Learning in the openness: the lost way of the MOOC

Andrés Chiappe
andres.chiappe@unisabana.edu.co
Universidad de La Sabana, Colombia

Herly Constanza Ibarra
herlyibco@unisabana.edu.co
Universidad de la Sabana, Colombia

Luis Lizasoain
luis.lizasoain@ehu.es
Universidad del País Vasco, Spain

Abstract

At the end of the 2000´s, MOOCs broke into the educational field with the promise of learning with features more suited to the demands of our times. Their connectivist genesis provided a provocative expectation regarding the potential of collaboration, sharing, reuse, and free access, as factors of a possible transformation of the current educational system, which has been characterized by being rigid and reluctant to change. Given the relevance and growing participation of MOOC in education, there is a strong interest in understanding both their functioning and structure so that they can be considered as relevant educational options for a networked society. In this sense, a multi-method, exploratory and mixed study was conducted on 225 MOOCs based on the four categories that make up their denomination: Massive, Open, Online and Course. The study was developed through three stages: enlistment, fieldwork and report. The results of the study show that the contributions of MOOCs as generators of shared and collaborative learning experiences as proposed in their origins are not reflected in the reality of their current offering.

Keywords

MOOC; Collaboration; Open Educational Resources; Network-based learning; Lifelong learning.

I. Introduction

The educational integration of Information and Communication Technologies (ICT) is a phenomenon in constant growth and that over the years has been consolidating and contributing elements of strengthening and updating in various educational practices such as teaching, assessment, content creation, among others (Hermans et al., 2008; Khan & Markauskaite, 2017; Tondeur et al., 2007; Varol, 2013). In that context, it would be expected that such practices would approach the expectations and requirements of 21st-century education (Hsu, 2017; Siddiq et al., 2017; Stuchlikova, 2016), which in some contexts, especially in developing countries, has not yet happened.

According to Pazur, Divjak and Arbanas (2016) and Wilson, Scalise and Gochyyev (2015), the relationship between ICT and Education is both diverse and complex and encompasses a broad spectrum of possibilities for its implementation. One special product of this relationship is highlighted by the academic and research community due to its contributions in the field of collective construction and democratization of knowledge: the Open Educational Movement.

Although the origins of the Open Educational Movement do not place it explicitly in processes of incorporation of ICT in education, but in a context where the general interest was aimed at reducing the gaps between communities with and without difficulties to access information (Ramírez & García-Peñalvo, 2015), it is true that the fulfillment of its purposes could not be now effectively implemented outside a digital ecology, of course, supported by ICT. In this sense, especially since the early 2000, a direct association between the Open Educational Movement and the processes of educational integration of ICT has been strengthened (Ramírez, 2013; Tovar & Piedra, 2014) as the framework for its development and evolution.

Within this context, a special product of the Open Educational Movement has been noted in a noisy way: the MOOCs (Massive Open Online Courses).

In this regard, it is worth mentioning the existence of a great diversity of conceptual approaches about MOOCs, mainly derived from the intense growth in the publication of specialized literature on this subject that was generated from the year 2012, as shown in the Figure 1.

