in it) contain?" we obtained the following results:

- Custom video player with customizable buttons - playback controls and additional buttons (mute, full screen, annotations on/off, subtitles on/off etc.) - 81%;
- Overlay video subtitles - 22%;
- Interactive transcript, the tutor's speech in text format which is synchronized with the video and with the help of keywords that allow the user to jump at the specific area of the material - 30%;
- Graphics and animations overlay, geometrical forms, animation elements (e.g. arrow), highlighted zones which draws attention to the parts of the video frame content - 46%;

- Hotspots, interactive regions with external hyperlinks - 35%;
- A timeline with the video annotations - 27%;
- A visual key frame map with static image/frame from the video - 22%;
- Multi-clip index - 7%;
- Downloadable transcript - 19%;
- Self-assessment quiz and homework proposals - 49%;
- Additional information area (e.g., authors, links to other materials on the same subject) - 30%;
- FAQ area - 46%.
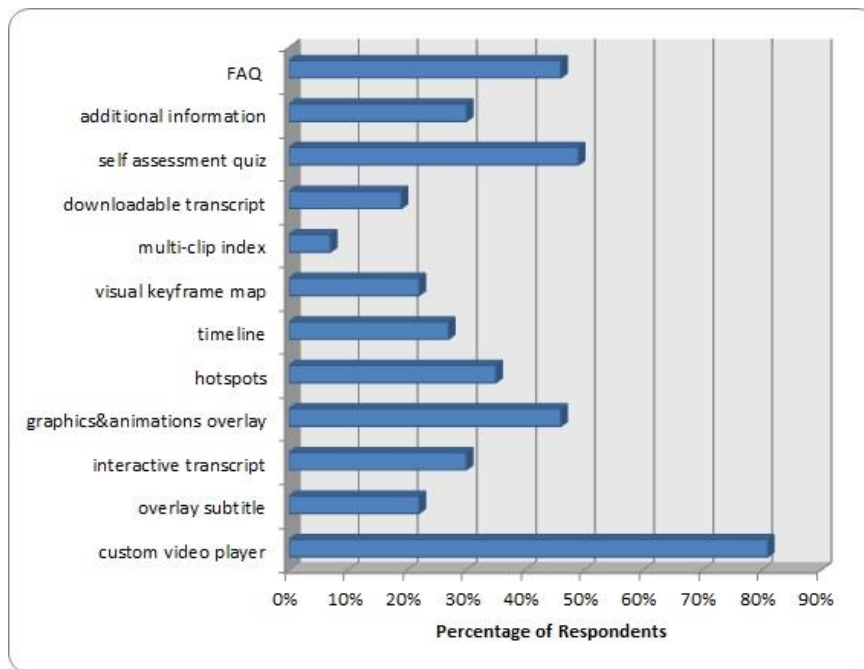
Figure 5.11. Video web interface elements

The interactive video environment is in its incipient phase in the Romanian education. However, there are approaches to this segment, student responses showing a predisposition for such items. We extracted the ideas and we underlined them in one phrase: classical video lectures (voice over presentation and talking head video) are completed with animation instructional videos and interactive parts, the resulted educational material is distributed on a scalable resolution (predisposition for various devices: tablet, mobile, monitor), in 10-15 minutes duration and visualized with the help of an interface based on a customizable video player and sections like quizzes, overlays, hotspots, transcript, visual maps etc. A graphic overview of categories and factors that brings a plus value to the video (interactive) environment in UPT is offered in Figure 5.12.
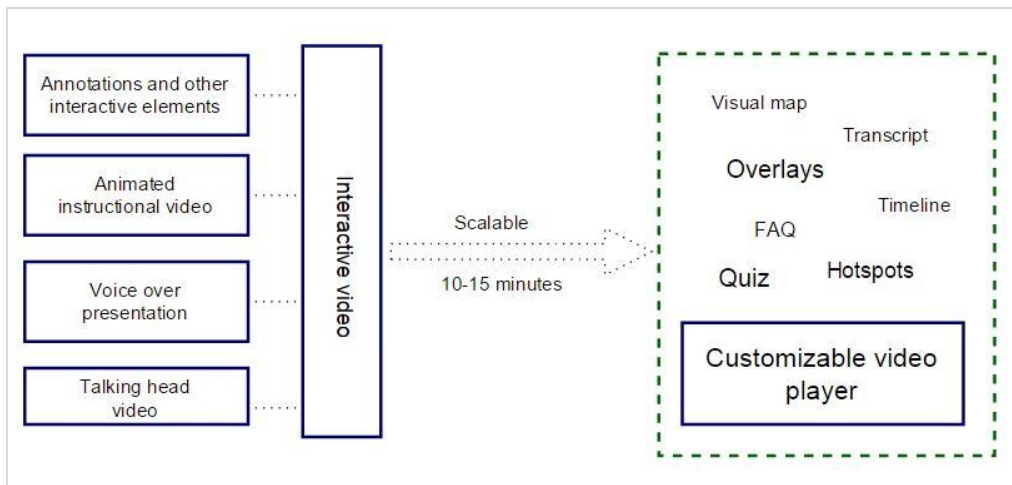
Figure 5.12. Elements for a UPT video (interactive) environment

5.4. Teachers Survey Analysis for Online Educational Resources and MOOCs

5.4.1. Methodology and Research Questions

In my research, I am not interested solely in the opinions of students but also in those of the teachers involved in the educational process. Therefore, I have constructed an online survey for them as well.

The questions that I was looking answers for were:

- Did Romanian teachers use Online Educational Resources? In what way have they used them? What is their opinion about them? Did they also create such resources?
- What are the strong and weak aspects of Online Educational Resources?
- Did Romanian teachers use MOOCs? What types of MOOCs?
- What is their opinion about MOOCs in respect to their structure, design and educational aspects?
- Have they any desires for the items in a course page interface?
- What are the advantages and disadvantages of MOOCs?
- Did the teachers use MOOCs in their courses? Did or would they recommend MOOCs?
- Had Romanian teachers develop MOOC materials?

My objective was to understand the necessity of the development of Online Educational Resources and MOOCs in Romania.

The survey was distributed via the educational platform of the Politehnica University of Timişoara, the Virtual Campus (https://cv.upt.ro), e-mail and social networks, in the period February-November 2015.

I used Google Forms to create the survey and I have built different types of questions, presented already in subchapter 5.3.

I have addressed to the teachers the following instructions and copyright agreement before completing the survey:

"This questionnaire is referring to the use of Online Educational Resources. These are all those resources facilitated by information and communication technologies, for consulting, use, and, if open, adaptation. Examples: online files (pdf, doc, ppt), html pages with educational content, educational videos, educational podcasts, virtual laboratories, etc. By completing this form you agree to the use of anonymous responses in future papers or publications".

5.4.2. Respondents' Background

I wanted to find out the medium where our respondents are teaching in. 90% of them are teaching in universities, 8% are in the training business, 2% are in private education and 2% are teaching in pre-university systems.

Regarding their age, 35.6% of the respondents are between 31 and 40 years old, 26% are between 51 and 60 years old, 22.1% are between 41 and 50 years old, 9.6% are between 61 and 70 years old, 5.8% are under 30 and one person is over 70 years old.

62.5% of the teachers are male and 37.5% are female.

As most of my network is from Timişoara, 83.7% of the respondents are from this city. Other numbers include 3.8% from Bucharest, 2.9% from Braşov and 1.9% from Cluj-Napoca.

The majority of 78% of the respondents are from my Alma matter, Politehnica University of Timişoara. 2.9% were from the West University of Timişoara and 2.9% were from the Transilvania University of Braşov.

Because of the high percentage of respondents from UPT this study could be biased and it is fair to underline that these findings would best apply to UPT.

5.4.3. Online Educational Resources

When asked if they have ever used online educational resources, our participants answered with "yes" in an 83% proportion. 49% of the teachers also created such resources. Only 3% have not used them and there was not a single teacher that had not heard of online educational resources before.

Next, I asked my respondents to rate the usefulness of OnERs from their point of view, on a scale from 1 to 5, 1 meaning not very useful, and 5 meaning very useful. The majority, 47.1%, opted for 5, 31.7% chose 4, 19.2% chose 3 and only 1.9% chose 2. That means a total of 78.8% who believe OnERs to be at least useful.

Further, I inquired about the role OnERs should have in our educational system. An almost unanimity of 93.3% of the participants indicated that these resources should coexist and complete the existing traditional and current ways of teaching. However, a small proportion of 5.8% would use them only optional and 1% said that these resources should replace the current ways of teaching.

Interesting feedback was received asking what parts of the educational system could happen online. The respondents were able to choose one or more of the following discussed items. 84.6% of the teachers think that the extra study time should happen online and 65.4% think that the theoretical courses could be place there. Almost half of the respondents think that consultations and extra-tutoring could happen online (46.2%) and study groups could be there as well (44.2%). 38.5% of the teachers that responded think that the unofficial evaluation of students could be on the internet and 27.9% would place there the laboratories and practical seminars. Only 13.5% of the participants think that the official exam should be online.

I also asked people what online resources they think are useful, again giving them the possibility to choose more than one option. Their responses can be seen in Figure 5.13.
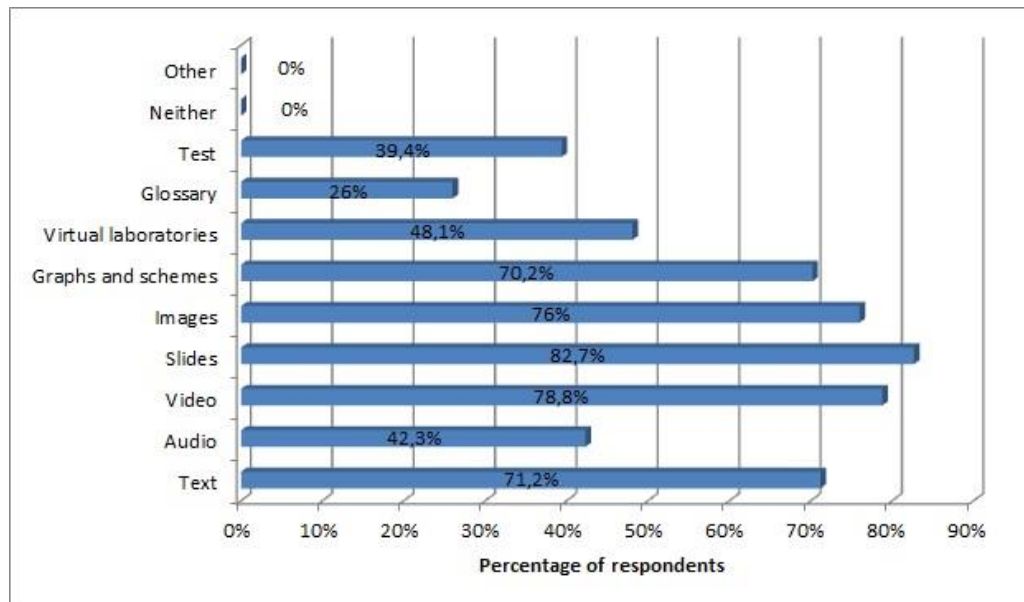
Figure 5.13. Teacher Survey Results – useful online resources

However, Online Educational Resources do not necessary mean Open Educational Resources, so I wanted to see the teachers' opinion about sharing resources created by them. A majority of 58.7% has already shared their own resources with others and another 23.1% would share them for free. 26% of the respondents would only offer part of their resources and 7.7% would offer them for a fee. 12.5% of the respondents do not know if they would offer their resources, probably because my question was not specific in what way to offer the resources. A surprising 1.9% of the participants would refuse to share their work because other people would steal it away. 1% would not share their work because they do not have time and 1% will not do it because they do not manage the technology.

Next, people were asked about the advantages of online educational resources. 79.8% of the teachers who answered think that the facts that these resources can be accessed anywhere and anytime are advantages. 78.8% of them think that the easiness of access is also an advantage. 54.8% chose as an advantage the fact that students can learn in their own rhythm and 44.2% said that the videos are an advantage. The course materials are considered an advantage by 36.5% of our respondents and the freeness of the resources by 33.7%. 27.9% of the participants think that it is easier to communicate with more "virtual" colleagues. Only 10.6% think that online resources are easier to understand than traditional ones and a surprising number of 5.8% of the teachers would opt for resources because they will not need to directly interact with students anymore.

I also inquired about the disadvantages of online educational resources and got some interesting answers. 85.6% think that the lack of direct interaction between tutor and student is a disadvantage. 19.2% of the teachers think that the students cannot learn by themselves and 14.4% think that online resources are

harder to understand than traditional ones. 8.7% think that the price is an issue and only 1.9% thinks that online resources are hard to access. Other disadvantages that I received were: "hard to elaborate", "lack of quality evaluation", "ambiguous authority of generation of online resources", "there is no flexibility in the adaptation of the message depending on the students reaction", "lack of performant computers", "no learning rhythm", "exchange of information unilateral and limited", "lack of time to get used with the resources", "illiteracy".

5.4.4. MOOCs

I wanted to be more specific and find out the relationship of our teachers with Massive Open Online Courses (MOOCs). 30.7% of the teachers have used a MOOC, 53% of which think that MOOCs are good, 41% think they are very good and 6% think they are not interesting. 46.2% of the participants did not use a MOOC but would like to try it. 18.3% of them do not know what a MOOC is and 4.8% do not intend on ever using a MOOC.

I asked the ones who used MOOCs about the platforms they followed and got the following results. 66% of my respondents used Coursera and 31% EdX. 29% of the participants followed a MOOC on Udacity and 14% did this on FutureLearn. 11% of the teachers used Udemy and 9% used iversity. 6% of my participants followed a MOOC on MiriadaX. Other platforms used: mit.edu and the virtual campus of the university (Moodle based).

The next step in my research was to find out how much did the teachers appreciate different aspects of the online course they followed on the MOOC platform. I asked them to rate from one (not good) and five (very good) a list of particularities of an online course. Their responses can be observed in Table 5.5.

	1 (low)	2	3	4	5 (high)
Easy to access	0%	2,3%	23,3%	27,9%	46,5%
Free	0%	5,3%	31,6%	21,1%	42,1%
Learn anytime	0%	4,8%	19%	19%	57,1%
Learn anywhere	0%	4,9%	19,5%	22%	53,7%
Course topic	0%	2,6%	33,3%	38,5%	25,6%
Easy communication	0%	17,1%	56,1%	14,6%	12,2%
Video content	0%	4,9%	26,8%	39%	29,3%
Other content	0%	0%	26,2%	47,6%	26,2%
Lack of pressure	4,9%	9,8%	43,9%	9,8%	31,7%

Table 5.5. Teacher survey results – rate aspects of a MOOC course

What I noticed is that, as well as the students, the teachers also appreciate the fact that a MOOC course is free and can be learned anytime and from anywhere. Its easy access is also considered an advantage. The lowest score was received by the communication on the course and also the lack of pressure is not appreciated as a quality of a MOOC.

I was also interested about the opinion of the respondents regarding the characteristic of the platforms that they followed MOOCs on. Again, I asked them to scale from 1 to 5.

	1 (low)	2	3	4	5 (high)
Design	0%	5,6%	33,3%	30,6%	30,6%
Platform structure	0%	2,8%	33,3%	41,7%	22,2%
Navigation	0%	8,8%	32,4%	35,3%	23,5%
Topic identification	0%	2,8%	33,3%	47,2%	16,7%
Interactivity	0%	14,3%	37,1%	40%	8,6%
Peer communication	3,1%	18,8%	34,4%	37,5%	6,3%
Teacher communication	3%	21,2%	39,4%	27,3%	9,1%
Video content	0%	0%	29,4%	47,1%	23,5%
Text content	0%	2,9%	32,4%	47,1%	17,6%
Other content	0%	13,3%	43,3%	36,7%	6,7%
Forum	3,1%	6,3%	46,9%	34,4%	9,4%
Other social tools	0%	20%	43,3%	33,3%	3,3%
Activities	0%	16,1%	25,8%	45,2%	12,9%
Homework	0%	3%	39,4%	45,5%	12,2%
Periodical tests	3%	3%	45,5%	36,4%	12,2%
Exam	6,3%	0%	50%	31,3%	12,5%

Table 5.6. Teacher survey results – rate a MOOC platform

To summarize Table 5.6, I point out that the videos, platform structure and course topics were rated with high scores. The teachers considered that the interactivity, homework, exam and other content than video and text are of medium quality. The lowest score was given to the communication, both between students and between teacher and student.

After rating aspects that are already on a MOOC, I asked the survey participants to tell us what they would like to find more on a MOOC. 65.9% want more interactivity with the teacher and 52.2% want more video material. 50% of the participants feel the need of more resources and extra information. 31.8% feel there is need for more interactivity with fellow students and 29.5% want more activities. Also 29.5% of respondents want more actual and correct information. More text is wanted by 18.2% of participants and 13.6% want more social links (Facebook, Twitter, LinkedIn, etc.). 11.4% of the teachers want other course topics and 9.1% want to better know their fellow colleagues. Other answers I got include "more interactivity with the platform".

When asked if they used MOOCs in their classes, 87.4% of the teachers denied this and 12.6% said they have used MOOCs in their own classes. I then asked them in what way had they used MOOCs in their classroom. I got a few

responses, which include "use of applets and video material", "flipped classroom concept", and "blended learning".

I wanted to see in what areas were MOOCs used and followed. 78.8% of the respondents chose the engineering field, 6.1% chose economic and another 6.1% chose socio-human sciences. Another 6.1% used it in mathematics and 3% of the respondents used MOOC in the personal development area.

When asked if they recommended MOOCs to their students, 56.3% of the respondents said yes, 42.2% said no and 1.6% said that MOOCs are not adequate for education.

