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MOOCs: ORIGIN, CHARACTERIZATION, PRINCIPAL PROBLEMS AND CHALLENGES IN HIGHER EDUCATION

Lourdes Normandi Atiaja Atiaja
Rey Segundo Guerrero Proenza

University of the Armed Forces ESPE (Ecuador)
University of Havana (Cuba)
lnatiaja@espe.edu.ec, rey@cepes.uh.cu

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MOOCs (Massive Open Online Courses) are an innovation that have attracted public academic attention in recent times, and which have resulted in the evolution of e-learning (electronic learning) and so far have not achieved their expectations in Higher Education. This is due to the fact that from the outset these courses have faced a number of problems and questions regarding their acceptance, credibility, quality, methods of assessment, learning outcomes and more; which has generated controversy among their opponents, fans and even the creators of MOOCs. This work forms part of a doctoral investigation; in essence these are the results of the preliminary and exploratory stages in the research process, in which projections on the solution of some problems will be included. MOOCs: Their evolution, problems and challenges up to 2015, will surely help to minimize the high dropout rates of students in MOOCs, supported by mobile technology.

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1 Introduction

One result of technology applied to education that is becoming a topic of interest to society and its communication media are Massive Open Online Courses (MOOC). These courses, as their name implies, are characterized like any other educational offerings online; that is, through Internet services, primarily by the Web, to be, in a sense, open (in terms of their potential customers) and what has been their most distinctive feature is a large number of students attending them, so many in fact that they qualify as "massive". It should be noted that "massive" is a vague definition, in a similar way that one talks of a "pile of stones", it is an indefinite amount.

The question is why MOOC have attracted the attention of both the media and the educational community. Of course, it is because of the difference in the teacher/student ratio and the correlation of the number of students in each class.

But perhaps most importantly, they have come at time when education, particularly at university level, is under pressure to make changes to meet the demands of knowledge society, and make education accessible to all, at any stage of their life.

At a first glance MOOCs would seem to be a great solution: many people, at any time can freely access information and acquire skills with their friends. Furthermore there are the means to the learning activity, the scope that supposedly everyone can access.

But the social practice has shown, once again, that "silver bullets" hardly exist outside the world of vampires. While the MOOC is expected to serve as a training solution for all, what is actually happening is that few people ever complete a program, at least in a way that can be verified. And if one criticism of universities in addressing educational challenges is the generalizing, expository and behavioral methods, the MOOC, at least in the initial stages, were guilty of these practices on a large scale.

It is therefore an important task to study the phenomenon of these problems with MOOC and try to find solutions to their shortcomings. Many researchers are currently involved in such work. Among them, the authors of this work are making an effort to contribute in this regard, through research, in the framework of a project and network of university educational innovation with ICT (Information and Communication Technology). The aim is to defend a doctorate in Educational Sciences, in the modality of Educational Technology, thus relying on the most relevant results of contemporary psychology science and the latest technological advances, particularly concerning mobile devices, to positively change the current situation in the processes taking place with MOOC's and consequently have a positive influence on their results.

2 The origin of MOOCs

It can be problematic to determine when something has become established or taken root. This usually happens when the very identity of the object or process is difficult to define, or when there are different views on what it is.

This may be the case with MOOCs. When exactly did MOOCs start? Really the first time that the term was used to characterize a process of learning was in 2008, following a course taught on Connectivism (Downes, 2008). What drew the attention of the participants and the media, and which led them to name them MOOCs was the vast number of participants.

Of course, these courses are a branch of existing broader classes, which essentially share the same origins. So in 1971, the OU (Open University) in the United Kingdom, established a policy of essentially free admission to the course regardless of prior academic performance of students (Gourley & Lane, 2009). As such the institution adopted a principle of MOOC philosophy by offering free courses, leading to open access to the educational context (open education). In a similar way in 1997 California State University, added more value to the open end, through the MERLOT project (Multimedia Education Resource for Learning and Online Teaching), developing a program of online library resources for free access learning for their students (Open Educational Resources). Indeed this project continues to the present day and has been expanded. MERLOT has become an open community with the purpose of sharing resources and specific learning materials.