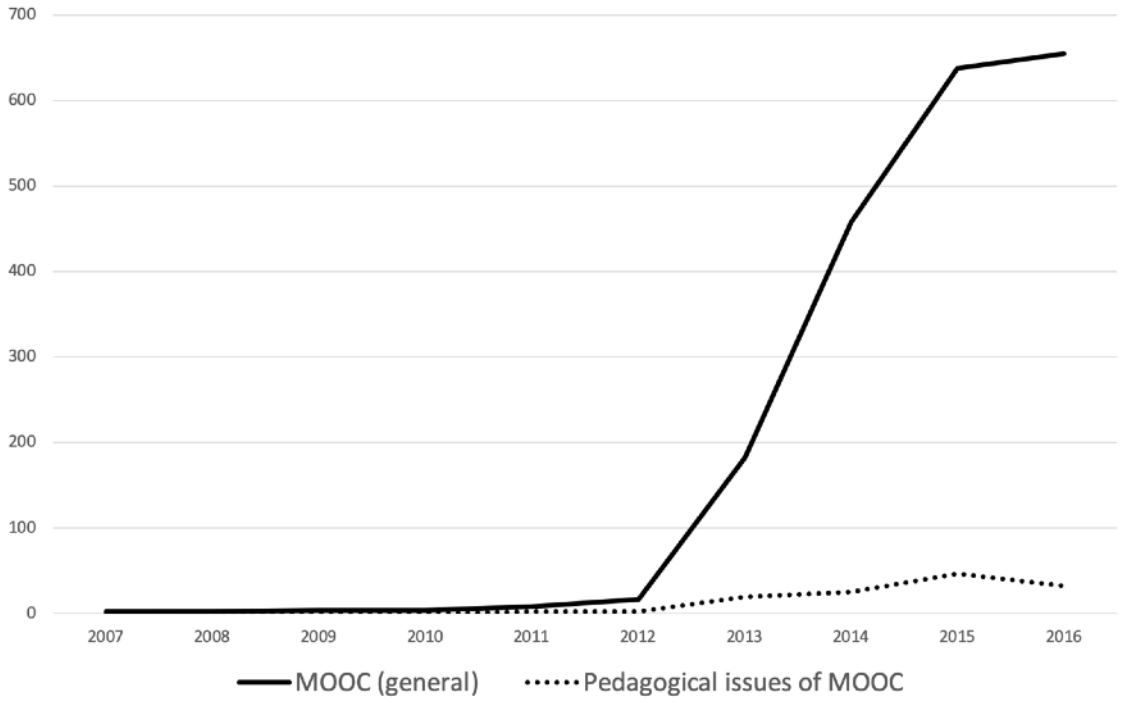

Figure 1. Comparison between general and pedagogy-related research about MOOC (Scopus)

Source: own elaboration based on Scopus data

According to Matías and Pérez (2014) MOOCs are defined as:

> […] a phenomenon that has achieved great force in recent years and which integrates connectivity to social networks, access to experts recognized in a field of study, an online collection of free access resources and its most important quality: the possibility of active participation with several hundred to thousands of "students", who self-organize according to their own objectives, previous knowledge, skills and common learning interests (p. 42).

Regarding the above, it is worth digging a little deeper into the implications of the letters that make up the term "MOOC" since on the one hand, they serve to complement its understanding and on the other, since they served as structural dimensions from which this study´s results were analyzed.

From a back-to-front analysis, the "C" for "course", implies that its structure must provide the constituent elements of a learning environment, that is, content, spaces for interaction, learning activities, possibilities for feedback and other resources that lead to learning (Boude & Medina, 2011). On the other hand, the first “O” of “online” implies that the learning experience will happen entirely through digital environments. The second "O" of "open" gives it characteristics that differentiate it from any other type of online course. Such characteristics are known as "attributes of the open" within which stand out, adaptation or reusing, sharing, collaboration, redistribution, among others (Wiley, 2010). Finally, the "M" for "massive" is perhaps its most distinctive feature. In this regard, it is worth mentioning that such feature does not have to do with the fact that during its execution there are many students enrolled in the course, but has been designed and built so that many students can enroll and that it works efficiently in the use of its resources and effectively regarding the generated learning.

It is interesting to note that in recent years research on MOOCs has not been addressing subjects directly related with pedagogical issues of social interaction, especially through Wiley's 5R's of "the openness", which focus on reuse, revise, remix, redistribute (sharing), and more recently, retain (Pete et al., 2017), which was perhaps one of the most interesting educational aspects of the emergence of MOOCs.