83.8% of the participants said that they did not develop MOOC courses and materials. However, 16.2% said they did develop such materials but after asking them to detail this, I understood that they either did not understand the question or made a confusion about what MOOC resources are.

In the end of the survey, I asked the teachers to mention other aspects relating OnERs and MOOCs. Here are some of their answers: "MOOCs are not recommended for academic formation", "a MOOC would be useful only for well-intentioned students who want to specialize in a specific area. The majority of students do not correspond to the normal exigencies at a higher education level", "online education is accessible only to students with a certain level of knowledge (at least good), who acknowledge the necessity of independent study and who can sustain this study", "there are few courses for instructing teachers about MOOCs", "free not free of charge".

5.5. Conclusions

When looking at other similar surveys worldwide, I found the following results. Kolowich [209] presents the MOOCs from the perspective of the professors that create them, after a survey conducted by "The Chronicle", on which 103 responded. Typically, a professor spent over 100 hours on his MOOC before it even started, by recording online lecture videos and doing other preparation. Others laid that groundwork in a few dozen hours. Once the course was in session, professors typically spent eight to 10 hours per week on upkeep. Most professors managed not to be inundated with messages from their MOOC students—they typically got five e-mails per week—but it was not unusual for a professor to be drawn into the discussion forums. Participation in those forums varied, but most professors posted at least once or twice per week, and some posted at least once per day. As far as awarding formal credit is concerned, most professors do not think their MOOCs are ready for prime time. Asked if students who succeed in their MOOCs deserve to get course credit from their home institutions, 72 percent said no.

It is fair to mention the biases of this study. The fact that the majority of the respondents were students or teachers of UPT means that these results are best applicable to this university and there is a possibility they would not apply to the whole country. Also, the level of e-literacy and tool understanding was not analysed, and this could also influence the results.

There are some key findings to my research, and I am going to point them out in this part of the chapter. First, I can conclude that the e-Learning literacy in the Politehnica University of Timişoara is high with 91% of our participants having used already online educational resources and finding them to be useful or very useful in a proportion of 80%. Our students think that e-Learning should be intertwined with traditional learning in a natural way, pointing out that the parts of

the educational system that are better displayed online are the extra-study, the theoretic courses and the self-assessment of knowledge. My study showed that our respondents are mainly interested in resources like video, text, schematics, slideshows and images. According to our participants the main advantages of OnER are their easiness to be accessed, the fact that you can access them anytime and anywhere and the fact that one can learn in his own pace. The disadvantages that emerged are the lack of communication with the teacher and with the fellow students.

The main results of the MOOC section of the questionnaire showed that there is an increased interest of both existing MOOCs and future MOOCs to be developed in Romanian, as I was expecting [250]. A third of respondents have participated in at least a MOOC and another half of them are interested in participating. By far, the most popular MOOC provider for Romanians is Coursera with two thirds of "MOOCers" having accessed it. In addition, the most followed topic in a MOOC seems to be Engineering, both for now and for future interest. This can be explained through the fact that Engineering related MOOCs are the most encountered online. A very interesting aspect is the fact that Romanians have a rate of completion of almost 50%, which is much higher than the global 5-15% [28], [90], [91].

Regarding some various aspects of the online course, I found that our participants appreciate very much the easiness to access, the freeness and the "learn anytime-anywhere" aspect. The video and other course resources are also a plus, followed by the course topic and the lack of pressure. The only aspect that our respondents were not decided about was the easiness of communication, where opinions are equally divided.

The opinions about the platforms where students underwent MOOC studies are uniform. The design, structure, navigation, finding course topics, homework assignments, periodical testing, video and text resources and the final exam are appreciated but not at a maximum. Interactivity has raised more of an "I don't know/Not decided" rating. Similar results were obtained regarding activities and other resources than video and text, which can suggest that participants are not so interested in other types of resources. I also think that social resources are either not used or not considered extremely relevant by our participants as the scores for forums and other social resources were inconclusive. The communication with other peers or with the teacher is rated as a minus of the MOOC platforms. Our participants are looking for more interactivity with the teacher and other students and for more actual and correct information together with more videos as resources. These aspects lead to the idea that Romanian students are ready for a superior experience in e-education and video. They can embrace a video more complex, more interactive either with the interactive part built in the video itself, either by offering these elements in the Web video interface. An interactive video content offers some particularities: superior, exhilarating, fulfilling experience for users; efficiency in delivery of information; a video more integrated and easy addressable from World Wide Web; much better correlation between different materials; user video adapting; facilitation of social connection between users in the same area of interest; redefining the audio-video production [175].

There is a vast majority of respondents who are interested in a Romanian MOOC, most of them in the fields of Engineering and Personal Development. This encourages future work into the actual development of a first Romanian MOOC platform based on the above results and recommendations.

After carefully analysing the results of the teachers' survey I can conclude the following. Romanian teachers are very aware of online educational resources and many of them have also created such resources. A vast majority of 78.8% of respondents consider OERs to be at least useful. The opinion that they should be used in a symbiosis with traditional learning is almost unanimous. More than half of the teachers think that extra study time and theoretical courses could happen online and almost all agree that the exam should not. The most useful resources are considered to be slides, videos, graphs, images and text. The advantages are, in the Romanian teachers' opinion, the access anywhere/anytime aspect and the learning in one's own rhythm. The most mentioned disadvantage was by far the lack of direct interaction between the tutor and the student.

As to what MOOCs are concerned, I found that only one third of my respondents used a MOOC at least once, but they are very curious about it. The most used platforms by Romanian teachers are Coursera, EdX and Udacity. The most appreciated aspects of a MOOC course are the "learn anytime/anywhere" aspect and the easiness of access. The least appreciated is the communication aspect. In the Romanian teachers' opinion the most appreciated particularities of MOOC platforms are the video and text materials together with the structure and design. The least appreciated aspects are the communication between peers and between the teacher and the students. The teachers feel there is more interactivity needed inside MOOCs. Even if only a few teachers used MOOCs in their own classes, around half of them have recommended MOOCs to their students and some even developed MOOC like material.

My theoretical contributions presented in this chapter consist in the analysis of Romanian perspective over MOOCs through the development of two surveys designated for students and teachers, in relation to the use of Online Educational Resources, MOOCs and videos in education.

Some results presented in this chapter have been published in [251].

6. STUDY CASE: MOOCS IN UPT

6.1. Introduction

Some university professors are using MOOCs in a successful symbiosis with their traditional courses, embracing blended learning or the flipped classroom concept [218]. This has usually occurred when the course developers and tutors of the MOOCs were also the ones who had been teaching the traditional course [252]. Blended learning refers to a formal education program where the student learns at least some parts of the course via the online and digital medium, taking other parts at face-to-face classroom sessions in a "bricks-and-mortar" school or institution. Flipped classroom is a form of blended learning in which the students usually learn the content from somewhere other than the school and in the face-to-face meetings they pose questions, solve homework and take part in practical activities. Many consider that having the time and space to investigate, communicate, and produce creative projects within a flipped classroom can only help set students up to be successful [235]. This idea of giving students more opportunities to work collectively is certainly engaging and relates to the new methods of teaching STEM subjects and new approaches to engineering education [246], [250].

In Europe there are a lot of good practices offered either by European MOOC platforms such as FutureLearn (United Kingdom), iversity (Germany), MiriadaX (Spain), FUN (France) or EMMA (the European multilingual MOOC) just to name a few, or they can take the form of successful collaborations with other platforms such as the case of LouvainX (Belgium university on edX platform). However, looking on Europe's map, it is very difficult to find anything related to MOOCs farther into East than Austria. This is something that we are planning to change as Romania is doing strong research into how it could integrate MOOCs in its higher education.

There are several ways in which MOOCs can be blended in higher education courses mainly based on the topic complementarity with the course, the synchronicity between the MOOCs and course, and the numbers of MOOCs to be integrated. In Politehnica University of Timişoara (UPT) there have been several pilots on integrating MOOCs in traditional courses and in the assessment and evaluation of student coursework based on this [246], [250].

One UPT case study was based on the participation of students from the undergraduate course on Web Programming in different MOOCs, and integrating this experience into a blended course run on Cirip.eu, in a dedicated private group in Autumn 2014 [246]. Reporting and analysing this study, two thirds of the students (66%) have completed more than half of the assignments, while nearly a quarter (24%) completed the whole course; almost half of the students participated in MOOCs hosted by Coursera (44%), nearly a quarter on Udemy (23%), while the

rest have chosen Udacity, edX, Khan Academy, Codecademy or FutureLearn. European MOOCs are also found on the Open Education Europa portal; most of these MOOCs were in English and a small number in French. However, several students have participated in the collaborative translation of materials into Romanian, where possible; some of the students reported that they have followed a few MOOCs in parallel with supporting other disciplines during the Autumn term (for a few courses, their activities in MOOCs were formally recognized by other teachers) or just for self/individual study.

6.2.   Background of the Courses

Another UPT study involved Master of Science students' in the Instructional Technologies course where MOOCs were used as external resources on the course during the autumn of 2014. The 27 students involved took 16 courses (45% edX, 34% Coursera, FutureLearn, iVersity, Udacity), on subjects related to educational technologies. During the evaluation of this pilot study, 19 students completed the MOOCs to which they subscribed, the rest using the materials only as reference. An interesting aspect of this pilot was the continuous critical discussion between the students and the teacher regarding the quality of the video materials, the instructional methods used in different courses, the course interaction between peers and the evaluation and assessment methods. Some of these discussions were held online in the dedicated blog on CVUPT (the university Virtual Campus) and some took place during the face-to-face classes. Some stirring comments in the blog were related to students expressing the need for direct communication and feedback from MOOC facilitators, not only from peers, as a more valuable and qualitative feedback and as a way of personalization of their learning. Some students suggested that in a MOOC the students should have the possibility to choose which of the learning pedagogies they want to follow.

A wiki tool in CVUPT was used by students to create or contribute to course content, which they assessed as relevant to the specific topics indicated by the teacher. The topic with the most comments and references was related to course structure, students concluding that "In order to have quality content, the teachers and course material creators should have access to a number of powerful and intuitive tools for content editing and structuring". At the end all students wrote a report on their experience on this study, on integrating and recognizing the activity from a MOOC in the traditional setting of the Master course.

Students reported a high interest in MOOCs and in the educational model they provide, and expressed their willingness to take part in future MOOC activities; previous to this pilot, only three students knew anything about MOOCs, and only about Coursera.

The main objective of these studies ran in courses of the Politehnica University of Timişoara was to see how integrating MOOCs into everyday teaching influences students' perception of online education, lifelong learning and how this can be considered a lifelong method for learning and skills acquisition. The study planned to include MOOCs in two different credit-based courses (Multimedia Technologies and Instructional Technologies) for the same students, the courses being taught in consecutive semesters by the same tutor. The courses are part of the traditional higher education Master of Science in Multimedia, the student cohort being between 23-28 years old, 60% of them male students, all with high-level ICT skills. This setting allows a rare opportunity to investigate if students' perception of

using MOOCs in higher education is changing and if MOOCs can increase students' learning. The study ran for 9 months, and involved 34 students at Master level with each student attending between 2-5 MOOCs.

During both courses several tools and methods were used as an organic evolution from the initial objective of including just one of the MOOCs in the course:

✓ Both courses used as learning support the university online learning environment CVUPT – Campus Virtual UPT   https://cv.upt.ro/.

✓ The tutor indicated relevant topics and courses to the students, but left the choice of the right course to the students. This was based on previous studies that indicate students' strong desire for control over their learning environments [253].

✓ Students communicated the selected course to the class. This was done in a dedicated blog in CVUPT.

✓ Selected topics from the MOOCs course were discussed during in-class hours. Topics were selected by the tutor and students to fit in with each weekly learning goal.

✓ Multimedia materials and videos were discussed during in-class hours.

✓ A wiki tool in CVUPT was used by students to contribute with course content (embedded links and comments) on topics relevant to every week's goal.

✓ Blogs in CVUPT were used by students to comment on and analyse the course, their experience and 'what they learned'.

✓ Each student submitted a final evaluation report of his experience in MOOCs, following the topics: the technical environment, the platform usability, quality of learning materials, activities performed and communication tools.

✓ Students completed an online evaluation questionnaire.

✓ Students attended a written exam related to the course topics (35% of test questions were related to topics learned from the MOOCs).

Results from the evaluation reports, online surveys and a general evaluation of their exam are presented in this chapter.

6.3.   MOOC Interaction and Analysis

As it can be seen from the Figure 6.1., a majority of 22% of the students followed a course on Coursera, 17% enrolled on Udemy and 12% each joined a course on Udacity or FutureLearn.
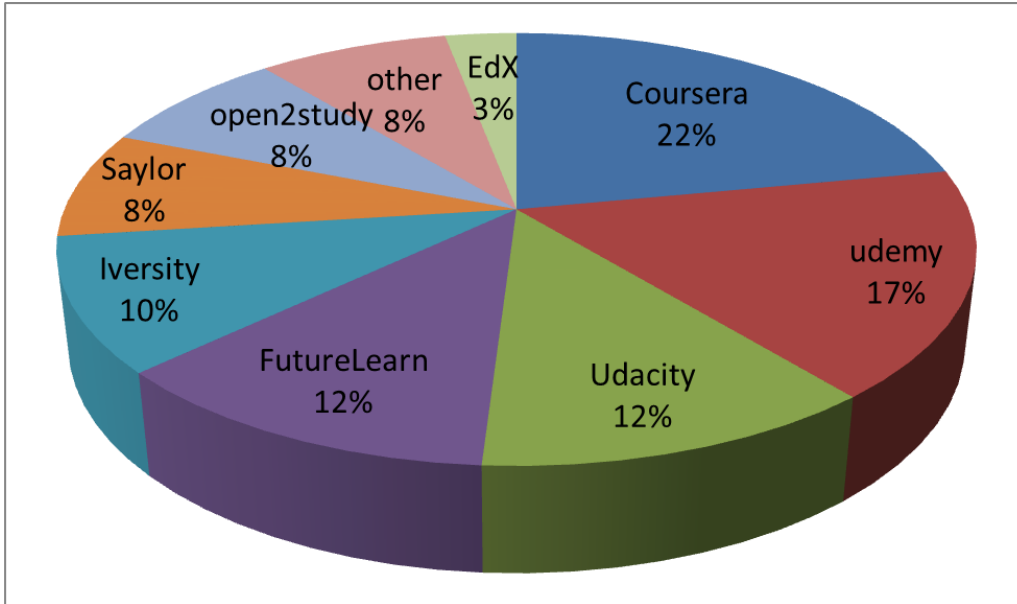
Figure 6.1. The platforms used by the students from the Master of Multimedia Technologies

In Figure 6.2., you can see the duration of the courses followed by our students.
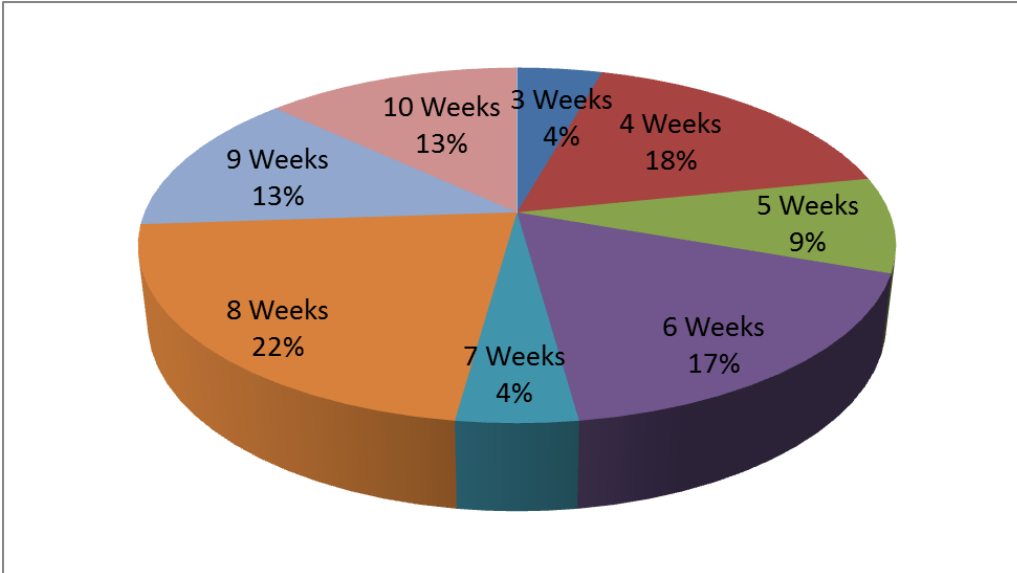
Figure 6.2. The duration of the courses followed by the students from the Master of Multimedia Technologies

Platform	User-Friendly	Intuitive	Easy to use	Attractive	Simple structure	Suggestive icons and colours	Connect with social media
Coursera	yes	yes	yes	N/A	yes	yes	yes
udemy	yes	yes	yes	yes	yes	yes	yes
Udacity	yes	yes	yes	yes	yes	yes	yes
FutureLearn	yes	N/A	yes	N/A	yes	N/A	N/A
Iversity	yes	yes	yes	yes	yes	yes	yes
Saylor	no	no	no	N/A	N/A	N/A	N/A
open2study	N/A	N/A	N/A	N/A	N/A	N/A	yes
Khan Academy	N/A	N/A	N/A	yes	N/A	N/A	yes
EdX	yes	yes	yes	yes	N/A	yes	N/A

Table 6.1. Technical analysis of different MOOCs platforms

Platform	Material	Additional info	Videos	Testing	Language	Certificate	Prerequirements	Progress	Colour coding
Coursera	different formats would be required	yes	can be downloaded, modify the speed	questionnaires, quizzes, weekly assignments,exam, individual and group projects	subtitles in other languages, courses in other languages	Respect deadlines, Verified Certificate	some	yes	yes
Udemy	very useful and explanatory	yes	excellent quality, cannot be downloaded, autoplay option	intermediary and final exam, quizzes	N/A	yes	N/A	yes	N/A
Udacity	good	yes	can be downloaded	problem sets, quizzes	N/A	yes	some	yes	yes
Future Learn	not stuffed, clear terms	external links	very good	weekly, short test	N/A	N/A	N/A	yes	N/A

Iversity	N/A	references, attachments, FAQ	N/A	quiz after each video, midterm,final exam	Videos in German with English subtitles	Exam, project	some	yes	yes
Saylor	N/A	external links	N/A	exam	English	after exam	yes	N/A	N/A
open2study	easy to navigate	N/A	on YouTube ,interactive transcript	quiz after each chapter, final exam	English, subtitles in English	after exam	N/A	yes	yes
Khan Academy	good	yes	good	N/A	N/A	N/A	N/A	N/A	N/A
EdX	pleasant and attractive	yes	interactive transcript	quizzes, final test	N/A	N/A	N/A	yes	N/A

Table 6.2. Learning materials analysis of different MOOC platforms

Since the students were left with large liberty into analysing the courses and the platforms that they followed, it is very interesting, in my opinion, that a vast majority presented similar findings or at least looked into similar components from the platforms. For example, from Table 6.1, I conclude that students were interested in the structure of the platform analysing how simple it is, if it is user-friendly, intuitive or easy to use. They also analysed visual aspects such as attractiveness and suggestivity of icons and colours. Finally, the majority of students checked if the platform allows the user to connect with social media.

