Research contributions on the educational use of MOOCs

Aportaciones desde la investigación para la utilización educativa de los MOOC

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Abstract:

In recent years, online teaching and training with MOOCs has become increasingly important. This is demonstrated by the number of publications about them. Here we present a meta-analysis of the research that has been performed, focusing on the educational opportunities provided by MOOCs. This study was conducted using Social Sciences peer review open journal publications from the last five years (2011-2016). These indexed publications can be found in the following databases: JCR, Scimago Journal-SCOPUS, and Sello Fecyt. The main result obtained was quantitative data gathered from questionnaires referring to the most worked area of materials and content design. As an initial conclusion, it identifies a need to broaden the scope of study to include more general educational journals.

Keywords: Online teaching and training, MOOC, Meta-analysis, Open journal publication.

Resumen:

La formación *online* a través de los MOOC ha cobrado una gran relevancia en los últimos años, como demuestran las publicaciones que se han realizado en torno a ellos. En las líneas siguientes presentamos un meta-análisis de las investigaciones realizadas respecto a las posibilidades educativas de los mismos. Este se ha realizado en torno a las revistas publicadas en el área de Ciencias Sociales vinculadas al área de tecnología educativa y que, además, se publican de manera abierta y que se encuentran indezadas en JCR, Scimago Journal-SCOPUS y Sello Fecyt en los últimos cinco años (2011-2016). El principal resultado alcanzado es el que se refiere al diseño de materiales y contenidos, siendo el método más empleado de investigación el de corte cuantitativo, empleando mayoritariamente el cuestionario para la recogida de los datos. Como conclusión inicial se puede indicar la necesidad de ampliar el horizonte de estudio a revistas educativas de corte generalista.

Descriptores: Enseñanza y formación *online*, MOOC, meta-análisis, revistas en abierto.

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1. Introduction

When discussing MOOCs (Massive Open Online Courses), we are concerned with a very interesting educational technology or strategy that is still seen as emerging and has, at the same time, inspired high expectations and considerable criticism. With regards to these expectations, several editions of the Horizon Report have described it as a technology that will quickly be incorporated into the educational system on a massive scale (Durall, Gros, Maina, Johnson, and Adams, 2012; Johnson, Adams, Cummins, Freeman, Ifenthaler, and Vardaxis, 2013; Johnson, Adams Becker, Cummins, Estrada, Freeman, and Ludgate, 2013). Similarly, other people have described MOOCs as a disruptive technology that will transform the student-teacher relations that are traditionally found in teaching and will take education to all corners of the world (Conole, 2013; Marauri, 2014; Bonk, Lee, Reeves, and Reynolds, 2015). At the same time we find authors (Popenici, 2014; Cabero, 2015; Valverde, 2015) who have criticised the more romantic and extreme viewpoints that they have inspired.

Their importance can also be seen in the efforts various journals have made to publish special issues on this topic, for example: *Apertura. Revista de Innovación educativa* (2014, 6, 1, «Aprovechamiento y efectividad del uso de las TIC y los MOOC»; *Comunicar* (2015, *22*, 44, «MOOC en la educación»); *RIED. Revista Iberoamericana de Educación a Distancia* (2015, 18, 2, «La filosofía educativa de los MOOC y la educación universitaria»); *Profesorado. Revista de currículum y formación del profesorado* (2014, 18, 1, «Los MOOC y la Educación Superior: La expansión del conocimiento»); and *Educación XX1* (2015, 18, 2, «MOOC. De la teoría a la evidencia»).

One area that we believe is significant is determining whether or not MOOCs are a technology. From our point of view they are not in themselves a technology, but instead should instead be seen as a medium and resource that is supported by different technologies, such as websites, video clips, on-line learning platforms or audio podcasts.

With regards to their major features and in line with the suggestions made by various authors (Castaño and Cabero, 2013; Vázquez, López, and Barroso, 2015), we can classify them as follows: they are an educational resource that has some similarity to a class; they have start and end dates; they have evaluation mechanisms; they take place on-line; access to them is free; they are open on-line and do not have admissions criteria; and, finally, they allow interactive participation by a massive group of students.

We should also not forget that when discussing MOOCs we can find different conceptions of them, or rather implementations or typologies (Cabero, Llorente, and Vázquez, 2014; Vázquez, López, and Barroso, 2015). These basically fall into three categories: xMOOC, cMOOC and a hybrid model that has been called a tMOOC. However, some authors such as Clark (2013), expand this

to seven types: transferMOOCs, madeMOOCs, synchMOOCs, asynchMOOCs, adaptiveMOOCs, groupMOOCs, connectivistMOOCS and miniMOOCSs. Furthermore, POOCs (Personalized Open Online Course) are started to be discussed.

Focussing on the three categories initially cited, we find that xMOOCs are clearly supported MOOC design models in which students acquire a series of contents; to some extent we could say that they are on-line versions of the traditional learning formats (reading, instruction, debate, etc.) that Universities use in their elearning activities. In contrast cMOOCs do not so much focus on presenting content in a formalised way, but instead on discursive communities that jointly create the knowledge (Cabero and others, 2014, pp.17-18).