In that sense, recent research has been focused on issues such as self-regulated learning (K. Li, 2019; Wong et al., 2019), adaptive support systems (Jin et al., 2019; Lerís et al., 2017; Xi et al., 2018), Big data applications and learning analytics (Dessì et al., 2019; Khalil & Ebner, 2016), engagement and completion (Kashyap & Nayak, 2018; W. Li et al., 2016; Nagrecha et al., 2017; Suresh & Mallikarjuna, 2019; Whitehill et al., 2017), communication, (Ossiannilsson et al., 2015), digital support systems (Zhang et al., 2017), perceptions, attitudes and student´s motivations (Higashi et al., 2017; Shapiro et al., 2017), implications of free access and cost (Cross & Whitelock, 2017) and their insertion in various educational levels, among others (Sanchez-Gordon & Luján-Mora, 2017), among others.

Considering the above, it is worth emphasizing that the magnitude of research on pedagogical aspects of MOOCs is just a small fraction of the research generated on this subject, as is also seen in Figure 1.

Regarding this, some previous studies that have been carried out on the pedagogical quality of the MOOC, either from literature reviews (Duart et al., 2017; Sangrà et al., 2015), or limited to the MOOC offer in certain languages (Lemos de Carvalho & Raposo, 2017; Raposo et al., 2015), indicate on the one hand, that MOOC do not show higher than average levels of quality compared with other online learning experiences and, on the other hand, they demand the need to undertake more studies that allow to liberate them from the pedagogical pre-determination of the global platforms that offer them.

In addition, studies such as Conole (2016) or Pilli and Admiraal (2016) focus on its pedagogical aspects both from a historical perspective and from a critical analysis of the classic typologies (cMOOC and xMOOC/content-oriented MOOC) as well as updated and extended typologies on this subject and “the 7Cs of Learning Design framework”.

Beyond the above and taking into account such diversity of focus of interest about MOOCs and its increasing immersion in all the educational levels, it is important to consider that this special type of courses are being recognized worldwide as valuable resources to support education in a changing and uncertain social context as 21st century, where collaboration and social interaction are considered key factors for lifelong learning (Batchelor & Lautenbach, 2015).

Regarding the aforementioned, a mixed study was carried out whose purpose was to explore the current educational offer of MOOC in search of elements that allow to recognize them as a suitable educational option for an everchanging networked society.

II. Method

a. Type of study

The exploratory study was carried out under a mixed research perspective, called by Bolívar (2008); Creswell (2009) and Sánchez (2015) as multi-method, in which are considered, in a complementary and articulated way, qualitative and quantitative approaches referred, among other aspects, to the processes of analysis of the collected data. The above, according to

Mertens (2014) and Díaz (2014), is considered relevant within the framework of educational research due to the possibilities of triangulation and data enrichment and the deepening in the understanding of the addressed educational phenomenon.

In addition to the above, given the comparative nature derived from the purpose of this research, it was found pertinent to follow the guidelines of the multi-case study as a research design. According to Stake (2013) and Houghton et al. (2013) the multiple case study is convenient when a phenomenon to investigate is placed in multiple contexts or circumstances and prevails the intention to investigate it by the same subjects, independently of the circumstances. For the purposes of this study, each of the analyzed MOOC was considered as a particular case, each of which was studied from a comparative perspective, under the same parameters and criteria.

b. Phases of research

The methodological path of the study followed the recommendations of Álvarez and San Fabián (2012) in terms of conducting activities or sub-processes from main three phases, as shown in Figure 2.