Next, I move on and analyse the findings from Table 6.2. The students rated the material from the platforms taking into consideration the formats, the clarity, the quality, the difficulty of navigating through the course or its usefulness. Moreover, they focused on the videos observing their different qualities, the possibility of downloading, interactivity options and the availability of subtitles or transcripts. General particularities, such as progress check, colour coding and pre-requirements were also analysed by a majority of students. Finally, the students presented their views on testing possibilities and the methods through which they could receive a certificate for completing the course.

Here are some other facts that I observed from the detailed analyses of the students' reports.

Iversity allows users to create online CVs, to work with private workspaces and create archives of their online resources. The users can create course resources to help other peers; they can upload files or create links to webpages. The user has

the possibility to add annotations to the course material. Some courses are equated with ECTS (European Credit Transfer and Accumulation System) credits.

In Coursera, the information is received weekly, as topics are gradually available for access. The course has a "Join a Meetup" option, where people can enrol in groups or create new ones for facilitating the communication between participants. Another interesting thing to mention is the existence of a Course Material Errors section where students can describe their problems encountered during the course. Technical Issues is similar, but refers to the problems that appeared in the platform.

Coursera allows one to obtain a Verified Certificate at the end of the course, for a certain fee. A student can start a course for free and then, at the end, he can choose to pay and gain a verified certificate.

During quizzes in Coursera, feedback for mistakes comes under the form of hints (only for some of the questions). The user has five attempts for completing the quiz. After completion, a detailed feedback is offered. There are two deadlines for the assignments, the second one meaning that the student will be penalized for being late. If the assignment is not completed after the two deadlines, the student receives 0 points for the assignment. In another course the tests could be redone (100 times limit), but on the exams there were only three attempts and the time limit was two hours.

In 2015, Coursera has introduced the Coursera Specialization. This specialization is a set of 2-3-4 courses on a specific subject. To be eligible for a specialization one must have attended and promoted the course with distinction and with the signature track.

In Khan Academy, the practical part requires the student to code, in the left part of the screen, while seeing the results in the right part. If the student makes a mistake, then a popup appears with some help explaining about the mistake that was made. At the end of the exercise, the student receives energy points and a mascot congratulates him.

In open2study, the student is motivated to follow the course, not only through the modern and interactive methods of learning, but also through periodic testing, where a 60% success rate is required. Each student can take a test for three times, the highest score being the one recorded. In addition, a motivational fact is the symbolic medal that the student receives at every completed step of the course (for example watching a video grants you a bronze key, watching all 40 videos will grant you a gold key).

The quizzes are very interactive, for Udacity, with a series of elements for responses. If the student makes a mistake, he gets a small hint or help. The questions are not very difficult and stimulate creativity.

In Udacity, there is a focus on the discussions, the participants being encouraged to pose questions and answer to others.

Live streaming sessions are offered (office hours), one hour each, for direct interaction with the students and for offering answers to their questions.

The paid courses, in Udacity, offer extra in-class projects, feedback related to the project, code analysis, a tutor for guidance, personalized simulation support and a certificate.

In Khan Academy, you can participate in a course without an account, but then you do not receive "energy points".

Udemy is easy to use both as a creator and as a student. For creating a course, the platform helps the user with pop-up messages at every step. Every published course is first verified and tested by the Udemy team. If the quality

standards are respected, the course will be added to the "marketplace" where it will be visible to users. This usually takes 3-4 working days, according to information on the website. If the creator decides to request a task per enrolment, then 30% of the earnings are going to the platform. The platform offers the possibility of discount coupons to be given to students, discount that will diminish the profit of the creator. As to the nature of the published courses, these have to include at least 30 minutes of video material. Another hard to fulfil standard is that the video materials should last between 2 and 15 minutes each. If some courses require short instruction videos, then 2 minutes seems a lot. If, however, one wants to have shorter videos, the platform support team could validate them. Udemy allows a thumbnail to be associated to the video, but the list of options is limited. The deletion of course materials is not very intuitive for the user, as he should first access the editing button of the course. Realigning the order of the materials can be easily operated through drag and drop.

Similar to e-commerce platforms, Udemy allows a user to add a certain course to his "wish-list".

Also for Udemy, every lesson has a button for checking it as completed, therefore it is up to the student when he considers that he finished and understood a particular lesson. There is another option, which can be activated or deactivated, regarding the automatic progression to the next chapter. After completing the test, the user can see a report about his result and the general result of the rest of the class.

After completing the course, a 50% discount voucher is offered, in order to buy another course from the platform. In comparison to Udacity, where the student who reported this was also a member, Udemy is less user-friendly and less interactive.

When the student enters the course, in EdX, the platform notifies him about the last activity that he has visualized. Each video has the transcript next to the video and by clicking on a part of the transcript, the video jumps to that section, therefore being very easy to navigate.

Built in 2008, the Saylor Foundation focused on the continuous exploring of education and on reducing online education costs to zero in order to raise the access level. Saylor is mainly based on members of the academic community, who create the courses. An experienced commission revises every course on Saylor. The commission will evaluate the course structure and design, the quality and purpose of the materials created. The revision happens only after the course is completed and uploaded on the website. In order to receive a certificate, the student needs to register on ePortfolio.

Saylor is not accredited like other traditional systems, but they have their own accreditation system using badges. This project is supported by the Mozilla Foundation together with the HASTAC organization and allows the platform to display the badges in an open system.

To start a course, there are some instructions, "how to work through the program". The course starts with Unit 1 and continues with the units in order. There is a "Time advisory" that estimates the amount of time needed for completing the course, but not all courses have one. Every course offers a Creative Commons Attribution license. Saylor has a calendar where the user can see what courses are available and what courses are going to start soon.

One student thinks that the auto evaluation tests and proposed homework have an important role in grounding and appliance of basic concepts. Another says

that the style of the courses, combining videos with quizzes, maintains the student alert and helps for fostering thinking.

Next, I am going to summarize the advantages and problems of the MOOC platforms as underlined by the students.

Advantages reported by students:

- The platform is adaptive and the student can follow the course from his mobile devices (iversity)(Coursera);
- The percentage of completion is helpful for self-administering the learning process (iversity);
- The progress bar (Udacity); - mentioned by more than one student
- The option to jump straight to the quiz if you already know a section (Udacity)(Coursera);
- The very well-structured syllabus (Udacity);
- Learning in one's own rhythm (Udacity); - mentioned by more than one student
- All courses are openly accessible, without start or end dates (Udacity);
- Powerful accent on pedagogy (Udacity);
- Asynchronous courses are very favoured by students, as they can study anytime and anywhere (Udacity)(Saylor)(Coursera);
- Large amount of courses to choose from (Coursera);
- Many information offered in individual courses (Coursera);
- Many videos have a subtitle option for English and other languages (Coursera);
- Almost all courses offer a certificate (Coursera);
- All courses have a short introduction or presentation video (Coursera);
- Interactive way of learning (Coursera);
- Learning in a relaxed environment (Coursera);
- Involvement of specialists (Coursera)(Udacity);
- No commercials (FutureLearn);
- For a user it is extremely useful to see the rank of the course (from 0 to 5) and reviews about the course written by other peers (Udemy);
- It is a very good method to gain new knowledge, having access to information in a structured way (EdX);
- Accessibility, flexibility, comfort (Saylor); - mentioned by more than one student
- Splitting the course into modules helped the information to be assimilated in a progressive way (open2study).

Problems reported by students:

- The forum is too complex in the current context, with too many layers of information (Coursera);
- Technical issues during tests (Coursera);
- Lack of a gradebook (Coursera); - mentioned by more than one student
- Lack of motivation, as tests are not sufficient for testing ones knowledge; game-like activities would help (Coursera);
- Difficult requirements (Coursera);
- Not all courses are open for enrolment (Coursera);
- Peer-grading is not reliable (Coursera);
- Deadlines are hard to fulfil (Coursera);
- Lack of motivation of the teacher (Coursera);
- No information about the abilities gained (Coursera);

- No search feature inside the lesson (Coursera);
- The lack of a synchronous communication activity, where students could communicate instantly (Coursera);
- Lack of detailed explanation and lack of examples (Udemy);
- Few free course (Udemy); - mentioned by more than one student
- The course could be separated in two (beginner and advanced) (Udemy);
- Accessing the course could be challenging for an IT beginner, as some video plug-ins are required to be installed (Udemy);
- There is some blur in the videos (Udemy);
- Lack of interactivity (Udemy);
- An error that was observed is a shift of the text in the case of an older browser version use (Udemy);
- The lack of a final exam could leave the student with the false impression that he understood and gained all the knowledge that the course offered (Udemy);
- Errors and bugs during tests (Udacity)(Saylor);
- Lack of explanations for some lessons (Udacity);
- Lack of text material (FutureLearn)(Saylor);
- Disappointment for not being able to visualize a course that starts in the future (FutureLearn);
- No possibility to solve an assignment if the deadline expired (Iversity);
- Few courses (Iversity);
- Description for course in English, but course in German (Iversity);
- Lack of option for choosing the level of the student (Udacity);
- No visualization of changes during the feedback about the code (Udacity);
- No feedback in the discussion section (Udacity);
- No certification for non-paying students (Udacity);
- It could encourage procrastination (Udacity);
- As exams are unsupervised, cheating comes into discussion (Udacity);
- Some courses require knowledge gained in previous Udacity courses;
- The lack of a tutorial for the use of the platform (Saylor);
- Difficulties in usability (Saylor);
- Not professional enough (Saylor);
- Videos that are too long – one hour (Saylor);
- Too much content and bad structure (Saylor).

6.4. Conclusions

Striving for better and more effective instructional delivery models is a sincere desire of every faculty member. The advent of Massive Online Open Courses (MOOCs) has opened new possibilities. One of the more innovative ways of utilizing MOOCs especially in challenging subjects and more challenging courses is as a flipped classroom. These new delivery models can enhance student engagement, improve student retention, and significantly improve students' critical thinking. By using different MOOCs on a traditional course, students are exposed to high quality materials created with top educational technologies, using methods for global collaboration and leading to a broader range of experiences than those to which they otherwise might have access.

I have presented objective opinions of our students, opinions that help me into developing a first Romanian MOOC platform. It is clear for me that the most

important focus in developing a platform for Romanian students should be the video lecture section. The quality of the videos and the facilities offered by the video player (downloading, speed modifying, transcript, etc.) were signalled as vital. The platform should be easy to use and access with clear explanations about how it works. The students' progress has to be clearly visible through a progress bar and through periodical self-testing. Interactivity and being adaptive are also two key factors that emerged from my study. What I should be careful when building this platform is the construction of the forum tool as this seemed to frustrate many of the students on different platforms.

After conducting various experiments and surveys I am left with enough conclusions and good practices required to build a first Romanian platform, which the will be tested by experts and students for validation of my conclusions.

This critical analysis of a study case regarding the use of MOOCs in traditional courses from UPT is another theoretical contribution to this thesis.

Some results presented in this chapter have been published in [254], [255].

7. PROPOSED CONCEPT AND MODEL

7.1.   Description of the Concept

7.1.1. Instructional Aspects

I have tried to build the Romanian MOOC model based on the ADDIE (Analysis, Design, Development, Implementation, Evaluation) concept, which can be seen in Figure 7.1.
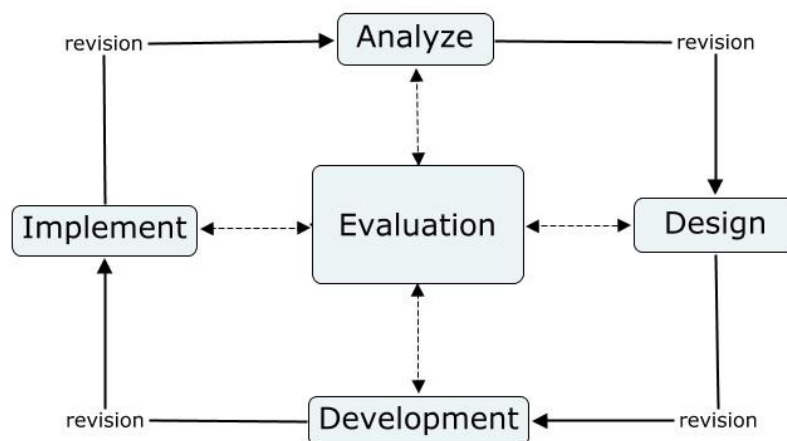
Figure 7.1. ADDIE model [256] (created by Ward, licenced under CC BY-SA 3.0 via Wikimedia Commons)

The model is composed of five main steps. Let me explain those steps in connection to my thesis and to Massive Open Online Courses. First, I have analysed the most important existing platforms, understanding the concept, identifying the need and presenting the pros and cons of MOOCs. The analyse is also presented

from the point of view of Romanian students and teachers, through the surveys that I have conducted and through the activity report of Master Students from my university. I try to answer some questions such as, who are the learners of MOOCs, what are the learning barriers of the online models, what are the pedagogical aspects or what are the delivery options for the platform. The next step is to design the platform and the course based on the conclusions of the analysis. That can be seen in the structure proposal which I present. The development phase is constructed as a demo version of the Romanian MOOC platform UniCampus with a course sample. Here, I create storyboards and graphics for the platform and try to identify possible usability or programming errors. The complete implementation and evaluation of the platform will be developed in future work. I only present the evaluation made by distance and online education experts together with the results of focus groups with students.

The thesis is also based on Mike Sharples's concept of socio-cognitive engineering [257]. The framework consists of two main parts: a phase of activity analysis to interpret how people work and interact with their current tools and technologies, and a phase of systems design to build and implement new interactive technology. The architecture of the concept can be seen in the Figure 7.2.
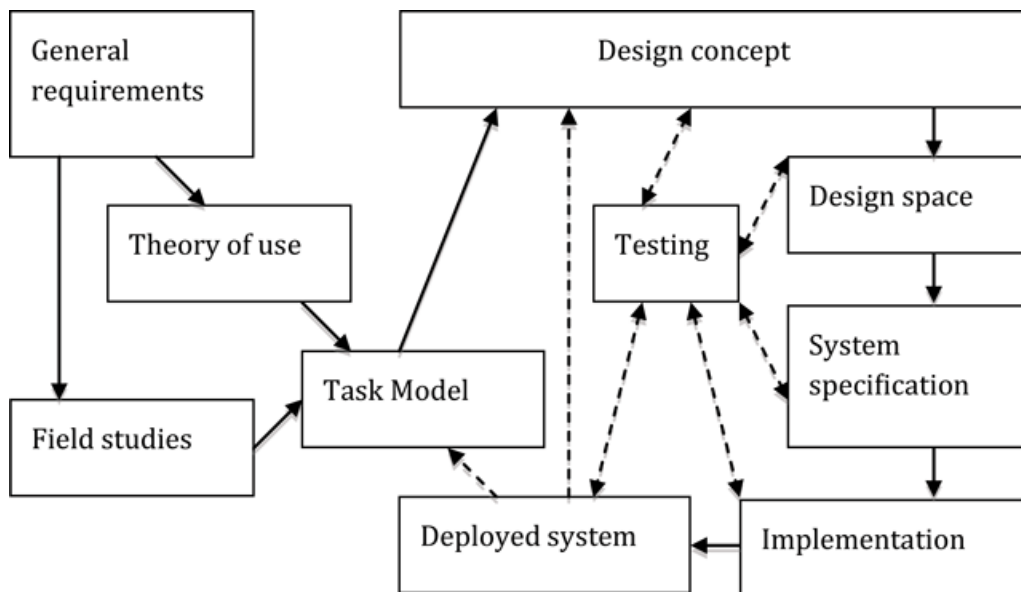
Figure 7.2. Socio-cognitive Engineering model [257]

7.1.2. Hardware and Technology Aspects

The platform must allow us to embed video content, and to enrich it with textual explanations and annotations. The platform should be easily extensible in order to implement teaching methods like game-based learning, peer teaching and evaluation, and to connect with virtual laboratories.

Delivering a MOOC to a massive number of possibly concurrent users needs a robust technical infrastructure, and a scalable architecture. There is a need for a

tool that both technically and legally allows and facilitates experimentation with and modification of the whole system [24].

Each potential system has its own unique advantages to offer:

- Content management systems regarding the flexibility of the management and delivery of learning content;
- Collaborative platforms with reference to the communication features;
- Learning management systems relating to the support for quizzes and course design [24].