By 2001, the Massachusetts Institute of Technology (MIT) had announced its Open Course Ware project (OCW), whose purpose was to make available to the public, free of charge, all learning materials developed and employed in courses under a free license; thereby facilitating the concept of MOOCs. Around the same time the first initiatives emerged, also approximating the concept of MOOC, from three elite universities, Oxford, Yale and Stanford. These were nonprofit, through the project Alllearn (Alliance for Lifelong Learning), creating open online courses in various subject areas of general interest. These were courses without credits. The initial audience for these courses were the alumni of the three institutions, and since 2002 these courses have been open to the general public. 2001 can therefore be considered the boom year for online courses (Jokivirta, 2006). Later in 2008, George Siemens and Stephen Downes of the University of Manitoba (Canada) organized a course called "Connectivism and Connective Knowledge - Connectivism and Connective Learning", which incorporated open learning strategies based on connectivism, new approaches for interaction and social networks. The course lasted for 12 months and recorded the participation of about 2,300 students. Thus following this course the MOOC's arose under the precedents of open education, open

educational resources (OER), open educational content (Open CourseWare), online courses (e-learning). Then in 2011 the second MOOC was given on an Introduction to Artificial Intelligence, which was organized by Sebastian Thrun, professor of the Stanford University and Peter Norvig, director of research at Google. In this year 160,000 students were registered worldwide. Following the success of this MOOC, Sebastian Thrun left Stanford University to create the Udacity platform for MOOC courses.

In 2012, the MIT offered its first MOOC "Circuits and Electronics", using its own MITx platform, more than 120,000 students registered. Following this some prestigious institutions in the United States together with large companies, established alliances and partnerships, leading to the emergence of various platforms. Harvard University together with the Massachusetts Institute of Technology announced the edX project. The Coursera platform developed by academics at Stanford University which offered free courses via the Internet also appeared. These first platforms that were popularized by MOOC Coursera, Udacity and edX were then followed by the Open University, which developed the platform FutureLearn. This proliferation of MOOC platforms undoubtedly had an impact in the educational field, to the point that one of the major newspapers in the United States, the New York Times published an article noting that 2012 was the year of the MOOC and that they had become a trend that revolutionized Higher Education. The novelty of the emergence of the MOOC phenomenon has in some ways led to several institutions seeing the need to offer such courses and / or develop their own platforms to expand access to their education and attract more students. In early 2013, the main platform for Spanish speaking, MiriadaX an initiative of Universia was the largest network of collaboration of Ibero-american Universities and Telefónica Learning Services offering 1,232 Latin American universities the chance to offer courses in Spanish, and therefore an MOOC appeared.

3 The characterization of MOOCs

The concept of MOOC comes from the initials of the English "Massive Open Online Course" or in the Spanish language terms known by the acronyms COMA (Cursos Online Masivos Abiertos), CMEA (Curso Abierto En línea Masivo), or CALGE (Curso Abierto en Línea a Gran Escala) this, despite the fact that the term MOOC is not standardized yet.

Today we find different definitions of MOOC, due to the great controversy between the advocates and opponents of this mode of learning, the proliferation of platforms, diversity of MOOC and because it is a futuristic trend that has not yet attained a degree of maturity.

In the beginning the MOOC were defined as a phenomenon that integrated the connectivity of social networks, access by a recognized expert in a field of study and a collection of online open access resources, where several hundred to several thousand students could actively participate and self-organize according to the objectives, prior knowledge and skills and the common interests of learning (McAuley *et al.*, 2010). Another definition, Times (2014), is simpler and states that it is a class supported by the Web, designed to accept a large number of participants.

Some experts refer to the MOOC as an open educational service, a distance learning course, through the Internet, where anyone can participate, provided they have access to an Internet connection and a computer (McAuley, Siemens, Cormier, & Stewart, 2010). The idea of this approach is that students collaborate providing content and creating a network for use upon completion of the course. This is a true definition of MOOC only when it includes further statements such as; an open course where anyone can participate; massive, i.e. there are no limits to this participation, and online access via the Internet.