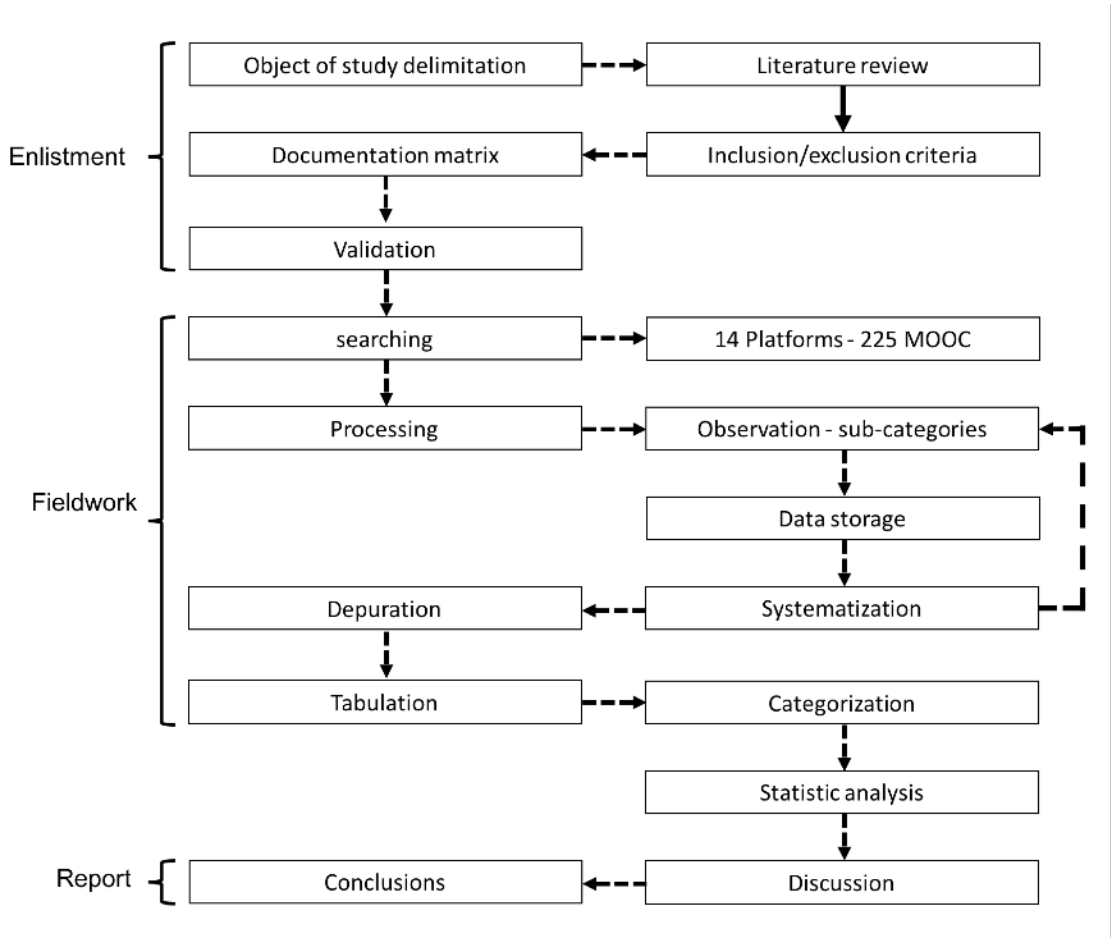

Figure 2. Phases of research
Source: own elaboration

b.a. Enlistment phase

Also called as pre-active phase, during the enlistment phase, the selection and delimitation of the research object and a systematic literature review were carried out. Also, the data to be collected were determined and the data collection instrument was designed, which was first validated through a 10-MOOC exploration pilot and then subjected to expert judgment, which Robles and del Carmen (2015), consider a suitable procedure for this type of exploratory studies.

Considering the breadth and diversity of the current MOOC offer, in this phase the inclusion and exclusion criteria were established in order to form the set of courses to be analyzed in the next phase. The criteria established were availability and thematic diversity. With regard to the first criterion, a 6-month search interval was established in which the MOOC were explored in different platforms that were open or that it was possible to access their contents during that period of time. On the other hand, the criterion of diversity indicated that MOOC should be selected from multiple thematic areas, platforms and educational institutions, at least in Spanish and English.

b.b. Fieldwork phase

In this phase, also called interactive phase, two complementary sets of operations were realized, first those directed to the searching of information and second those related to its processing. Within the first set, the search of platforms, the selection of MOOC that met the inclusion criteria and the registration in the available courses for review were carried out.

Sampling

The application of the inclusion and exclusion criteria provided a sample of 225 MOOC to analyze which in terms of Silverman (2016) and Taylor, Bogdan and de Vault (2016) designate an intentional non-probabilistic sampling. Table 1 shows the 14 platforms that were reviewed, in which 4632 courses were identified and 225 were available during the period of time determined for their exploration.