One needs to estimate the resources that one will need, depending on the type of educational resources and structure desired by each teacher staff and on the expected number of participants.

Meinel et al insisted that "the private cloud infrastructure allows flexible scalability and the provision of more computing resources by simply adding additional physical hosts to the cloud respectively shutting down servers for reduced power consumption when the server load is low" [24].

Another person who mentions the use of a Cloud for demonstrating how artificial intelligence instructors will be able to grade thousands of students is Peter Norvig: "We have a system running on the Amazon cloud, so we think it will hold up" [258].

An xMOOC platform requires fewer sub-systems but must, of course, be designed to handle very high volumes and inputs from all over the world. However, whereas universities own and operate multiple Moodle installations, the administrative components of MOOCs (especially if they begin to make extensive use of Learning Analytics [141]) are too complex for a teaching unit in a university to operate without huge resources. For this reason most universities might eventually opt for cloud-hosted MOOC services with control over data releases through contracts with for-profit service providers [28].

In my opinion the most important aspects when it comes to the hardware and technology components of a MOOC platform is to maintain its scalability and integration with collaborative technologies. Scalability refers to the capacity of the course to expand to large numbers, without causing major disruption to any of the component parts or activities of the educational experience [8].

Most of these aspects are satisfied by the Moodle platform, my choice for building this MOOC

7.2.   Description of the Structure

The structure depends on the type of MOOC one wants to develop. It can be a cMOOC (connectivist) or an xMOOC (content based). The cMOOCs are based on the connectivism theory of learning with networks developed informally. They provide a platform to explore new pedagogies beyond the traditional classroom setting. cMOOCs provide great opportunities for non-traditional forms of teaching approaches and learner-centred pedagogy where students learn from one another [19]. In a connectivist course, everything is optional. What is important about a connectivist course, after all, is not the course content. This serves merely as a catalyst, a mechanism for getting the projects, discussions and interactions off the ground [21]. Connectivist teaching and learning consists of four major sorts of activities: aggregation, remixing, repurposing and feeding forward.

Siemens defines connectivism as "the integration of principles explored by chaos, network, and complexity and self-organization theories…. The starting point

of connectivism is the individual. Personal knowledge is comprised of a network, which feeds into organizations and institutions, which in turn feed back into the network, and then continue to provide learning to individual. This cycle of knowledge development (personal to network to organization) allows learners to remain current in their field through the connections they have formed" [259].

The xMOOCs (appeared in 2011) follow a more behaviourist approach. It is the instructional model, essentially an extension of the pedagogical models practiced within the institutions themselves. xMOOCs can be divided into for-profit and non-profit. They are based mainly on interactive media, such as lectures, videos and text. xMOOCs have been criticized for lacking any innovation in what pedagogy is concerned. However, they have a huge success amongst students, possibly because of the effervescent nature of their discussion forums and their available learning tools and virtual laboratories [24].

Siemens [18] compared the two types of structure saying that "our cMOOC model emphasises creation, creativity, autonomy and social networking learning", whereas the xMOOC model emphasises "a more traditional learning approach through video presentations and short quizzes and testing. Put another way, cMOOCs focus on knowledge creation and generation whereas xMOOCs focus on knowledge duplication." In a 2012 Twitter post, Mark Smithers said "in an xMOOC you watch videos; in a cMOOC you make videos".

I would like to propose a combined structure, agreeing with the duality proposal of Crosslin [30].
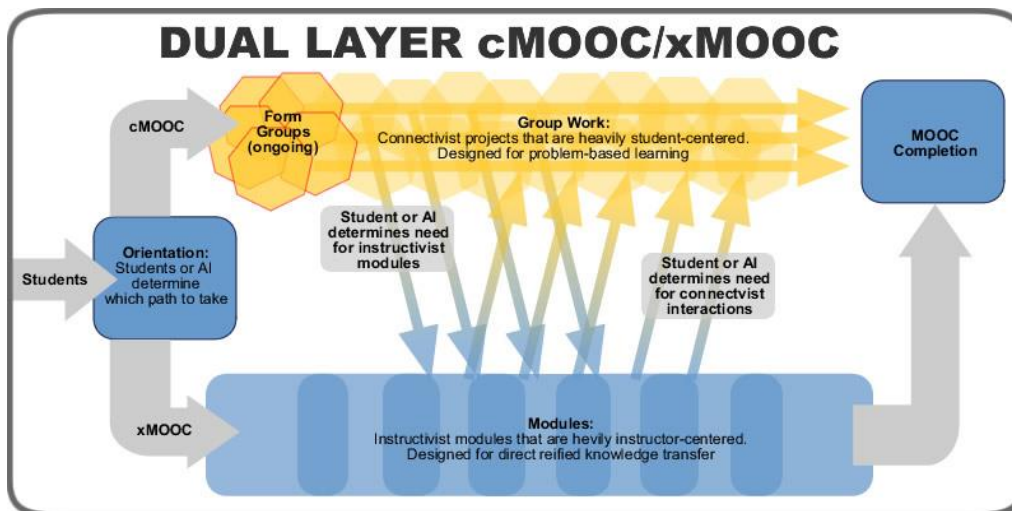
Figure 7.3. Dual Layer cMOOC/xMOOC [30] (created by Crosslin, licenced under CC BY-NC-ND 3.0 US)

The following structure is proposed after reviewing existing courses on both cMOOCs and xMOOCs.

The students should have the possibility to choose which of the learning pedagogies they want to follow. Of course, any of the both paths they may choose should respect the curriculum of the course.

When accessing a course, there should be two kinds of structure elements: static elements and dynamic elements. What does one understand as static

elements? They are those elements that remain on screen, no matter what the in-course activity of the user, as static. In the upper part of the screen, I think that the following should be present: course title, course tutor/tutors, hosting institution and, if provided by the course creator, a logo of the course. Another part that should be static is the course menu, whatever the course creator might think as appropriate to include in this menu (course chapters/weeks, discussion forum, assessments, bibliography, links, etc.). Because of usability reasons, I propose that this menu should be in the left part of the screen, as research shows that the majority of people first eye-scroll that side of a website first [260][261].

The deadlines should be clearly marked, using a calendar tool, in order for the student to be able to easily acknowledge how much time he has until his homework or quiz are due. The 'about page' should have information regarding the course, such as the syllabus and the grading system.

The course is structured in x weekly units. For each week, there should be produced and offered video lectures, reading materials, web links with information and quizzes for students to review their progress. The videos should contain annotations for quick self-testing (multi-answer questions with or without explanation) and annotations with bibliography and/or useful links for extra-reading. For programming courses, the in-video quizzes should refer to short code sequence writing. The student should be prompted to answer the short questions in order to advance through the video. The videos should be available with subtitles and captions. There should be the option to modify the screen resolution, the sound and the speed of playing the video. At the end of a video lecture, the user should have the possibility to restart the current lecture or to jump to the next video lecture. A direct link to a help section regarding technical issues should be easily accessible. Another useful link would be to a forum thread where students point out content mistakes.

There should be a section of course announcements, included inside the discussion forum. Discussion forums should be managed and set up for each week, taking into consideration the topic presented in that specific week. The teacher team should actively moderate this forum, which is separate from the one regarding technical issues. Chiang and co [133] found out that posts usually fall into three main categories. The first is small talk, for example student introductions. The second is about course logistics such as homework deadlines. In addition, the final category is course-specific questions, which are of most use to the students. The problem is that these posts are not seen because of the small talk. Chiang et al developed an automatic system that identifies small talk and filters it out. This should help students focus on the useful posts and enhance the learning experience. Another solution would be with forum grading. Forums should have the possibility of filtering by date, submitter and/or subject. If there are some forum topics that generate a lot of reaction from the students, then it would be a great idea to create some more videos that respond to those topics. Forums are pervasive in MOOCs and have been characterized as "an essential ingredient of an effective online course" [129], but early investigations of MOOC forums show struggles to retain forum users over time [130]. Cheng et al [131] have shown that students who voluntarily participate in forums perform better and receive higher exam grades. Reputation systems provide concrete, yet limited benefits for MOOC forums [130].

A wiki tool would be useful for students and/or teaching staff that want to create or contribute to the course content.

A meet-up site can be arranged for students who live in the same geographical area to organize themselves some live study groups. Also, conference

tools would be useful for virtual meet-ups. One tool that is open and accessible is Google Hangouts, an instant messaging and video chat platform. As analysed by McGuire [137], experiments in MOOC with Hangouts, despite being a disaster from the technological point of view, was quite interesting. McGuire took Coursera's Introductory Human Physiology course by Duke University. Students that were interested were asked to announce in advance their participation. Only 6 students were invited to join the Hangout at a time. This is a great opportunity for the shyer students to be able to interact with the teacher in a more comfortable environment.

Depending on the nature of the course, one might also need a tool for document sharing possibly supplemented with rubric-scoring tools to facilitate peer grading.

For progress assessment, besides the short weekly quizzes there should be multiple-choice tests, which the students can take several times. I consider that they should not have the possibility to take them an indefinite number of times, because in my opinion, motivation will decrease. For each question, there should be explanations available after the final submission deadline has passed. Different deadlines with different penalties should be imputed. One should be able to save his answers before submitting for a future check of his quiz attempt. Most MOOCs are using quizzes as a main instrument of assessment. However, these quizzes with short multiple-choice questions are not necessarily the best solution when assessing. Some MOOCs are offering essay-type tasks, but with a limited number of teacher staff and thousands of students submitting these essays, it is not possible to evaluate them all. One solution could be peer assessing.

If the discussion is about a computer-programming course, then an assignment that requires programming code would also be appropriate.

There is an important debate regarding the problems of cheating and plagiarism. How does Coursera's verification system work? Early in the course, the students will have to hold up a picture ID in front of a webcam and then make a photo of them. A human being will compare the two pictures to see if they match. Then, each student will be required to type a short phrase, sort of like a personal signature, so that Coursera can register his keyboarding pattern. Each time the students will submit an assignment or quiz they will be asked to type the same short phrase for matching check. However, this system is not as secure as the fingerprint scan or other biometric methods [262]. For my model, I propose a verification system that requires the students to be physically present in one of the institutions that are partners of the platform.

Homework could also help, with two possibilities, teacher assessment or peer assessment. At the beginning, I believe that, for our case, teacher assessment is more appropriate, students in Romania being unfamiliar with the concepts of peer assessment. If the course offers some sort of certification or badge, these homework tasks should have a number of points granted for the correct solving, partial or total. Assessment tools have to be user-friendly and interactive so that they engage and motivate learners.

In a MOOC, assessment does not drive learning; learners' own goals drive learning. The aim of participating in a MOOC may or may not be to obtain a credit, or a qualification – the aim is primarily to learn [263].

I think that the students should be able to easily access or review their course progress. A "to-do" list tool could be useful, with auto or manual complete fields like course video, weekly quiz, and homework or meet up sessions. The platform should offer three types of content creation for a user. The first type, at a personal level, should be content that only the student sees, like notes for example.

The second type is the one shared with the teaching staff, something like mail or instant messaging. Finally, the third type of content is the one shared with all the other learning community, for example blogs, wikis and discussion forums.

The platform should allow the students to create their own blog where to post ideas. When in one survey from 2010, respondents were asked why they participated in blogs, the most important reasons, in rank order, were:

1) space to develop my own ideas;
2) ownership;
3) self-expression;
4) familiarity with using blogs;
5) an attractive layout to express ideas;
6) personal learning;
7) quiet slow reflection;
8) personal relationships;
9) own pace;
10) establishing a presence;
11) thoughtful long-term relationships;
12) personal voice [129].

Students should have the possibility to connect to their other services and devices, and to be able to work offline. Therefore, all the learning content should be available for instant download, including the videos. There should be widgets for social media so that the student can share his work or progress, via Facebook, Twitter, LinkedIn, Google+, YouTube or other popular social sites that students use. I think that students need to have the possibility to export their work via Google Drive, Google Calendar, planning platforms, or other tools they might find useful.

In order to have quality content, the teachers and course material creators should have access to a number of powerful and intuitive tools for content editing and structuring.

When creating a course, one has to address two types of learners, the novice learner, who needs a meaningful and explicit path to follow in order to access and understand the learning content, and the advanced learner, who might want to freely jump between sections and topics, in order to reach the ones meaningful to him.

According to Meinel et al, "learning content needs to be presented in its hyper textual structure, in order to allow learners to grasp more than a linear sequence of content, i.e. the rich connections that exist between knowledge inside and across learning domains" [24].

One example of how things go wrong if the structure isn't designed well enough was pointed out by Morrison [139]. A factor that could cause considerable distress to students is the lack of instructions for the assignments or the group activities. When one decides to create a group activity, one has to give very clear and detailed instructions. The students should easily find a description of the purpose of the assignment, why it was chosen a group activity over an individual one and how will they benefit from this type of activity. Access to technical tools should be provided so that students can easily communicate and share in their own group. When Google Spreadsheet is used for collaborative work, one might expect the Google server to not being able to handle the traffic and crash.

Consequently, I conclude by stating that building a platform structure for a MOOC is not an easy job, and only after I launch the first pilot courses I will be able to quantify if my model is both sustainable and usable. I hope that the developers',

students' and teachers' experience with the platform will offer me the best practices to adopt for this prototype platform.

7.3.   Proposed Model

I have constructed a mind map of the entire platform, using the platform coggle.it, both because of its functionality and because it is free of charge. The structure can be visualised both in Romanian (Figure 7.4) and in English (Figure 7.5).

Figure 7.4. Romanian version of the structure

Figure 7.5. English version of the structure

The structure proposed is composed of three main parts, the main page of the platform, the course intro page and the course page. The mind-map was as such built so that the place of the items on the screen is similar to the ones in the graphic.

7.3.1. The Main Page (First Page)

This represents the main page of the platform, the first interaction that the students have with the Romanian MOOC.

In the upper part of the screen I propose the following items:
- Courses – list of the courses available on the platform;
- Universities/Partners – list of institutions that have courses hosted by the platform;
- About – Information about the platform.
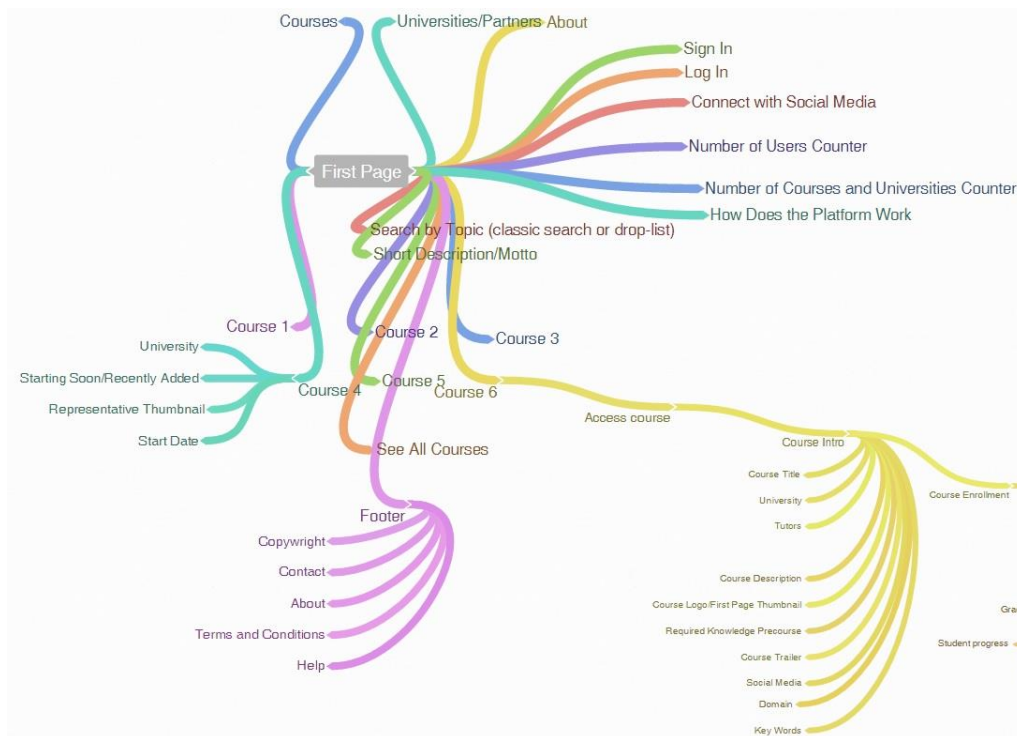
Figure 7.6. Main Page (First Page) and Course Intro Page of the Proposed Model

In the top right side of the screen I propose the following items:
- Register button – create an account on the platform;
- Log In button – use your platform account;
- Connect with Social Media – use the platform with your Social Media account;
- Number of Users Counter – counts how many users have an account on the platform;
- Number of Courses and Universities Counter – counts how many courses and institutions exist on the platform;
- How Does the Platform Work – walkthrough about the use of the platform either as written guidelines, video guidelines or both;

In the centre of the page I propose the following items:
- Search by Topic – classic text field or drop-list;
- Short Description/Motto – of the platform;
- 6 courses disposed on the two rows and three columns, each course with (as observed as a common practice on most MOOC platforms)
  - Title
  - University
  - Starting Soon/Recently Added info
  - Representative Thumbnail
  - Start Date
- See All Courses button.
  The footer should contain the following:
- Copyright – information about copyright issues for material on the platform;

- Contact – contact page for the platform;
- About – information about who created the platform;
- Terms and Conditions - information about legal use of the platform;
- Help – FAQ section.