Another way of understanding an MOOC is as an online course that is provided mostly for free, a meeting of participants willing to share knowledge and experience for individual or collaborative learning (Waard, 2015).

In general, we can say that all definitions of MOOCs, are given in relation to the four letters of the acronym MOOC; variations such as collaborative or shared participation. Interestingly the European Association of Distance Teaching Universities (EADTU), in one of their reports published in February 2015 relating to institutional MOOC strategies in Europe, notes that MOOCs remain relatively poorly defined and that MOOCs can be seen as a term or related to the scalability of open education and online services. This statement can certainly be justified by many open courses which do not meet the characteristics derived from the acronym MOOC.

Based on our participatory experiences in different MOOCs of Coursera, OpenLearning and edX, we would define the MOOC as online courses that allow a massive and open participation on certain platforms, whose main components are as follows: a collection of videos of recorded classes by a renowned professor from a prestigious university (often they attribute the success of the MOOC to the prestige of the university, but not necessarily the quality of learning), links to material support, automated assessments, discussion forums and peer reviews, providing greater accessibility to a flexible and ubiquitous education.

The main characteristics that distinguish the MOOC are: massive participation and free access to online courses. Additionally, these courses allow interaction via discussion forums between participants (students-students). However, according to our experiences in the various courses Coursera, edX

and OpenLearning, we did not find evidence of a direct interaction between student-teacher; this is understandable given that one, two or three teachers cannot be expected to meet the learning demands of hundreds and even thousands of participants.

There are some MOOC courses that do not meet their main characteristics; we found some platforms such as Udacity, Udemy, Alison, Eliadymy, WizIQ, offering courses that are paid for, while Coursera offers free courses and if the student requires a pass certificate for the course, they pay a fee for this certification; while edX, MiriadaX, KanAcademy, FutureLearn, OpenLearning and others offer free access courses.

In some cases we feel that these courses should have a cost, in order to maintain the MOOC. In one journal published by the University of Athabasca (November 2014), the study investigated the requirements and costs incurred by MOOC distribution and found on average a cost of around USD 68,000. This cost is due to the need for a technological infrastructure, technical staff, designers, instructors, etc. beyond the initial implementation costs.

The MOOCs have been proliferating and several universities around the world are adopting these courses as an educational strategy; while MOOCs diversity has led to classifications being established, where most of these courses are based on recorded video classes, automated and peer evaluations, discussion forums. Downes classifies them as cMOOC because they allow learning through the exchange of information, participation and interaction of the participants based on a connectivist strategy because the courses are recorded as traditional classes, videos and are based on a behaviorist approach, he called xMOOC.

Whereas according to Yousef *et al.* (2014) the MOOCs are classified as:

- BMOOCs (Large Scale Open Online Courses) - They are similar to xMOOC, but the course is limited to a number of participants (usually no more than 50 students).
- DMOOCs (Distributed Open Collaborative Courses) - The course material is distributed among students from different institutions, but the administration of these courses varies. They are built with the experience of participants from different institutional backgrounds.
- MOORs (Massive Open Online Research) - The course is a mixture of video based, readings and student research projects guided by instructors.
- LOOC (Little Open Online Course) - Online courses are open to a limited number of registered students who can take the course as long as they pay a course fee.
- SPOCs (Small Online and Private Courses) - They use the same infrastructure as MOOCs although their range is not massive and closed elements may be included in its contents. These are courses with a

limited group of participants, similar to BMOOCs, but with students based on the conventional model of the classroom, teacher interactions are similar to the inverted model class.

- SMOCs (Synchronous Massive Open Online Courses) - What distinguishes these courses is that classes are broadcast live, so that students must be connected online simultaneously.