PLATFORM	# MOOC
Coursera	35
EdX	29
Ecolearning	13
Udacity	33
MiriadaX	38
Khan Academy	10
FutureLearn	30
UNED	9
EAN	3
Unimooc	7
CentrumX	2

Udemy	3
Canvas	8
Emma	5
Total	225

Table 1. Number of analyzed courses by platform
Source: own elaboration

In accordance with the criterion of thematic diversity, the sample included 42 different topics, which are summarized in table 2.

Topic	**#MOOC**
Computer Science	66
Social Sciences	41
Arts and Humanities	36
Business, management and accounting	32
Mathematics	19
Health Professions	12
Engineering	8
Agricultural and Biological Sciences	5
Physics	3
Environmental Science	3
Earth and Planetary Sciences	3
Chemistry	1

Table 2. Number of MOOC by topic based on SJR subject areas
Source: own elaboration

Categories for data analysis:

The categories by which the information was searched and subsequently analyzed were derived from the structural components of the designation "MOOC". In that order of ideas, 4 main categories were established: Course, Massiveness, Online and Openness. For each category, some sub-categories and guiding questions were established, as shown in Table 3.

Categories	**Guiding questions**

Course-Topic	Is a specific topic addressed?
Course-Length	Is the course limited in time?
Course-Resources	Does it contain resources according to the topic?
Course-Support	Does the course have institutional support?
Course-Tutoring	Does the course have tutoring?
Course-Learning	What kind of learning is promoted?
Course-Objectives	Does the course have clear objectives?
Course-Assessment	Is learning assessed?
Course-Cost	Are the courses free of cost?
Massiveness-Components	What components support massiveness?
Online-Time	Is it synchronous or asynchronous?
Online-Space	Is this a distance education course?
Online-Communication	What communicative tools are used in the course?
Openness-Use	Does the course use open educational resources?
Openness-Collaboration	Does the course allow collaboration?
Openness-Adaptation	Can the contents of the course be modified?
Openness-Redistribution	Are the course contents shared?
Openness-Free access	Is it possible to freely access the course?

Table 3. Categories of analysis and guiding questions
Source: own elaboration

The final part of the fieldwork was conducted through an on-line observation and documentation process through which data was extracted and stored. An extract of the matrix in which the data was collected is shown in Table 4. Data matrix´s url is: https://bit.ly/2LiFSXV.

	Mooc1	Mooc2	Mooc3	Mooc4	Mooc5	Mooc6	Mooc7	Mooc8	Mooc9	Mooc10	Mooc11	Mooc12	Mooc13	Mooc14	Mooc15	Mooc16	Mooc17	Mooc18	Mooc19	Mooc20	[...]
Course-Learning																					
Previous knowledge						x		x					x			x					
Individual activities	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	

Collaborative activities						x									x	x				
Autonomous learning	x	x	x	x	x		x	x	x	x	x	x	x	x	x		x	x	x	
Project-based learning		x				x										x				
Learning by doing		x								x				x	x					
Research based																				
Problem solving								x				x			x					
Case study	x				x															
Discussion forums		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Social networking					x					x										
Peer review						x			x			x	x	x	x		x	x		
Course-Resources																				
Video instruction	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Educational software																x	x	x	x	
Readings	x		x		x	x		x	x	x		x		x	x			x		
Blogs															x					
Googledocs/ wikis																				
Test	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	
[...]																				

Table 4. Extract of documentation matrix
Source: own elaboration

The matrix was built and shared using Google Drive which allowed the research team to access to all available data anytime and from any place through a simple Internet connection.

In addition to the issues related to the sub-categories mentioned above, the main features of the 14 explored platforms were documented in the matrix, in terms of institutional support, coverage, language, thematic offering, certification, availability and visibility, among others. This phase concluded with a process of data clustering, a qualitative and statistical analysis and the elaboration of graphics for interpretation purposes.