7.3.2. Course Intro Page

After accessing one course, the user is sent to a Course Intro page where he can see more information about the course, before deciding to enrol into it. These information should be:

- ✓ Course Title;
- ✓ University;
- ✓ Tutors;
- ✓ Course Description;
- ✓ Course Logo/Main Page Thumbnail;
- ✓ Required Knowledge Pre-course – what students should already know before starting that course;
- ✓ Course Trailer – short introductory video about what the students should expect from the course;
- ✓ Social Media – the possibility to share on social media;
- ✓ Domain – area of the course;
- ✓ Key Words – most relevant words related to the course.

7.3.3. Main Course Page

Next, if the student decides to enrol, he is sent to the Main Course Page. The tutor should have a separate section with the possibility of editing certain parts of the course material and structure and with a video presentation mashup tool integrated in the platform.

In the upper part of the page I propose the following items:
- ➢ Course Title;
- ➢ University;
- ➢ Tutors;
- ➢ Course Logo/Main Page Thumbnail.

In the left side of the page the structure should contain:
- ✓ About the Course
  - o Guideline – how to best use this course and the platform;
  - o Structure – of the course, number of weeks, name of chapters, assignments, deadlines;
  - o Syllabus – what the course consists of;
  - o Grading System – detail explanation about the grading possibilities;
  - o Tutors – information about the tutors.
- ✓ Weeks/Chapters;
  - o Student Progress – the progress the student has made so far in percentage, and/or explicit name of chapters or subchapters that he has completed;
  - o Chapter 1, 2,…, X – course material;
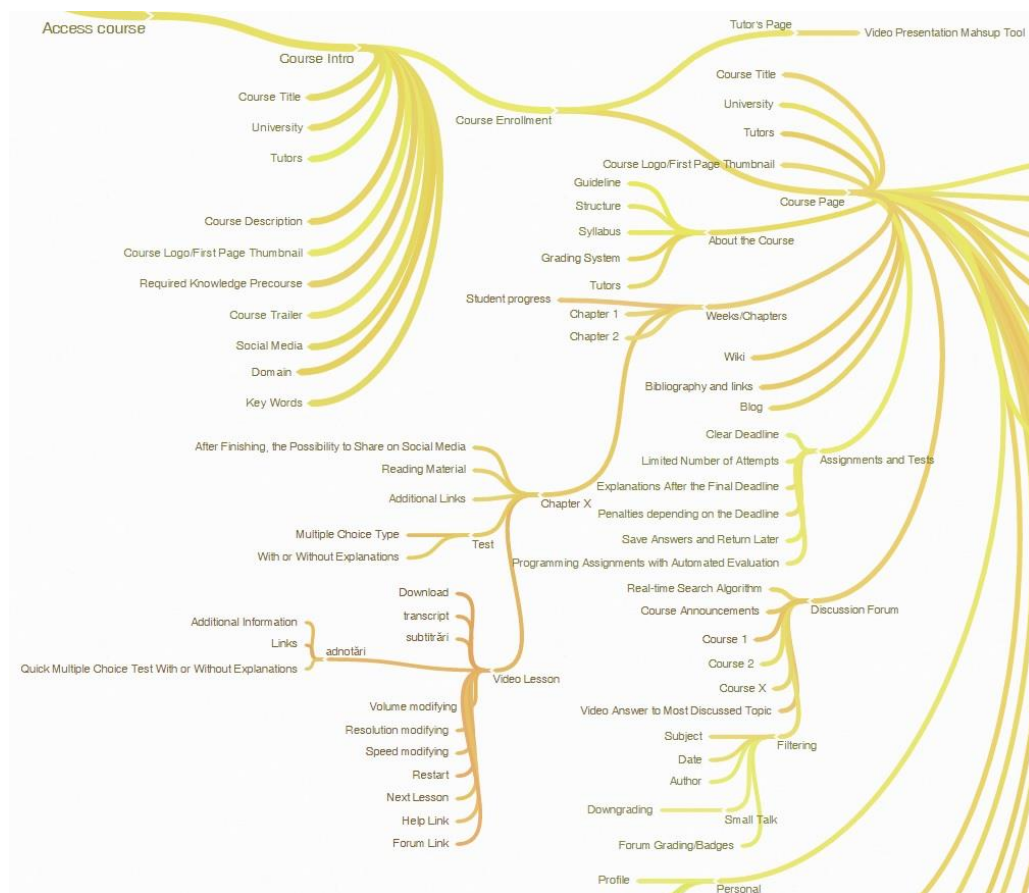
Figure 7.7. Main Course Page of the Proposed Model

- ✓ Wiki;
- ✓ Bibliography and links;
- ✓ Blog;
- ✓ Assignments and tests;
  - o Clear Deadline;
  - o Limited Number of Attempts;
  - o Explanations After the Final Deadline;
  - o Penalties Depending on the Deadline;
  - o Save Answers and Return Later option;
  - o Programming Assignments with Automated Evaluation;
- ✓ Discussion Forum;
  - o Real-time Search Algorithm;
  - o Course Announcements;
  - o Course 1,2,…,X – each with its own section;
  - o Video Answer to Most Discussed Topic;
  - o Filtering;
    - ▪ Subject;
    - ▪ Date;
    - ▪ Author;

- ▪ Small Talk/Bad Talk – results in downgrading;
- ▪ Forum Grading/Badges of recognition;
- ✓ Personal Section;
  - o Profile;
  - o Personal Notes;
  - o Personal Blog;
- ✓ Questionnaires;
  - o Pre-Course;
  - o Post-Course;
- ✓ Glossary;
- ✓ FAQ/Help Section;
- ✓ Document Sharing;
  - o Rubric-scoring for Peer-grading;
  - o Google Drive – limit of 50 editors in the same time;
- ✓ Podcasting;
- ✓ Upload of Technical Formats (Matlab, R, XML, etc.);
- ✓ Student Handbook;
- ✓ Virtual Lab;
- ✓ Padlet;

Each chapter should have the following options:

- • After finishing, the possibility to share on Social Media;
- • Reading Material;
- • Additional Links;
- • Test;
  - o Multiple Choice Type;
  - o With or Without Explanation;
- • Video Lesson (the most important);
  - o Download option;
  - o Transcript;
  - o Subtitles;
  - o Annotations;
    - ▪ Additional Information;
    - ▪ Links;
    - ▪ Quick Multiple Choice Test with or without Explanations;
  - o Modify the volume;
  - o Modify the resolution;
  - o Modify the speed;
  - o Restart the lesson;
  - o Jump to next/previous lesson;
  - o Help Link – to FAQ section regarding videos on the platform;
  - o Forum Link – to this section from the discussion forum;

On the right side of the screen, I propose the following items:

- ➢ Calendar/Schedule – with automated dates by the course and with the possibility of the student to introduce events as well;
- ➢ Meet Up tools;
  - o Virtual Study Room;
  - o Google Hangout;
  - o Conferencing Tool Audio/Video;
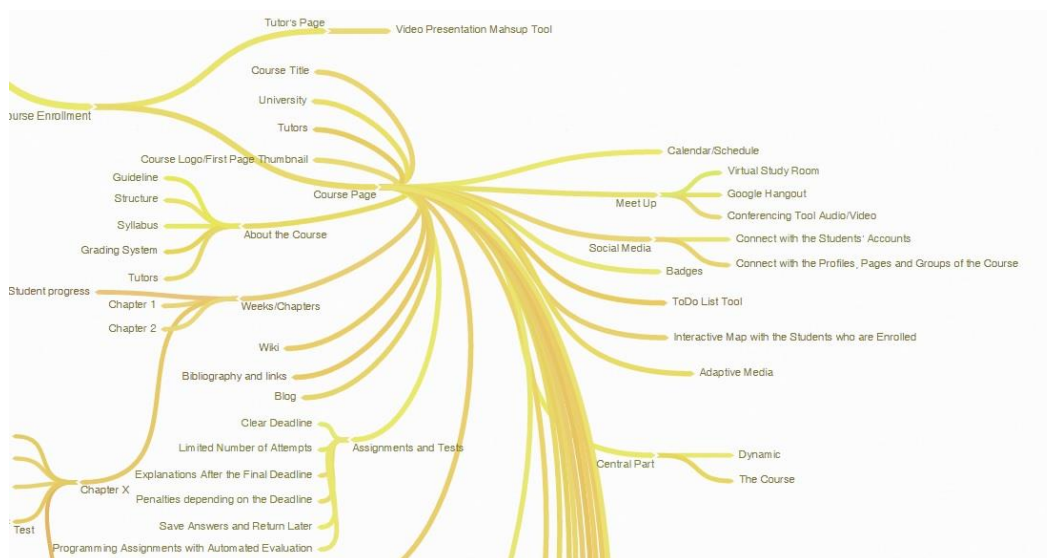
Figure 7.8. Main Course Page of the Proposed Model - detail

➢ Social Media;
  o Connect with the Students' Account;
  o Connect to the profiles, pages and groups of the course;
➢ Badges;
➢ To-do List Tool;
➢ Interactive Map with the students who are enrolled in the course;
➢ Adaptive Media;

The central part of the screen should be dynamic, the one that changes depending on the options that the student chooses and the part of the screen where the course materials and videos will be shown.

7.4.   Experts Evaluation

The structure was sent to a series of experts in education, education technologies and e-Learning. In order to better fit with the UPT related model, analysis and surveys, the experts were chosen among UPT teachers and teachers from the West University of Timişoara, who collaborated with UPT instructors.

They were required to evaluate each one of the items that I chose for the structure, with 'YES/NO' and explain the reason of their choice, where they thought appropriate. If they had other recommendations they were kindly asked to state them in the designed space at the end of each section. Other suggestions were welcomed with the request to insert them accordingly.

In this subchapter I am going to present their opinions.

On the main page, in the top right side of the screen, it is proposed to only have 'Register/Log in' with Register/Log in with Social Media as an option and not a separate section. Terms of Use and Privacy Policy are needed here to be read and accepted. There is a need for a 'forgot my password' option. The number of users counter could appear at the 'About' section or under the search field below, not as visible as it was proposed. The number of courses and universities counter could

appear at courses catalogue or under the search field below and it makes sense only after a greater amount of courses and users. The 'How does the platform work' would be better placed next to the 'Courses', 'Partners' and 'About' sections.

For the centre of the page, it is proposed to have a 'Search by institution' option. There is a need for a better delimitation between the 'About' section mentioned for the upper part of the main page and the one mentioned in the lower part of the main page.

In the 'Course intro page' it is suggested to have Connected/Recommended courses as well.

Jumping now to the 'Main course page', a valid suggestion is to clearly mention who has permissions to contribute to the course wiki: only the tutors or the students as well. Another expert was of the opinion that the wiki tool is not useful for the non-connectivist courses. The blog tool got some question marks as well, as the experts require more explanation about its purpose as a 'course blog'. For the discussion forum, it was not clear for the experts what is the platform going to search in real-time. The video answer made by the tutor for the most discussed topic is pointed out as a very good idea.

Small talk/bad talk filtering is suggested only for some courses. It was not clearly stated for the 'Private section' what is 'private' and what is 'public', with the assumption that the private notes are visible only to the user and the private blog being visible to all enrolled users.

Podcasting is considered to be useful only for a limited amount of course types such as foreign language courses for example. The technical formats should be available for upload all over the platform and not as a separate section.

An interesting proposal was made for the subtitles of the video, as it is considered useful to have a collaborative translation possibility. Regarding the interactive map tool, the experts inquired about the possibility to communicate and send messages based on that map, probably with the intent of creating study groups based on location.

The experts agreed fully with the proposed structure and encouraged its implementation in order for proper learnability evaluation.

7.5.   Conclusions

In this chapter I described the concept of my model, based on the ADDIE method and on the socio-cognitive learning paradigm. I presented both instructional aspects and technological aspects, arguing my choices with conclusions drawn from the existing literature.

Then, I continue by presenting the model, both in graphic and in a detailed description. I divided the model into three main parts: the main page or first page, the course intro page and the main course page. Each of these has different aspects, structures and particularities. Even if I incline towards a simplistic approach and construction, in order to suit every course's and teacher's needs I propose a multitude of facilities, which I strongly suggest not to be used in the same time as this would undoubtedly distress and confuse the students.

In the end of the chapter, I present the conclusions and suggestions of a series of experts in e-Learning, associated in some way with UPT, my institution. As their opinion is unanimously a positive one, I incline into concluding that this model is a proper one for the needs of our students. The next step, presented in chapter 8 is the implementation of this model in an independent platform, UniCampus.

The theoretical contributions of this chapter consist of the analysis and presentation of the concept together with the justification of the model based on existing literature. The interpretation of the conclusions of the experts who evaluated this model is also a theoretical contribution of this thesis.

The practical contribution to this thesis is the proposed structure which is a complex mixture of educational aspects and technologies both behind the structure and integrated in the structure.

Some results presented in this chapter have been published in [264].

8. UNICAMPUS

8.1.   UniCampus Main Page

I created a demo version of the UniCampus platform. The main page of this demo version is offered in the Romanian language. In the upper part of the screen there is a menu containing sections for Courses, About, Universities and Contact as seen in Figure 8.1. In the upper left corner you can see the design that the team behind this MOOC agreed upon, and in the upper right corner you can see the Log in/ Register buttons.

A search through courses option is available and two slide shows can be seen in the middle of the screen, one for partner universities and one for courses. The courses have some important information displayed, such as the title, the university, the starting date and a representative thumbnail.

Figure 8.1. UniCampus – Main Page, top

After the courses slideshow, some short information about the platform can be observed focusing on its main advantages: learn for free, learn in your own pace, learn from experts and learn from home, as seen in Figure 8.2. The social media connections are visible in the bottom of this image as links to Facebook, Twitter, Google+, Pinterest, Flicker and LinkedIn were inserted in the platform.
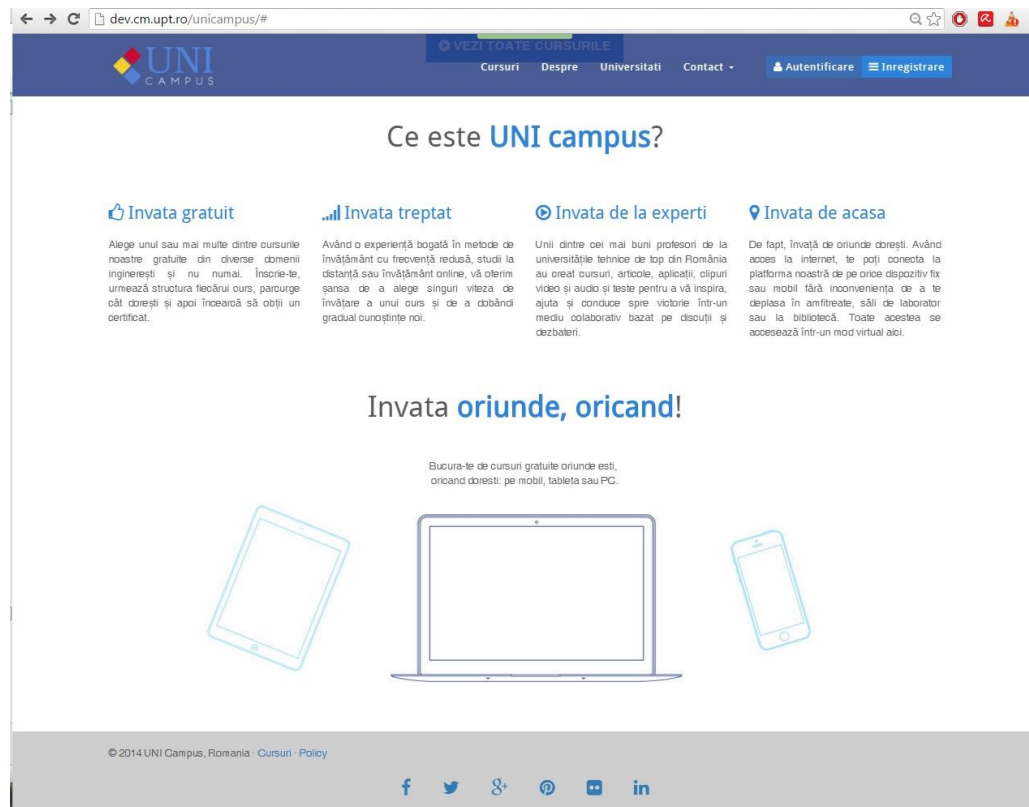
Figure 8.2. UniCampus – Main Page, bottom

Accessing one of the courses either from the main page or from the courses list sends the user to the 'Course Intro Page' where detailed information about the course are presented, like course title, university, tutors, course description, course requirements and course trailer. In this page, the user can see if the course has any fees or any credentials. After carefully analysing this information the student can enrol into the course or share this page on social media. This section can be overviewed in Figure 8.3.

Next, if the user chooses to see the courses list, these are presented in a compact manner with some extra information from the main page such as the names of the teachers, the course summary, the number of weeks, the number of estimated hours/week and the type of credentials offered after finishing. When hovering over one course, this will enlarge as to gain more focus into it, as seen in Figure 8.4.