The last type, tMOOCs, focus on the student performing tasks and activities.

Moya (2013, p.167) has compared the basic types of MOOC with the basic pillars of the Delors Report (Table 1), thus providing an overview of their educational possibilities.

TABLE 1. Pillars of Education of the Delors Report and xMooc and cMOOC.

Pillars of Education	xMOOC	cMOOC
Learning to know	— Learning centred on the information that the teacher transmits. — Linear guided learning	— Learning based on sharing knowledge with others. — Active and participatory learning.
Learning to do	— The tasks proposed are more about evaluating whether or not the content has been absorbed based on self-evaluation. — The learning is passive.	— The tasks depend on the involvement of the participants and their relation with the others. — This is more active learning, emphasising «learning by doing».
Learning to live together	— From the standpoint of the model together xMOOCs do not contemplate this perspective of learning to coexist, as the learning process is totally individual.	— The connection established in this form of courses is a good example of shared collaborative cooperative learning and so involves relating with the rest of the course community.

Pillars of Education	xMOOC	cMOOC
Learning to be	— xMOOCs propose totally individualised learning, and so it will depend on the participant whether or not he or she develops. — Life-long learning character.	— The offer clearly reflects this learning, as it means at all times that the connection with the rest of the participants and the interactions make us grow and develop as people. — It maintains the essence of life-long learning»

Source: Moya, 2013, p. 67.

The criticisms identified by different authors (Zapata, 2013; Popenici, 2014; Cabero, 2015; Valverde, 2015) follow different line, the most significant of these are: in some MOOC models the basic point on which all of the curriculum design and development is based is knowledge as a product; the unidirectional content transmission that gives the teacher the role of «expert» and the student a «banking» role; the future of education cannot be changed simply by incorporating technology; the existence of a strong cognitive distance between teacher and learner; and finally, that their mass character makes it impossible to establish meaningful interactions between students.

To complete these initial references we will cite the work by Hollands and Tirthali (2014), who performed 62 interviews with different agents from 29 institutions that included MOOCs in their educational practices, and eventually identified six main objectives for providing them:

— Extending the scope of the institution and access to education.

— Building and maintaining the brand.

— Improving economics by reducing costs or increasing income.

— Improving educational results, both for participants in MOOCs and students on campus.

— Innovation in learning and teaching.

— Carrying out research on learning and teaching.

It is on the last of these that our work focuses, on analysing what types of actions have been carried out based on this research.

2. Method

The main objective of this study is to analyse the various contributions about MOOCs that have been made to academic journals that focus on education in an international field in the 2011-2016 period.

Consequently, the work presented is based on a systematic review of various articles, that approach the subject of MOOCs with the aim of obtaining a common quantitative index (Sánchez-Meca,

2010), in other words a meta-analysis in which we have performed a methodical search in various databases from the field of social sciences, concentrating on open access education-technology journals; and, qualitatively identifying the various areas considered in these massive open on-line courses from the most scientific viewpoint.

To carry out this systematic review, we used the analysis performed by Liyanagunawardena, Adams, and Williams (2013) as a starting point. These authors analysed the articles published between 2008 and 2012 on MOOCs, specifically considering various academic contributions from a quantitative and qualitative perspective, classifying them by type of publication, year of publication and authors, and then defining eight topics or areas of interest. Likewise, the meta-analysis carried out by Sangrà, González-Sanmamed, and Anderson (2015) has been considered. This listed 228 pieces of research, from a position of identifying components they obtained eleven thematic categories and the number of articles in each of them by year and type of publication on MOOCs in the 2013-2014 period.

The proposed methodology for this study is primarily based on the previous analyses, using MOOC as a key word in various databases where the journals and the most relevant contributions on the topic of this systematic observation are hosted. Specifically *ISI Web of Knowledge* was searched for contributions with JCR impact factor, Scimago Journal & Country Rank, SCOPUS and Sello Fecyt, although with all of them we started from the premise that they would be open-access and that they were journals from the field of Educational Technology.

As in the studies by Liyanagunawardena and others (2013) and Sangrà and others (2015), articles that did not fully correspond to the field of our analysis were discarded. This way we established as a relevance criterion all of the articles that had been submitted to journals with both JCR factor and SCOPUS, and JCR-SCOPUS-Sello Fecyt; and that were also research articles or theoretical ones.

Finally, 89 articles in total were compiled from the different journals consulted, from the period from 2011 up to the first two months of 2016.