Report elaboration phase

In this phase, also called post-active, the discussion of the results was generated, drawing conclusions and consolidating the final report of the research as a product of social dissemination of knowledge.

b.c Data analysis

The mixed nature of this research was aimed to address the main research question: What are the main characteristics of the current offer of MOOC? and how do these characteristics support their performance as an appropriate educational option for the 21st century?

For the How and What are these characteristics, an observation of MOOC´s activities, learning strategies, content and evaluation was conducted. As part of the quantitative component, frequencies, averages, percentages and correlational analyzes were performed, based on the application of chi square and correlation for continuity of some categories and subcategories.

Finally, strengthening the reliability of the data extraction process and its subsequent analysis was conducted through the verification of two observers on the same unified set of data to which a Cohen´s kappa was applied whose result was k= 0.65, which according to Grant et al. (2017), is an acceptable inter-rater reliability result.

III. Results

The results presented below are shown with two base data: the frequency of appearance (n) and the percentage corresponding to each found aspect in relation to their total.

a. Results related to the category "Course"

One of the most representative features of the MOOC offer is its thematic diversity. It is worth highlighting the interest in learning programming languages (n=19; 27.9%), use of computer tools (n=10; 14.7%), educational topics related with ICT use (n=12; 17.9%), soft skills development (n=10; 30.3%), mathematics and statistics (n=15; 51.7%) and basic introductory courses in foreign languages (n=6; 8.82%).

Regarding for the duration of the courses, two groups of MOOC were found, a first group (n=200; 88.9%), which explicitly shows the number of modules usually corresponding to working weeks, and a second group (n=171; 76.0%) indicating the expected study time per week that includes access to readings, videos, practice exercises (if any) and questionnaires or final exam (optional). The detail of the time consumption is shown in Table 5.

# hours per week	# MOOC	%
3	70	40.9
5	53	30.9
7	34	19.8
9	4	2.34

+10	10	5.85
# modules	#MOOC	%
1	1	0.52
2	4	2.08
3	11	5.51
4	49	24.5
5	33	16.5
6	36	18.0
7	21	10.5
8	14	7.06
9	3	1.53
10	6	3.13

Table 5. Hours per week (time consumption)
Source: own elaboration

Generally, the platforms offer a timeline of the various activities to be carried out per week, as well as the lessons and contents with the estimated time to be realized. Given the duration as a factor of analysis, it is possible to generate a typology in which those of a first group (n=96; 42.6%) remain permanently open, while those of the second (n=129; 57.3%) have start and end dates.

Regarding the resources used in the MOOC there is a general prevalence of downloadable or embedded videos (n=225; 100%), PDF reference texts as complementary content resources (n=123; 54.7%), discussion forums (n=171; 76.0%), third-party resources (n=108; 48.0%) such as apps, social networks and bibliography and the use of software packages (n=52; 23.1%) mainly in technological topics (n=27), mathematics and physics (n=10), pedagogical themes (n=8), and language, health sciences and leadership management or business (n=7).

Other aspects to be analyzed in relation to the components of a course are the type of activities and the evaluation. In relation to this, it should be mentioned that 100% of the MOOC analyzed were structured to conduct the student progressively to take the guided readings of the lessons or weekly modules accompanied by the observation of explanatory videos. 45.8% (n=103) of the MOOC requires previous knowledge. As complementary activities, 24.0% (n=54) use "learning by doing" methods, through guided practices in videos, use of simulators or software that allows students to perform exercises and experience in practice. On the other hand, in 9.32% (n=21) of the MOOC, students must submit a final project, in 8.07% (n=18) using case studies, in 77.8% (n=175) discusses a topic through the discussion forum and 29.8% (n=67) use social networks as part of strategies for the analysis and discussion of topics related to the course.