Figure 8.3. UniCampus – Course Intro Page
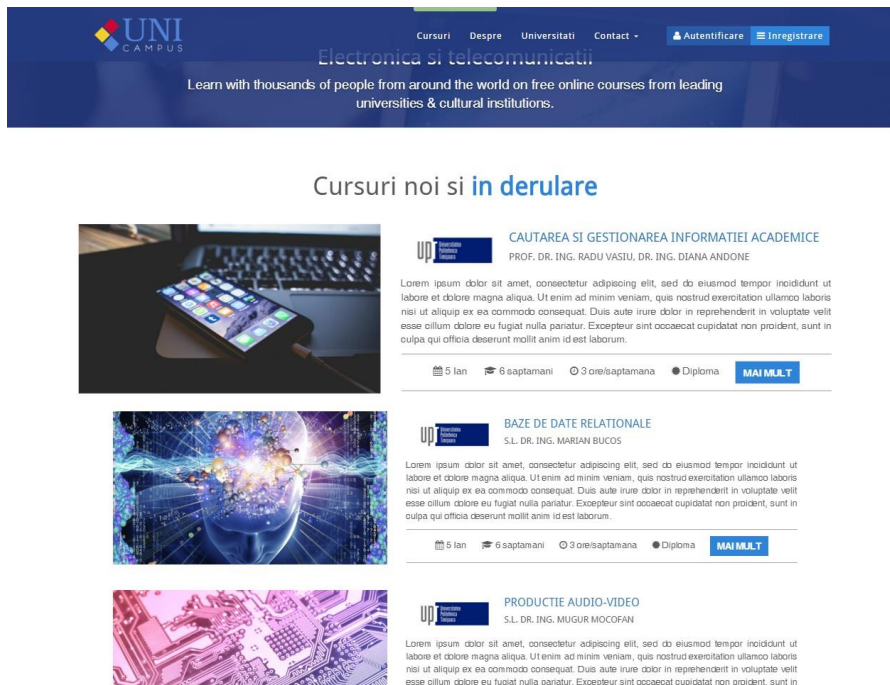
Figure 8.4. UniCampus – Main Page, courses list
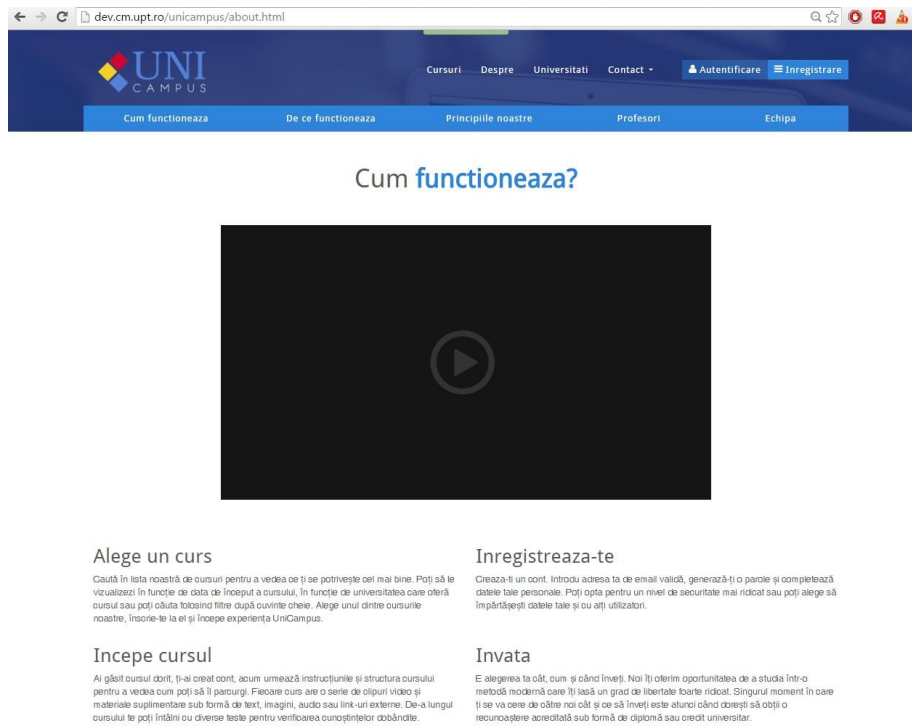
Figure 8.5. UniCampus – Main Page, about section

In Figure 8.5 one can see the about section of the main page, as a tutorial video helps users into working with the platform. Some easy steps about how UniCampus works are also presented as text. Separate sections are prepared for 'How it works', 'Why UniCampus', 'Our principles', 'The teachers' and 'The team'.

The universities and institutions that are partnering in this project and are offering courses on the platform are being enlisted in the 'Universities' section of the main page.

Finally, the contact section allows users to get in contact with the creators of the platform or of the courses.

8.2.   Moodle Customization

I have pointed out in Chapter 3, the reasons that directed me towards the use of Moodle as the platform on which to test the proposed structure of a Romanian MOOC.

The platform was built on the Moodle 3.0 version, released on 17th November 2015. This version combines popularity with efficiency offering enhanced options for installing plugins, four new quiz question types (Select missing words, Drag and drop into text, Drag and drop onto image, Drag and drop markers), tagging and course editing improvements along with a number of other welcomed features.

The next step was the choice of an appropriate theme on which to adapt the proposed model. As the Moodle 3.0 version appeared only very recently, the list of

options was limited. I opted for the theme that best fitted the intersection of a colourful and attractive design with structure simplicity and a proper learnability model. In my opinion, this theme was 'Pioneer', a beautiful, responsive theme loaded with great features from custom tabs and a course gradebook slider to the ability for teachers to upload their own header image in course summary files. Each of the main elements in the theme can be customized from the theme settings page. Pioneer is made in Michigan at Dearborn Public Schools (K-12).

Even if some modules already existed, part of this theme, I had to customize, adapt, install new plugins or even modify the code in some parts in order to best simulate my proposed model.

For the login part, Moodle does not implicitly allow for a user to create a new account. It only permits users, for whom the administrator of the site has created a user and a password, to connect. However, in the *Administration > Site administration > Plugins > Authentication > Manage authentication* section there is a possibility, which I have enabled, for users to self-register based on a valid email address. The platform also allows the user to reset his or her password if he forgot it. As both myself and the experts who evaluated the platform agreed on the fact that users should be able to login also through their social media accounts, I have installed and customized a plugin called 'Authentication: Google / Facebook / GitHub / LinkedIn / DropBox / Windows / VK / Battle.net authentication' which allows a user to connect via one of his social accounts from the list above.

I have also modified the settings so that a user can also connect through his valid email instead of only the username.
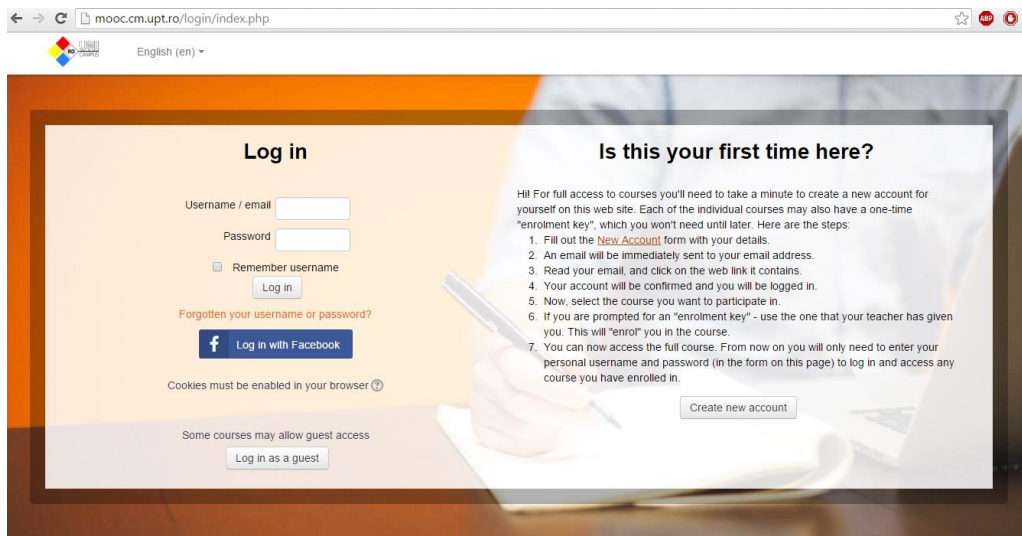
Figure 8.6. Log in/Register page of UniCampus, integrated with Social Media

8.3. Pilot Course

In order to better evaluate the platform, I needed to build a pilot course on which to test my proposals. I chose to use some materials presented during the Open Education Week 2015 event hosted by the Centre for Distance Education, Low

Frequency Education and e-Learning (CeL) of the Politehnica University of Timişoara [265].

Open Education Week (OEW) [266] is a celebration of the global Open Education Movement. Its purpose is to raise awareness about the movement and its impact on teaching and learning worldwide. Participation in all events and use of all resources are free and open to everyone. In 2015, it took place during 9-13th of March.

CeL organized the *Opening Up Education Workshop* on the 13th of March 2015 from 10:00 to 14:00, focusing on the following topics:
- ✓ What are OER and MOOCs?
- ✓ How can they be used and integrated in traditional higher education?
- ✓ Practical examples and study cases of using OER, MOOCs in traditional higher education, technical education, post-secondary education.
- ✓ How can mobile learning be used in post-secondary education?
- ✓ Several study cases from Romania.
- ✓ What is Open Access and how to make your research Open?

The general overview of the course can be seen in Figure 8.7. In the left part of the screen, one can observe some buttons/menu items. The first one, 'Open Education Week 2015', if hovered on, shows the short information about the course: course title, course logo, tutors (with direct links to their information page), university (with link to its homepage) and university logo. This can be observed in Figure 8.8.

Figure 8.7. UniCampus – Open Education Week 2015 Course
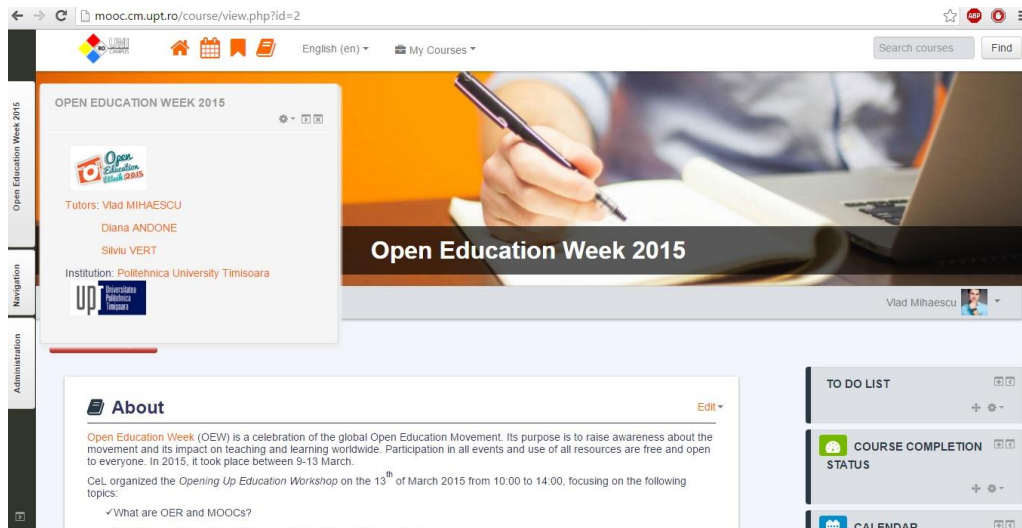
Figure 8.8. UniCampus – About course block

By hovering on the second item, 'Navigation', one is able to visualize the components of the course. As envisioned and presented in the model from chapter 7, the user is able to see: information about the course (guideline, structure, syllabus, grading system, tutors), the pre-course questionnaire, the different weeks of the course, each in a separate section, the course wiki, bibliography and links, discussion forum (with separate topics for each week), glossary, document sharing, FAQ/Help section, student handbook, to-do list, virtual programming lab, meet up tools (virtual study room and video conference), the final exam and the post-course questionnaire.
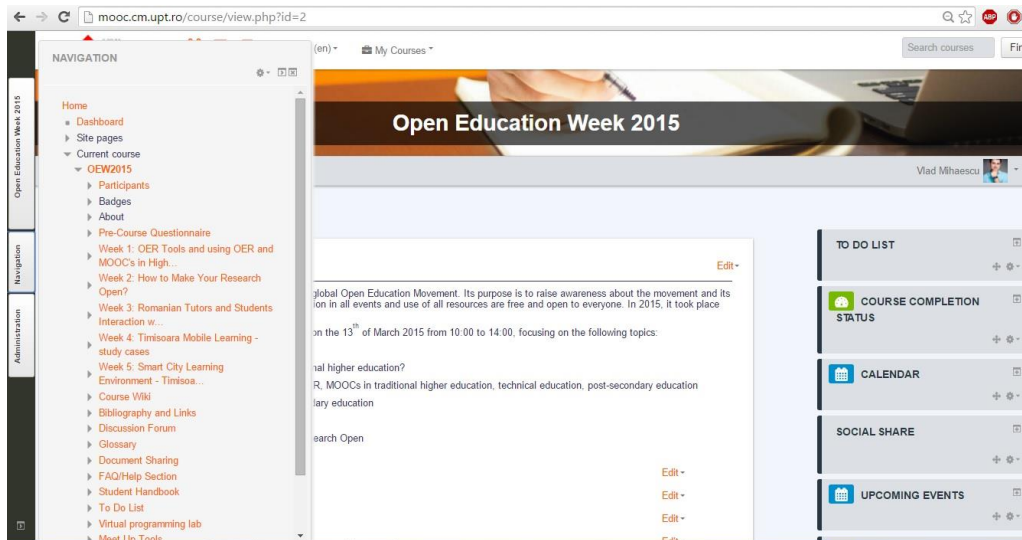
Figure 8.9. UniCampus – Course navigation

In the right side of the screen one can have quick access to the to-do list tool, the course completion status, the course calendar, social sharing options, upcoming events and the badges that one has earned.

Some supplementary tools were required to be plugged in this Moodle version in order to satisfy the proposed model. For example, I chose the 'Checklist' plugin for the to-do list tool. This plugin allows both teachers and students to create their individual tasks lists based on every individual's needs. The user is allowed to add items on the list, check them as completed and see the progress of his activity.
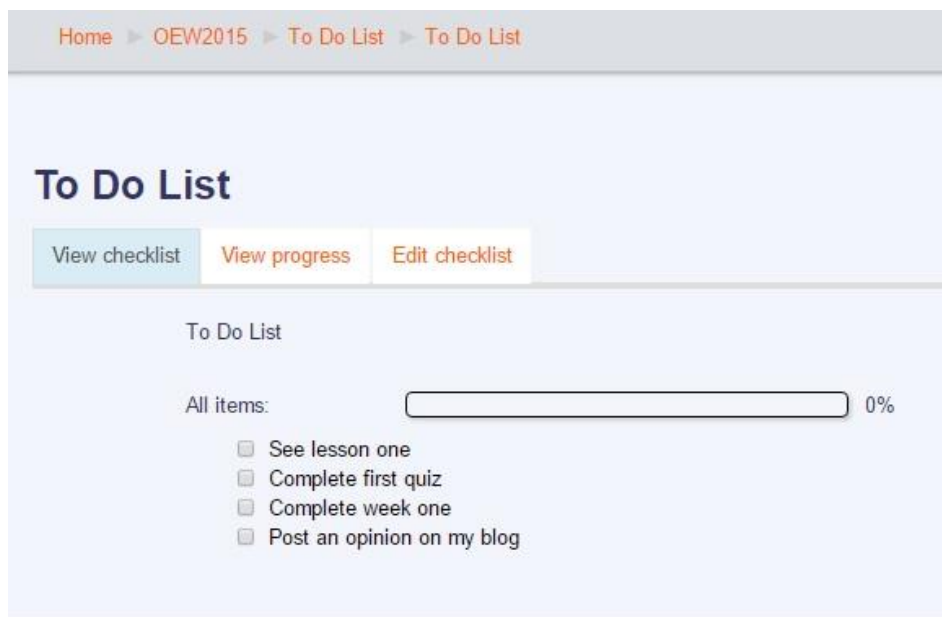
Figure 8.10. UniCampus – To-do list tool

The 'SocialShare' plugin allows the presence of a Social Share block, which has the possibility of Facebook like and share buttons, Twitter button, Google+ share button and StumbleUpon share button. This is possible, of course, if the creator of the course allows the content to be public and to be shared on other websites.

The 'Virtual Programming Lab' module is an activity module that manages programming assignments. It enables the possibility of editing program source codes in the browsers and students could run interactively programs in the browser. One could run tests to review the programs. The module also allows different searches for plagiarism between site files and can put restrictions into pasting external text.
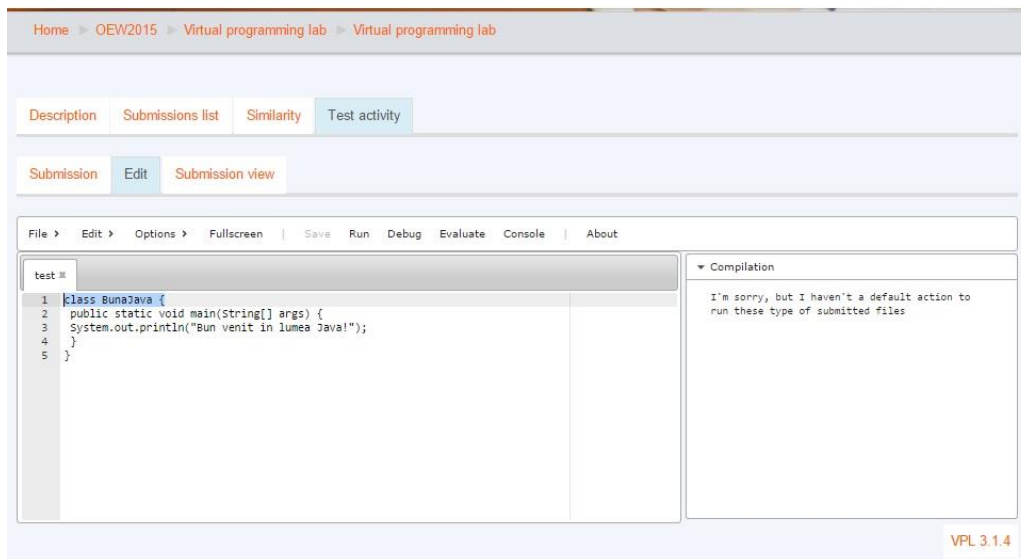
Figure 8.11. UniCampus – Virtual programming lab module

For the meet-up tools I have installed and customized the 'Video conference' plugin and 'WizIQ: A Virtual Classroom' plugin.