In addition to this classification Hernández *et al.* (2014) describes the iMOOC term developed by the Open University of Portugal, and notes that it combines features of xMOOC and cMOOC. Another classification is established by Clark (2013), based on functionality for Learning:

- Transfer MOOC (MOOC Transferred) - Developed from an existing online course, which is not very successful, and therefore underwent a facelift to make it MOOC thereby attracting more participants. This author includes several courses from Coursera in this category.
- Made MOOC (MOOC specifically created) - They are considered more innovative and focus on the use of videos. They also tend to be formal in building materials and the use of specialized software. Work and peer review is used, an example would be Udacity.
- Synch MOOC (Synchronized MOOC) - These have a specific start date and specific days for specific tasks or evaluation.
- Asynchronic MOOC: (MOOC asynchronous) - These do not have specific dates for their implementation.
- Adaptative MOOC (MOOC adapted) - They use algorithms to customize the student learning experience in monitoring and evaluation content.
- Group MOOC (Group MOOC) - These start with a small group of students who work together and this collaboration is maintained throughout the course.
- Connectivism MOOC (MOOC connection) - They are called cMOOC, with the philosophy of a flexible training based on interaction and group work.
- Mini MOOC - Tend to relate to universities, but there is an emerging trend to create shorter MOOC with regard to content and development time. Given this diversity, Tony Bates (2014) mentions that some of these developments generated confusion about the definition and objectives of MOOCs, especially in relation to massive and free; i.e. ones which refer to the existence of courses that are not entirely free, or are not open.

4 Problems and challenges facing MOOCs

Based on an analysis performed on different bibliographic, digital and scientific articles related to MOOCs plus our participatory experience in various MOOC courses, it is evident that there is little up to date statistical information on completion rates of MOOC courses.

Several reports such as EMOOCs in 2014 issued by the University of Reading, The Global Information Technology (2015) and the University of Pennsylvania in England, demonstrate the results of several MOOC experiences. They reflect low rates of students completing courses (less than 10%). As such it is not surprising that the most significant problem faced by MOOCs is the high dropout rates which range from between 75% to 95%. Given these results, researchers believe that these courses are not effective tools for learning and furthermore are simply a technology or business model, since many platforms charge a fee for the courses. Even Sebastian Thrun, the Udacity platform creator, has pointed out that the MOOCs follow a traditional course format using the components noted above. It is also notable that many of the videos used in the courses are long and boring and that they do not motivate students, and furthermore there is a lack of innovation in the design of the audio and video content in MOOCs.

The following summarizes some of the main causes of the problems facing MOOCs due to the high dropout rates:

- The lack of pedagogical rigor or adequate monitoring (Vardi, 2012; Zapata-Ros, 2013), assessments that are used are usually simple knowledge tests; no value is placed on participation and/or student's interaction with peers and teachers.
- There is a lack of quality in instructional design, according to the report Instructional quality of Massive Open Online Courses (MOOC) Anoush Margaryan, Manuela Bianco and Allison Littlejohn (2014).
- Questionable absence of standards to evaluate their pedagogical quality (Bernal, Molina & Perez, 2013).
- Lack of personal contact between the participants of the teaching-learning process; whereas in virtual environments, students see and are aware of the presence of their Professor (Kang & Im, 2013).
- Poor monitoring; as the methodology itself is designed so that monitoring by a teacher is kept to a minimum. (Because courses are large scale, individual monitoring would simply be impossible).
- Their generally unofficial characteristic makes them difficult to certify, although several institutions are beginning to deliver certificates at the end of school years and many of them do so in exchange for a fee.
- In 2014 EMOOC and Armstrong (2012) agreed that the reasons students

were dropping out of MOOCs was the lack of motivation, monitoring and mentoring, due to the large-scale of the courses.