Regarding the evaluation, only 16.9% (n=38) of the courses use peer review methods as activities in which students evaluate the work of another partner. On the other hand, 80.4% (n=181) of the MOOC perform automatic type tests, quizzes, practical questionnaires, evaluations or examinations, with multiple-choice questions with only one correct answer, where a focused tendency is observed in the evaluation of memory.

b. Results related to category "Massiveness"

An interesting element to analyze in relation to the mass nature of the MOOC is the presence or absence of tutors, since they are the closest referent in terms of quality of interactions and feedback within the context of online education. What is shown in Table 6 on this subject is that the number of tutors is very low in comparison to the number of students, which allows to infer that the tutors no longer assume the traditional follow-up, accompaniment and feedback roles of online education. In that sense, only 207 (92.0%) of the MOOC analyzed had tutors and the remaining 8% become a set of courses where the interaction takes place only through content.

# tutors	#MOOC	%
1	84	40.6
2	48	23.2
3	34	16.4
4	9	4.35
5	9	4.37
6	6	2.92
7	6	2.91
8	3	1.47
9	1	0.53
+10	7	3.48

Table 6. Number of tutors per MOOC
Source: own elaboration

In short, the main role of the tutors is focused in video class recording or through explanatory talks on the MOOC subject as well as providing information, almost always related to logistical issues of the course, which is mainly offered through discussion forums.

c. Results related to category "Online"

One of the most representative features of an online course is flexibility, in terms of time and space management. Regarding this feature, 100% of the analyzed MOOC are designed to access their contents in an asynchronous way, where participants can access at any time and from any place, which is possible due to the design of activities and content and the technological support of such MOOC.

However, there was a restriction on flexibility for the completion of courses in 57.3% (n=129) of the observed MOOC, which have both start and end dates. Out of this time, access is restricted to some content resources and activities such as peer review and questionnaires. This restriction is extended in other courses in which either a time limit or

expiration date is available to perform certain activities or to receive feedback in the discussion forums.

d. Results related to category “Openness”

The results based on this category show how open the MOOC are and how the attributes of "openness" have been applied. In this sense, the attribute that is applied in a recurrent and structural way (n=225; 100%) is free access, through which access is allowed to content resources, videos, digital documents, software, audio and external content found in the MOOC for their pedagogical use.

On the other hand, the attribute "collaboration" was observed as the second most frequent attribute of "openness" being related mainly to the use of discussion forums (n=175; 77.8%), wikis, blogs and networks (n=67; 29.8%). Notwithstanding the foregoing, it should be mentioned that the use of these tools was mostly focused (n=154; 90.1%) as mediations to share information related to the logistics of the courses or to request general information while a small fraction (n=17; 9.92%) used them as mediation to generate collaborative learning. In fact, in platforms such as Udacity, where forums have been held since 2014, there are few replications and responses on average (n <3) to the messages placed in the discussion forums. It is interesting to review the minimal use of tools typically used to support collaborative or peer-learning activities such as portfolios (n=2; 0.932%) or platforms such as Google Drive (n=3; 1.36%). As for evaluation, only 18.2% of the revised MOOC (n=41) presented peer task reviews or peer feedback.

This is complemented by the analysis of the presence of autonomous activities that are associated with some of the aforementioned tools and that are deployed differently on both commercial platforms and those offered directly by universities. The results shown in Tables 7 and 8 indicate that although there is a significant difference (p=0.03) as an inverse trend, the interpretation must be careful due to the decompensation in the items related to the different platforms; commercial (n=213) and university (n=12), so it is considered relevant to consider the results only as merely tendential even when significant differences emerge.

Table of contingency					
			Autonomous learning		Total
			No	Yes	
Type of platform	Commercial	Count	102	111	213
		Expected frequency[a]	98.5	115	213
		Typified wastes	0.43	-0.32	
	University	Count	2	10	12
		Expected frequency	5.53	6.52	12.0
		Typified wastes	-1.55	1.42	
Total		Count	104	121	225

Table of contingency					
			Autonomous learning		
			No	Yes	Total
Type of platform	Commercial	Count	102	111	213
		Expected frequency[a]	98.5	115	213
		Expected frequency	104	121	225

Table 7. Comparative autonomous learning per platform
Source: own elaboration

	Value	gl	Sig. asintotic (bilateral)	Sig. exact (bilateral)	Sig. exact (unilateral)
Pearson´s chi square	4.45[a]	1	0.03		
Correction by continuity [b]	3.28	1	0.07		
Reason for likelihood	4.91	1	0.02		
Fisher´s exact statistics				0.04	0.03
# valid cases	225				

[a.] 0 cells (0%) have an expected frequency of less than 5. The minimum expected frequency is 5.55.
[b.] Calculated only for a table of 2x2.