8.4.   Experts Evaluation

Similar to the evaluation of the structure, I needed a solid confirmation that the platform built based on that structure is useful and well made. Therefore, I requested the help of several experts in the fields of education, education technologies and e-Learning. Their overall opinion, over the UniCampus demo platform and the OEW 2015 Demo Course, was a very positive one, offering a strong argument for its validity and encouraging me to develop it further.

There were, however, several observations into details that the experts considered should be modified for creating a more efficient platform in terms of usability and learnability. Next, I am going to present these observations.

A first observation was a visual one, as some star shaped items integrated from the Moodle theme used, were present in the bottom of each page without having any use or sense. Therefore, these items had to be removed. As it turns out, those visual items were related to marketing aspects of the site. I eliminated them by choosing "Toggle Marketing Spot display" > "Never show".

Another annoying aspect was the 'About' section description, which was visible in all the week section pages. This section should only be visible in the main course page. Again, this was a particularity default by Moodle. I solved this problem by commenting the code lines 762->711 from the file /course/format/renderer.php.

The experts believe that the forum section should not appear only as a separate section, but should have a chapter dedicated section implemented in each week/chapter of the course and also a quick access module integrated in the right hand side menu of the screen.

The calendar and upcoming events modules are not deemed as extremely important so they should appear in the bottom of the right side menu. The experts

agreed on the fact that all modules should have a more compact form and the user should choose which module to fully see.

Since this is a demo version, several sections of the course were only present by name, without any content or explanation. This was considered wrong by the experts, because even if they understood what everything stood for, when evaluating with students, they could probably have difficulties into understanding. Therefore, proper explanations or sketch pieces of content were introduced in every section or tool.

Another aspect mentioned as not useful by experts was the 'Administration' module for students, in the left side menu. As this block only contained the student gradebook, their opinion was that it should disappear and the gradebook should be moved elsewhere.

Regarding the content pages of the course, the experts noticed that the video was visible in a small frame, with a large portion of unused space being visible on the screen. As the content, especially the video one, is the most important in a MOOC course, the experts encouraged me to fill the most of the screen possible with the content frame. Which, I did by modifying the html code, respectively the width and the height of the frame.

8.5. Students evaluation

Another important evaluation method that I applied was conducting focus groups with students. The purpose was to evaluate the implemented UniCampus platform and the OEW 2015 demo course taking into consideration its usability, learnability, technology and structure. I organized three separate focus groups with students from the 1st year Master Program of Communication, Public Relations and Digital Media (5 students), the 1st year Master Program of Multimedia Technologies (5 students) and the 4th year Bachelor Program of Multimedia Technologies from the Electronics and Communications Faculty (7 students).

I have created separate accounts for each student and enrolled them in the 'Open Education Week 2015' Demo Course. I first asked the students to navigate through the platform and use as many tools as possible, completing the Pre-Course Questionnaire, going through at least one course module and solving at least one quiz.

Then, I asked specific questions, trying to focus on what I believed would be most relevant. The first question was to analyse the possibility of connecting to the platform by using ones social media account, a module implemented by myself. All of the students agreed that this is a positive aspect, especially because of its time saving. However, there were some concerns regarding the information that the platform will automatically have access to, from the social media account.

The following questions were directed to the time availability for completing pre-course and post-course questionnaires. For the pre-course questionnaire, the opinions were equally divided between 5 and 10 minutes, while for the post-course questionnaire, a large majority preferred to give 10 minutes of their time.

Next, I directed the students to the introductory section and asked them to rate from 1 (not useful) to 5 (useful) the presence of each section. In order of their preferences, the sections received the following scores on average: Guideline (4.6), Syllabus (4.6), About (4.4), Structure (4.3), Tutors (4.1) and Grading System (4).

Then, I asked the students about their opinion regarding the structure of the Week 1 of the demo course. They appreciate it as well designed, accessible and

easy to understand. Moreover, the learning content is considered well organized and easy to learn. The presence of the video as a course support material was highly praised. In addition, the students were happy with the lack of technical errors. However, there were some critics as well, the most important being the fact that not all the lessons have buttons for navigating between the week topics.

After the first lesson, I built a quiz with two different types of questions: a multiple-choice question and a mini-essay question. The students think, in a high majority, that the multiple-choice question is friendly. Some believed that it is too easy while others thought that it was difficult, but not posing real problems. On the other hand, the mini-essay question was considered more relevant and difficult because it required the student to think and search for information in order to offer a correct answer. Some believe that this type of question could pose problems, as not everyone is patient to offer longer answers.

I also required the students to tell me how often these quizzes should appear in a course, offering them some choices: during videos, after every lesson, after every week, a few times during the course, only at the end of the course. The majority of the students agreed that the verification should happen either after each lesson or/and after each week. Even if all of the options were chosen, only one student opted for quizzes during videos, some students even claiming that this type of verification distracts the student from the educational content.

My final question related to the quiz, was if this type of examination should influence the final score of the student. The opinions were equally divided, with both pros and cons. Some believe the students will pay more attention at every lesson if they have quizzes that influence the final score, while others believe those quizzes should only stand for self-verification. My volunteers agree that even if the quiz has an influence on the final score, the percentage impact should depend on the frequency and placement of the quiz inside the course.

Moving on to the video lessons, I asked the students to express their opinions regarding the use of subtitles and transcripts. Almost all of the students appreciate the importance and usefulness of the subtitles offered by my demo course. Their arguments in favour of subtitles are the decrease attention span from our days, the easiness to remember information when it is read, heard and visualized in the same time, or the fact that it helps people who do not know the language of the presentation so well. Some students would prefer a transcript as well and only one preferred the transcript to the subtitle arguing that the subtitle distracts his attention. One of the students could not find the way to activate the subtitle so this should be addressed in the FAQ section.

The students appreciate the presence of navigation buttons in some lessons (previous chapter, next chapter and refresh chapter). They insisted on having such buttons on every page for an easier navigation. Some students proposed design improvements for the buttons indicating a smaller, more discrete button would be better or by stating that rather than the arrow design that I chose, they would prefer buttons with explicit text (e.g. 'To the next course').
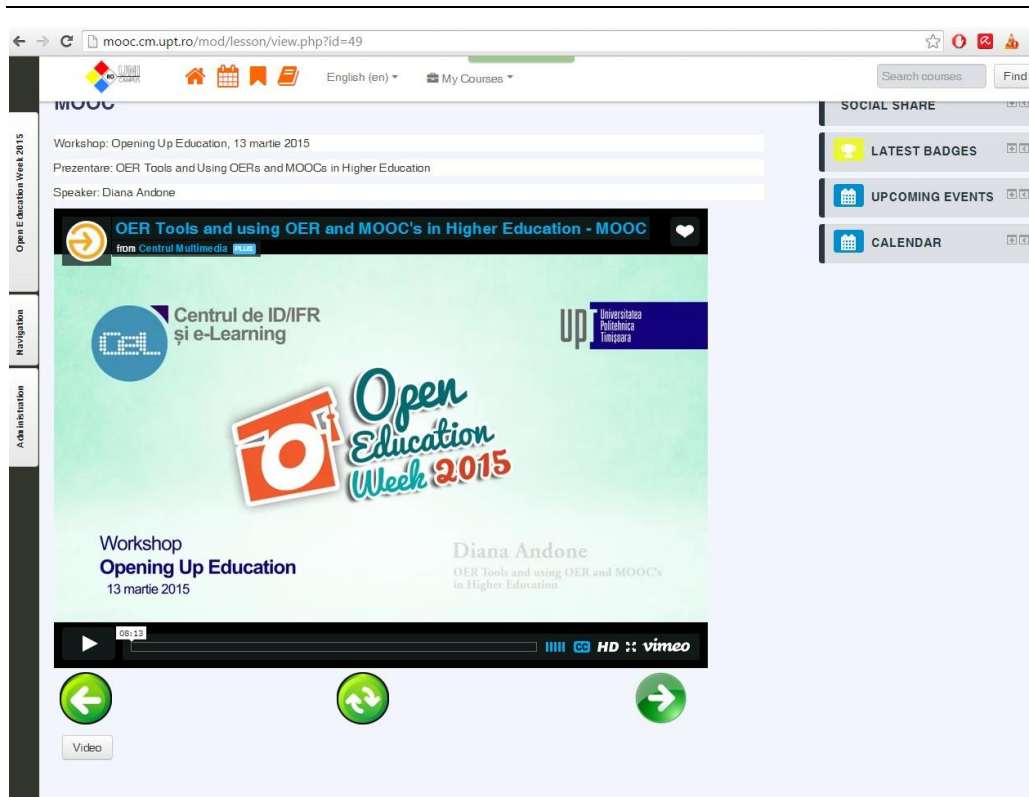
Figure 8.12. UniCampus – Video Lesson Example

Next, I asked the students about their views regarding the 'Course Completion Status' section. They agree this is extremely useful and the vast majority prefer that the course automatically checks as completed the activities which they finish. Another argument in the favour of progress checking is the fact that this motivates users and helps them track their evolution.

Another motivational tool is the 'Badges' section, where users receive various predetermined virtual ribbons for completing certain tasks. All the students believe this helps them to be more motivated and complete more activities. An interesting proposal was of using a system similar to the ones found in gaming, where the 'player' receives experience points (XP) for completing certain tasks. After passing predetermined thresholds, the user advances to the next level and receives certain bonuses. It would be interesting for further study to see if and how this system could be integrated in MOOCs.

Distribution of content on social media was the next topic of discussion. All of the students agreed this is a positive aspect and stated they would share certain course topics with others in order to help others learn and easily find information.

Regarding the type of content the students prefer, I asked them to rate in order of preference the following type of content: video, html text, pdf text, ppt, external links or combinations. The only type they all agreed upon was the video, which was rated the first in their preferences. Next, the opinions are equally divided between ppt and pdf type files. The least preferred were the html pages and the external links. The combination that was proposed by some students was video-text content.

The last specific aspects that I required students to rate from 1 (not useful) to 5 (useful) were the following tools and sections: wiki, bibliography and links, discussion forum, glossary, document sharing, FAQ, student handbook, to do list, virtual programming lab, virtual study room, video conference, calendar, upcoming events and blog. The results were positive as all of these tools received an overall above the average score in usefulness. A detailed view is presented in Figure 8.12. What I want to point out is the fact that the highest scores were received by the 'Bibliography and Links' section together with the 'Video Conference' tool. The least appreciated tools were the 'To Do List' and the 'Calendar'.
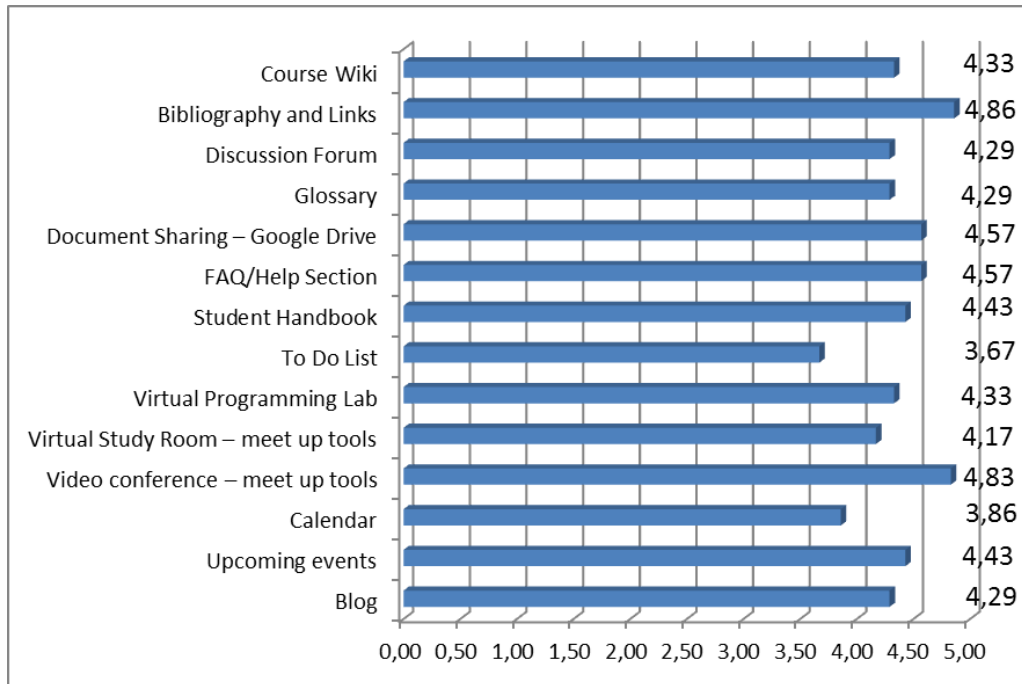
Figure 8.13. Students Evaluation of UniCampus – tools rating

My next step into evaluating the platform was an adapted version of an IsoMetrics questionnaire. IsoMetrics was a project designed to develop a software usability instrument. The usability techniques will be enforced by the desirability evaluation which follows a model proposed by Microsoft Usability Lab [267] and has been used in evaluating the user 'pleasure' and the market value of the tool.

	Mostly disagree		Undecided		Mostly agree	No opinion
How appropriate it is for the task?	**1**	**2**	**3**	**4**	**5**	
The platform forces me to perform tasks that are not	85%	15%				

	1	2	3	4	5	
related to my objective of completing the course.						
The platform allows me to perform all the work routines related to the activities I want to complete.			15%		85%	
The functions implemented in the platform help me in performing my activities				45%	55%	
I perceive the arrangement of the fields on-screen as appropriate to the work that I do through the platform			14%	43%	43%	
There are too many steps required for solving a specific task	29%	29%	29%		13%	
The platform suits my student activity needs				30%	55%	15%
In a given scree, I find all the information required for a specific situation	15%			15%	70%	
I can easily adapt the platform for performing new tasks			42%	29%	29%	
The important commands for performing my activity are easy to find			15%	15%	70%	
I am able to adapt the presentation of results (on the screen, printer, etc.) to my various activity requirements				55%	45%	
Self-descriptiveness of the platform	**1**	**2**	**3**	**4**	**5**	
I can easily access specific explanation for using the platform, if it is necessary			44%	12%	44%	
I immediately understand what is meant by the messages displayed by the platform			15%	15%	70%	
The platform offers sufficient information about which entries are permitted in a particular situation				55%	45%	
The terms and concepts used in the platform are clear and unambiguous				30%	70%	
The platform always visually marks the current entry location (e.g. highlighting, contrasting colour, blinking cursor, etc.)		28%	16%	16%	40%	

I can easily tell the difference among different feedback messages, confirmation requests for entries or commands, warnings or error messages		12%		44%	44%	
Controllability	**1**	**2**	**3**	**4**	**5**	
The possibilities for navigating through the platform are adequate				55%	45%	
The platform allows me to easily switch between different menu levels				45%	55%	
The platform allows me to return directly to the main menu from any screen				15%	85%	
It is easy for me to access those procedures which I require for my current work				45%	55%	
It is easy for me to move back and forth between different screens		15%		30%	55%	
In order to perform my tasks, the platform requires me to perform a fixed sequence of steps	16%		16%	28%	40%	
When I select menu items, I can speed things up by directly entering a letter or a command code	16%		40%	28%	16%	
Conformity with user expectations	**1**	**2**	**3**	**4**	**5**	
The platform is inconsistently designed, making it difficult for me to do my work	100%					
The designations are used consistently in all parts of the platform	14%	14%	14%	14%	44%	
When executing certain commands, I have the feeling the results are predictable		29%	42%	29%		
The messages output by the platform always appear in the same screen location			44%	12%	44%	
Error tolerance	**1**	**2**	**3**	**4**	**5**	
When I make a mistake during completing a form (questionnaire, quiz), I can easily come back to the previous state				30%	70%	

	1	2	3	4	5	
My impression is that the platform is not designed to allow correcting mistakes	40%	28%	16%	16%		
There are no system errors (e.g. crashes) when I work on the platform				30%	55%	15%
When I make a mistake while performing a task, I can easily undo the last operation			30%	15%	55%	
I perceive the error messages as helpful	15%			30%	55%	
Suitability for individualization	**1**	**2**	**3**	**4**	**5**	
The platform allows me to adapt forms, screens and menus to suit my individual preferences			29%	29%	42%	
The platform can easily adapt to suit my personal level of knowledge and skill			15%	55%	30%	
I can adjust the quantity of information (data, text, graphics, etc.) displayed on screen, according to my needs			16%	28%	40%	16%
Suitability for learning	**1**	**2**	**3**	**4**	**5**	
I needed a long time to learn how to use the platform	55%	30%	15%			
The explanations provided allow me to understand the platform so that I become more and more skilled at using it			16%	40%	28%	16%
So far I did not have any problems in learning the rules for communicating with the platform (e.g. data entry)				44%	44%	12%
I was able to use the platform on my own right from the beginning, without having to ask other users for help	15%				85%	
In order to use the platform properly, I must remember many details	55%		15%		30%	
I find it easy to use the commands of the platform	15%			15%	70%	

Table 8.1. Student evaluation of UniCampus – IsoMetrics results

After analysing Table 8.1, I conclude that the platform UniCampus that I have created can start to be properly used by students who are interested in MOOC courses. The limited amount of problems detected by the students in the focus groups allows me to better adapt and improve the platform.

The final evaluation which I conducted with the students was the analysis of the desirability of the platform. I chose to adapt the 'Microsoft Reaction Card' method in order to check the emotional response and desirability of the platform, its videos and its tools. The 'product reaction card' was developed as a toolkit to measure "desirability" [267]. This method has also been used for the evaluation of a dual-device learning environment at University of Brighton [268]. The students had to choose the words which best described a certain item from the following list: accessible, fun, attractive, overbearing, high quality, collaborative, complex, comprehensive, confusing, connected, consistent, overwhelming, time-consuming, desirable, trustworthy, dominating, efficient, emotional, exciting, familiar, not valuable, flexible, straight forward, frustrating, difficult to use, unpredictable, gets in the way, slow, busy, uncontrollable, inconsistent, intimidating, unconventional, organized, perfectible, personal, predictable, fresh, too technical, fast, relevant, rigid, simplistic, sophisticated, stressful, time-saving, stimulating, inviting, motivating, enriching, durable, easy to use, usable, useful and valuable.