- Lack of timely feedback on proposed activities within the course, limiting the possibilities of resolving doubts and correcting errors in these environments (Parkinson, 2014; Fei & Shi, 2014; Stuchlíková & Kósa, 2013; Eckerdal *et al.*, 2014; Hew, KF & Cheung, 2014); the level of difficulty of the course and the lack of support by the teacher can be a factor for the abandonment of the courses according to (Onah, Sinclar & Boyatt, 2014).
- The teacher is not effectively fulfilling their role as facilitator and does not establish a learning environment where they discuss, interact and collaborate with students. (Only interaction between participants is seen, facilitating connections and creation of groups or networks whereby participants build knowledge and resolve doubts together (Andersen & Ponti, 2014; Siemens, 2008).
- The MOOC platforms do not have sufficient technological tools to allow for synchronous and immediate interaction, an important requirement for students. David Chernoff, professor of the first MOOC released by Cornell University, through edX platform, mentions that this course does not allow for face to face interaction between teacher and students. Considering that this factor is important to mark the success of the MOOC's future, interaction is one aspect that allows students to enjoy learning in any place and at any time.
- The course content is not innovative or interactive, in comparison with new technology.

Perhaps surprisingly, despite these problems and considering the objectives for which the MOOCs were created, the expansion of open education, knowledge globalization and the fact that MOOCs play an important role in this new digital age, there is a great interest from students and several institutions in adopting the MOOC as an educational strategy. It is therefore crucial that this type of learning should focus on minimizing the flaws which have dogged MOOCs from their outset. As such the following points are necessary:

- To train participants in digital literacy on MOOC courses, especially in the development of an adequate level of use of technological tools, to learn to share and interact, create, criticize, analyze and evaluate multimedia texts and meet the required ethical responsibilities that this type of environment requires. In this way participants of a MOOC can develop skills in a massive environment. Furthermore teachers must receive training to familiarize themselves with new educational tools.
- Improve the quality of learning through high levels of automation, so

allowing the optimization of teachers' time with tools that promote scalability of a need for early treatment of the large numbers of students.

- Adoption of evaluation criteria for ubiquitous learning, according to the 5 dimensions established by Mike Sharples, Dan Oliver Corlett and Westmancott; ie: active, cooperative, constructive, authentic and personalized; we would also add a reflective assessment as a further criteria for evaluation.
- To determine strategies of a techno-pedagogical design that enrich the course where the semantic web, learning analytics, big data and the adaptive systems could play an important role, and in such a way help to identify the learning requirements of the students and provide continuous monitoring and mentoring of students.
- To guide the broad lines of research according to the pedagogical design; highlighting the importance of active learning undoubtedly increases the commitment of participants, improving knowledge retention and learning motivation (Koller, 2012).
- Creative content design, by judicious selection of techno-learning tools such as social media, augmented reality, gamification, virtual reality and mobile content; so as to encourage the student to significant learning and meet the needs of students in the 21st century.
- Design of new methodologies that lead to reflection and criticism of the practice and the acquisition of new skills, transferability of skills to personal contexts, social, academic and professional and thus create the basis for lifelong learning.
- Establish a balance between technology and pedagogy that favors learning through interaction and collaboration (Kop & Carroll, 2011); also taking into account that the social construction of knowledge is a key element of MOOCs (Mackness *et al.*, 2013).
- Determine standards to validate the quality of learning that the participants of the MOOCs have acquired.

Conclusions

The origin of the MOOC is related to OER (Open Educational Resources) and OpenCourseWare, which are educational resources created by teachers in order to promote access to knowledge freely and without restrictions.

The concept of MOOC is not standardized, nor is there a definition formally established of this type of course that in so few years has proliferated and diversified and even led to the commercialization of courses through certain platforms which has ultimately resulted in many courses not meeting the main criteria of being free and for a massive audience.

Since their inception the MOOCs have suffered a series of criticism regarding their teaching model, financing, certifications and high dropout rates.

Many MOOC critics often point out that the quality of these courses has been attributed by the prestige of universities rather than the quality of learning.

No doubt the survival of the MOOC also depends on the different technological resources for its operation.

Based on the results obtained, we can say that MOOCs face a number of pedagogical and technological challenges and therefore these courses require a re-construction, in order to reduce the weaknesses which have been presented. For these reasons a MOOC design requires the adoption of pedagogical and technological strategies to achieve the goal of having a positive impact within the field of Higher Education.

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