Table 8. Chi square test
Source: own elaboration

Finally, it is possible to mention the almost absolute absence of possibilities of reuse, understood as adaptation, of resources within the MOOC. This is mainly due to the prevalence of text formats in PDF and the use of embedded videos and for which there are no licensing schemes that explicitly allow their reuse.

IV. Discussion

A global analysis of the results found in this study shows an x-ray of the current MOOC offer that, except for a few exceptions, is a set of pedagogical learning experiences very similar to

each other and distant from their connectivist origins located on the end of the decade of 2000 (Mackness et al., 2013).

A first conclusion to present has to do with how curious it is that a pedagogical proposal originally based on the potential of networked learning, which is enriched with the ideas and experiences of hundreds or thousands of co-participants, ends up being reduced to a solitary (although very flexible) video and PDF review process and that advances because of answering correctly some tests that mostly privilege the memorization.

In this sense, something important have disappeared: the connectivist learning approach based on reusing content, sharing and collaborative building of knowledge in spaces where unexpected things happen due to unplanned interactions with unknown people. These types of experiences, almost absent in the vast majority of current MOOC, are precisely those that enrich the processes of flexible and lifelong learning (Russell et al., 2014; Schuetze, 2006). The above generates a large number of individual learning experiences in the midst of a vast ocean of untapped interaction opportunities precisely created by the massiveness of MOOCs.

However, despite the above it is possible to rescue a structural element of MOOC that makes them interesting from the educational point of view: free access. This essential attribute of "openness" supports what is special about most of the available MOOC on the different platforms at the moment and which has to do with a spirit that is more democratic than innovative, which is very relevant especially for those socio-cultural contexts with deep needs for closing access gaps to education and promoting lifelong learning.

On the other hand, another conclusion has to do with, while recognizing the great value that free access adds to this type of learning experiences, it is necessary to gather it with other attributes of “openness” such as sharing, collaboration and adaptation so that MOOC become real spaces of co-creation of knowledge. It will be very difficult to achieved if current pedagogical designs persist based only on personal review of content and having individual tests as the only evaluation strategy. In this sense, social learning is considered relevant as a pedagogical foundation of MOOC, allowing developing spaces for both co-design and co-creation of knowledge, which could not be done adequately in learning environments in which it is not planned to interact with peer learners.

On the other hand, a final conclusion points out to that in order to advance in this direction, it would seem necessary to begin to combat the pedagogical predetermination on the part of the global MOOC platforms such as Coursera, Edx or MiriadaX, among many others. This study confirms what was found by Raposo, Martínez and Sarmiento (2015) on this matter, which could begin to be fought either by encouraging the autonomous publication of MOOC directly by universities, through a more flexible protocols or templates offered by MOOC platforms or through the use of open access resources, such as social networks or web 2.0 content creation and publishing apps.

Regarding the limitations of this study and future lines of research, it is worth mentioning that the number of MOOCs analyzed, despite being a significant figure and corresponding to almost all of those that were open during the time window of the study, could be considered with a moderate level of representativeness, given the total number of MOOCs offered globally and their annual growth. Such circumstance would merit replicating this study in frequent periods of time to determine if the results and conclusions produced by this study continue to be valid or if new elements of analysis emerge. An additional space that is interesting for future research related to MOOCs lies in verifying their effectiveness as instruments that provide flexible learning in digital environments and under pedagogical principles focused on network learning, personalization, informal learning and other constitutive elements of what is known as "21st century education".

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