First, I asked the students to select as many words as they wish, which best describe their overall experience with the UniCampus platform. In order of the most choices, these words are: efficient (90%), useful (90%), accessible (72%), trustworthy (72%), organized (72%), high quality (57%), collaborative (57%), easy to use (57%), comprehensive (43%), connected (43%), desirable (43%), attractive (28%), familiar (28%), flexible (28%), straight forward (28%), relevant (28%), simplistic (28%), stimulating (28%), inviting (28%), motivating (28%), fun (8%), complex (8%), consistent (8%), difficult to use (8%), unconventional (8%), perfectible (8%), time-saving (8%), enriching (8%), valuable (8%).

Then, the students were required to choose 5 words best describing their experience with the course video content and then arranging these words from 1 to 5, 1 standing for the word that best describes the item. The most mentioned words were useful, high quality, comprehensive, efficient and trustworthy. The words mentioned as most relevant were high quality, useful, accessible, straight forward, time-saving and relevant. Other words mentioned were organized, time-consuming, attractive, difficult to use, stimulating, motivating, complex, easy to use, consistent and flexible.

Finally, I asked the students to choose again 5 words and rate them from 1 to 5, this time for the tools of the UniCampus platform. The most chose words have been organized, efficient, easy to use, complex and familiar. The words mentioned as most relevant were useful, efficient, desirable, time-saving, accessible and organized. Other words mentioned were perfectible, attractive, high quality, enriching, usable, simplistic, consistent, flexible and sophisticated.

8.6. Conclusions

After proving the need of a Romanian MOOC platform, based on findings from the literature, the surveys I conducted and the study cases analysed, I have developed and envisioned a model for such a platform, which I presented in chapter 7.

For this model to be properly tested, I was required to implement it in an independent new platform. I chose to use the Moodle LCMS, with the arguments mentioned in subchapter 3.7. After installing the latest version, Moodle 3.0 and choosing the most appropriate theme, I continued with integrating step by step, my proposal into the newly created Moodle instance.

Some of the facilities and tools I required already existed and I only had to customize them. However, I was also required to search, install and edit different plugins and modules that were not custom present. Furthermore, in order to better fulfil my desired model, it was necessary to modify parts of the code, as well.

This implementation was also evaluated by the same experts who evaluated the model, in order to see if the implementation was a proper one from the learnability point of view.

I also decided to conduct three focus groups with different students in order to better evaluate the platform from the usability, desirability and learnability points of view. My findings prove the platform is a useful addition to the e-Learning Romanian community and it can start offering MOOC courses for interested students.

This chapter is the most important practical contribution of this thesis. Even if it is only a demo, its development and implementation, would allow with not so much effort to start fully testing and using it as a first complete Romanian MOOC.

9. CONTRIBUTIONS AND CONCLUSIONS

9.1.   Conclusions

The hype of MOOCs has passed and the disruption most foreseen has yet to happen. Some called the MOOC phenomenon a tsunami [74][269], others called it a revolution [270][76][75] and some went so far and stated that in 50 years, only ten universities will stand [110]. However, brick and mortar institutions have prevailed, and the disruption seems unlikely to happen, at least not in the way it was predicted a couple of years ago. Online education cannot replace the human factor, offered by real campuses. The on-campus experience helps the students interact with teachers and peers and helps them build upon their socialization and networking skills [205].

Hailed or failed, it is undisputable the fact that MOOCs have a big influence on the evolution of education. It is still unclear if this technology is trying to substitute traditional education or just complement it. In a world where poverty is influencing a big part of the population to get access to education, this could be a solution for almost free learning. I say almost because, for one to access it, one has to be able to use a device and to access the internet with that device.

The benefits of free online learning are undeniable and the opening that MOOCs offered to remote areas around the globe and to people who do not have physical or economical means to pass through the universities' gates is one of great importance to the ongoing development of humanity.

One big discussion revolves around the quality of the courses that are offered via MOOCs, as the providers usually leave the verifying of the material in the hands of the course creators. This could be satisfactory if the course was created by a university, but even so, there are many question marks regarding the seriousness with which this job is done. However, what happens when individuals choose to create a course and some platforms allow them to do so? The students need to have a very good filter when it comes to what is good education and what is not.

Carr, observed that "scholars who are sceptical of MOOCs warn that the essence of a college education lies in the subtle interplay between students and teachers that cannot be simulated by machines, no matter how sophisticated the programming" [98].

One of the reasons why universities want to have a MOOC is that they try to position themselves as global leaders of innovation, and as educational institutions capable of delivering high-quality education on a global scale.

How should one evaluate MOOCs? That depends upon what the goals of accomplishment are. According to Reich and Ho, "there is much blurring of distinguishable goals: from increasing educational access to disrupting higher

education, from screening for talent worldwide to advancing pedagogy in residential classrooms" [271][272].

I truly believe that in today's world, every university should at least try the MOOC experience. Offering what each university has best to offer, when it comes to courses for people who are not regularly attending it, is a great opportunity both to nourish minds but also to promote itself through educational value.

Overall, MOOCs started as an open concept, especially the connectivist versions. In time, however, once opportunity for profit arose, the open part was left at the end of the priorities list, which created big debates regarding if and how much of education should be open and free for all. The future will show us if the freedom or profitability of education will prevail.

One of the technological challenges that I foresee for the near future is for more complicated applications and activities to be available on MOOCs, in order to sustain the theoretical notions. I also anticipate that, there will appear economic changes in the field, taking into consideration the fact that there are a rising number of people who are willing to pay something for some form of official credential for partaking into a course. I am curious for how long the MOOC providers will refrain themselves from filling their platforms with annoying commercials, like all the successful web 2.0 platforms have done at some point.

I have shown that MOOCs are mainly based on web 2.0 and web 3.0 tools and technologies, being a fertile environment for developments of this type. The abundance of these technologies is helping MOOCs into bringing a revolution in the Higher Education system, making it easier and more fun for students to learn.

Nonetheless, there is a fundamental problem. The vast majority of the MOOC providers are still delivering a Learning 1.0 product in a Web 2.0 world. They have replicated all of the issues of the traditional model of lecture-based teaching and testing that model has minimal connection to student outcomes [86].

What many think and hope, is that adaptive software will bring the freshness so required by the education system, a system that has not been significantly renewed until now. Creating unique experiences for each user is taking the MOOCs to the next level, not only for education, but for the whole World Wide Web as well.

What we have to wait and see is if these new improvements will also help with the current economic problems. However, I believe that a problem, which could be solved, is that of exam cheating, with the help of biometric applications, which are part of the web 3.0 technologies.

I analysed in depth the infrastructure behind a MOOC and presented the most used solutions for each component and offered my own suggestions regarding the use of technologies and videos in MOOCs. I demonstrated the reasons that stand behind the decision of using Moodle as a platform to build a MOOC upon.

I found that evaluating the research, case studies, online surveys, content analysis, interviews and focus groups are the most used research methodologies present in the MOOC area. Analysing the titles of over 1000 MOOC articles I grouped the key words around education, change, future, collaboration, discussion and economy. These key words reflect the direction of MOOC research of the past years.

The results that I have obtained from the analysis of the online surveys designed for students and teachers, suggest a large degree of online educational resources knowledge and an increased interest in further development of OnERs and MOOCs in and for Romania. These surveys helped me to better understand which of

the components of a MOOC platform and a MOOC course are considered by students and teachers to be useful and important.

The study case ran with the courses of the Multimedia Master from UPT offered a clear and positive example of MOOC integration inside a traditional higher education course. The insights offered by the students allowed me to understand the aspects of a MOOC that they consider worthy of analysis.

After building, 'brick by brick', my model, taking into consideration all the educational and technological aspects, I managed to present a comprehensive and complex model for a future Romanian MOOC platform.

My final results consists in the implementation of the above mentioned model on a Moodle architecture and the implementation of a demo course that I have built specifically in order to satisfy the needs of my model.

The evaluation received from educational experts and students contributed significantly to proving both my model's and my platform's usefulness. These positive reviews have an important weight in demonstrating the essential theoretical and practical contributions of this thesis.

I conclude by stating that a Romanian MOOC would be a very useful addition to our higher university educational offers and, for UPT, a continuity of our distance learning experience.

However, the biggest question is if someone will try to be able to quantify the influence MOOCs have on society's development and on cultural and educational behaviourism. People receive a lot of power with the knowledge offer through MOOCs, but he who controls what kind of knowledge the MOOCs will offer, will be the real powerful one.

I will attempt to answer the research questions that I raised at the beginning of the thesis, based on my research findings:

1. Is there a need for e-Learning solutions and MOOCs in Romania?

I have shown in chapters 5.1 and 5.2 the status of e-Learning and MOOCs in the Romanian Higher Education, presenting a summary of the literature review of research related to these fields, done by Romanian scientists and for the Romanian educational system. The surveys conducted for students and teachers, presented and thoroughly analysed in chapter 5.3 and 5.4 brought me to the undeniable conclusion that there is a great need of more e-Learning solutions and MOOCs for the Romanian education with the implication that a Romanian MOOC would be extremely useful.

2. Can a MOOC improve education in Romania?

During this thesis, various advantages and disadvantages regarding MOOCs have been presented. From them, different types of improvement of education in general were signalled out. In chapters 5 and 6, there is a direct analysis of the implications of MOOC integration in the Romanian education. The study case in chapter 6 concluded that the use of MOOCs encouraged student involvement and were beneficial in the learning process, both from the student and the teacher's point of view.

3. How can you measure the usability of a MOOC from an educational point of view?

The usability of a MOOC was analysed through the interpretation of the surveys conducted with students and teachers in chapters 5.3 and 5.4 and the study case from chapter 6. The conclusions I reached were implemented in the

educational structure proposal and received positive reviews from educational experts and students.

4. Which tools and technologies influence the usability of a MOOC platform?

Chapter 3 analysed in very extensive manner the technologies that are used in MOOCs. The influence of social media was explained and demonstrated. Examples of web 2.0 and web 3.0 influences in MOOCs were enlisted. A complex analysis of the technologies that form the infrastructure of a MOOC were presented and analysed with practical suggestions for other researchers and developers. Some supplementary information about the influence of these tools over the usability of a MOOC platform can be read in subchapter 7.1.2.

5. What is the best possible educational structure for a MOOC in Romania?

After analysing existing MOOCs, and understanding the need of such platforms in Romania, I arrived at a proposal for such a structure, presented in chapters 7.2 and 7.3 The instructional models combine the ADDIE model and the socio-cognitive learning model. My model received positive reviews from educational experts, which suggests that it is a very good structure for a Romanian MOOC.

6. What is the best possible technological structure for a MOOC in Romania?

Based on the educational structure, and the technological aspects presented in 7.1.2 and 7.2, I created a demo version for the UniCampus Romanian MOOC, and implemented a technological structure, with various tools and technologies integrated into it. Chapter 8 offers a thorough description of this technological structure. Similar to the educational structure, this also received positive reviews from experts in the field, which encourages me to believe it is a proper structure for a Romanian MOOC. Moreover, after evaluating the platform and the demo course with the students in the focus groups, they also suggested that my work was useful and of significant importance.

9.2. Theoretical Contributions

(1) State of the art of MOOCs in relation to their appearance, development and impact and critical study of the most important platforms.

I presented in Chapter 2 a thorough investigation into Massive Open Online Courses. I explained the context of their apparition and I presented a historical timeline regarding their evolution. The most important platforms available around the world have been presented with a focus on Coursera, Udacity and edX. The impact on both the education and the economy was presented.

(2) Critical analysis of the debate regarding MOOC openness.

There is a strong argument going around in the researchers' community regarding the actual level of openness of MOOCs. I have presented my opinions and analysed openness in regards to the OCW movement and the actual copyright statements of the most important platforms. This was pointed out in subchapter 2.4.

(3) Overview of technologies used in MOOCs and critical analysis of their importance.

I presented the most used social media tools together with web 2.0 and web 3.0 technologies in MOOC platforms and courses. Afterwards, I have analysed their importance, presenting arguments pro or against them, together with my personal remarks. The results may be observed in subchapters 3.1, 3.2 and 3.3.

(4) Overview of MOOCs' infrastructure and critical analysis of the reasons for choosing them.

A thorough study was conducted, in subchapter 3.4 regarding the technologies that are in the backend of MOOC platforms. Those results have been carefully analysed and I presented suggestions for future researchers and developers.

(5) Critical analysis of video related aspects in MOOCs.

I presented elements related to videos in MOOCs, analysing existing platforms, explaining their choice and offering my own suggestions in the matter. This was discussed in subchapters 3.5 and 3.6.

(6) Overview of MOOC research methodologies and their critical analysis.

Different types of research methodologies applied by other researchers in MOOCs were presented and analysed. Based on them, I created the methodology of research applied in this thesis. These aspects are shown in Chapter 4.

(7) Analysis of Romanian perspectives over MOOCs: the development of a survey for students, in relation to the use of Online Educational Resources, MOOCs and videos in education.

I ran a survey between February and November 2015, designed for students, mainly from my university, which offered hundreds of answers that were carefully and thoroughly analysed. In my opinion, this offered the premises for the need of more development of e-Learning tools and MOOCs in Romania. It was also a useful overview of learnability aspects of a MOOC platform. The results are presented in subchapter 5.3.

(8) Analysis of Romanian perspectives over MOOCs: the development of a survey for teachers, in relation to the use of Online Educational Resources and MOOCs.

I ran a survey between February and November 2015, designed for teachers. Around one hundred answers were critically analysed and offered an overview of Romanian teachers' involvement in the use and creation of e-Learning material and MOOCs. It also proved the need of the further development of such tools in Romania. This can be seen in subchapter 5.4.

(9) Critical analysis of a study case regarding the use of MOOCs in courses from the Politehnica University of Timişoara.

In Chapter 6, I have analysed the use of MOOCs in courses from a master program in UPT. The opinions of the students were documented and presented in a comprehensive manner. After collecting their conclusions together with the impressions of the teacher I offered my opinions regarding this subject.

9.3.   Practical Contributions

(1) Description and creation of a model for a Romanian MOOC.

Chapter 7 offers a description of the concept of the first Romanian MOOC together with the educational and technological considerations of it. The structure of the model is thoroughly described and then presented in a step by step manner. After the opinions of the experts are taken into consideration the model is ready to be implemented.

(2) Implementation of the proposed model as the UniCampus platform.

The model is implemented on a Moodle 3.0 platform. I have analysed various themes and tools and chose the best suited for the model. Various parts of the platform were customised in order to suit the needs of the model. The platform was evaluated by educational experts and students and received positive reviews.

(3) Implementation of a demo course on the UniCampus platform.

I have created from scratch a demo course, based on the event "Open Education Week 2015", creating course material and adapting the tools from the platform in order to match the course requirements. The demo course was evaluated by educational experts and students and received positive reviews.

9.4.   Future Research Directions

There are several research directions that could be approached, in order to best continue my work from this thesis.

Implement a traditional course on the MOOC model. The most obvious one would be to proper test the platform by transposing one or more courses, which are currently traditionally performed in a Higher Education program, on UniCampus and analysing the opinions of the students and teachers regarding their functionalities and implementation.

Results analysis. Further analysis could be done on comparing results obtained before and after the use of UniCampus. Depending on these results, both the platform and the traditional classes could be improved in order to better serve the needs of the students.

Learning analytics. The potential massive amount of users that could enrol for a MOOC course, would permit administrators to collect huge amount of data regarding those users and their learning habits and behaviours. The analysis of those data would most likely have a beneficial impact over Romanian education.

Inter-institutional cooperation. The appearance of a Romanian MOOC platform brings the possibility of cooperating for a joint educational program and curricula, using specialized courses of each partner. Of course, this would assume the national educational legislation would be adapted into this direction.

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ANNEXES

Word	Number of appearances
MOOC	661
Learning	131
Course	109
Online	102
Education	89
Massive Open Online Course	71
University	68
Open	66
Higher Education	60
Student	56
Credit	50
Model	50
Collaboration	47
Change	46
Coursera	46
Free	43
Problem	43
Success	43
Technology	43
Support	41
Danger	39
Time	39
New	38
Revolution	38
Creating	37
Discussion	36
Big	35
Business	35
Compete	35
Future	35
Study	34
Online Education	33
Data	32
expand	32
Learner	31
Challenge	29
Current	29
Knowledge	29
Leader	29
Platform	29
Udacity	29
Evaluate	28

Professor	28
Theory	28
Cost	27
edX	27
Improve	27
Launch	27
Massive	27
Developing	26
Direction	26
End	26
Research	26
Disruptive	25
Emotion	25
Design	24
e-Learning	24
Practice	24
Use	23
Approach	22
Community	22
Elite	22
Global	22
Going	22
Real	22
Resource	22
Teaching	22
Team	22
Analysis	21
Classes	21
MIT	21
Money	21
Question	21
College	20
Think	20
Activity	19
Attrition	19
Behavior	19
Campus	19
Characteristics	19
Emerging	19
Fail	19
First	19
Institution	19
Internet	19
Many	19
Review	19
Strategy	19
Access	18
Blended	18
Engagement	18

Experiment	18
Focus	18
Opportunity	18
Delivery	17
Fix	17
Past	17
Pedagogy	17
Rates	17
Self	17
Simple	17
Social	17
System	17
Taking	17

Annex 1. Most frequent 104 words in MOOC research titles