To perform the quantitative analysis we considered some of the categories identified in the study by Cabero and others (2008) that concerned a meta-analysis of elearning and the proposals for the preparatory analyses, finally we considered: type of document (based on research or theoretical); the impact index of the journal; type of section in the journal; institution to which they refer; methodology and the research design proposed; type of instrument; etc. Using these categories we classified and categorised the articles considered. To identify the various topics or areas covered concerning MOOCs —the qualitative analysis— we examined the previous studies by Liyanagunawardena and others (2013), and Sangrà and others (2015), and the research by Hollands and Tirthali (2014) mentioned above that was directed at examining the cost-effectiveness ratio of the creation of these courses for

institutions. In total 21 areas concerning MOOCs were suggested:

1. Design of content and materials
2. Analysis and/or presentation of MOOC platforms
3. Institutional benefits
4. Problem of evaluation on MOOC courses
5. Economy in MOOCs: business model
6. Use of communication tools in MOOCs
7. Motivation and engagement of students
8. Comparison with other virtual educational strategies
9. Cultural and accessibility questions
10. Managing and administering MOOCs
11. Educational data mining: learning analyses
12. Designing activities
13. Different types of MOOC
14. Evaluation techniques and strategies
15. Problems with the application of MOOCs
16. Audiovisual resources in MOOCs
17. Abandonment rate-Failure rate
18. Pedagogical methodology and strategies
19. Learning theories and MOOCs
20. Problems in tutoring
21. Certification and accreditation with MOOCs

After the preparatory analysis, these were restructured into the following thematic areas concerning MOOCs:

— Design of content and materials
— Analysis and/or presentation of MOOC platforms
— Institutional benefits
— Problem of evaluation in MOOC courses: evaluation techniques and strategies
— Economy in MOOCs: business model
— Communication tools in MOOCs
— Motivation and engagement of students
— Comparison with other virtual educational strategies
— Problems with the application of MOOCs
— Methodology and pedagogical strategies
— Learning theories and MOOCs

Others (including various topics for each contribution that are not covered by the proposed areas).

3. Results

Based on the results obtained by year of publication over the period from 2011-2016 (the first two months only in the case of the last year), the articles analysed from educational technology journals show an increase in contributions, given that the greatest number of academic articles on the topic of MOOCs is found in 2015 (50.6%) and the smallest number in 2012 (3.4%). We can also see how in just two months examined from 2016 there are twice pieces as many as in 2013 (7.9%), while in 2011 there was 0%. This leads us to believe that 2015's total

of academic contributions will be exceeded in 2016.

With regards to the impact index of the journals where the selected articles are published, we find that just one of the articles is in a journal indexed in JCR (1.1%) while the majority are in journals that have a JCR impact factor and SCOPUS (57.3%). On the other hand, 32.6% of the academic contributions are in SCOPUS journals and 9% feature in all of the indexes.

When classifying the articles selected by the number of authors whose names appear on the articles, we found that the three-author option is most common (43.8%); in contrast there are fewer articles with more than three authors (13.5%). On the other hand, there is an equal frequency and percentage of publications with one or two authors (21.3% each). This result differs from the study by Liyanagunawardena and others (2013), in which articles by a single author predominated.

The results of the analysis by gender are logical, given that most of the articles studied are mixed (47.2%); followed by those written by men (33.7%); in contrast, there is a smaller number written by just women (19.1%).

This can be seen more clearly when consulting the articles by number of authors and gender (Table 2), where it is apparent that there are more articles by one single male author (53.3%), while for women articles with two authors are more common (52.9%). Nonetheless, the majority (64.3%) of articles are by three authors of mixed gender.

TABLE 2. Distribution of articles by number and gender of authors.

	Male		Female		Mixed	
	F	**(%)**	**F**	**(%)**	**F**	**(%)**
One	16	53.3	3	17.6	0	0
Two	4	13.3	9	52.9	6	14.3
Three	8	26.7	4	23.5	27	64.3
Over 3	2	6.7	1	5.9	9	21.4
Total	**30**	**100**	**17**	**100**	**42**	**100**

Source: Prepared by the authors.

When analysing the articles by type, the type being theory or research, we find that the majority of those in journals from the field of technology are research-based (68.5%) and just 31.5% are theoretical.

With regards to the space where the documents appear, we can observe that the great majority are published in monographic issues (57.3%), followed by those published in editions with mixed content

(40.4%), while just 2.2% are published as an editorial.

When classifying the characteristic of the journal issue (section) by type of article, it can be seen that theoretical articles are mainly found in special or monographic issues of the journals (60.7%), whereas the research-based ones are divided between issues with mixed content (44.3%) and monographic issues (55.7%).

Taking into account the type of institution to which the articles analysed from technology journals (Table 3) refer, we found that in the majority of them it is difficult to specify this (66.3%); 31.5% refer to universities; and, both there is the same percentage for those that refer to non-university institutions and those written for various institutions (1.1%, each).

TABLE 3. Articles by institution to which they refer.

	Frequency	Percentage %
University	28	31.5
Non-University	1	1.1
Business	0	0
Institutional	0	0
Various	1	1.1
Not identified	59	66.3
Total	89	100

Source: Prepared by the authors.

The type of methodology used in the article is another variable that was taken into account in this analysis. To do so it was decided that the theoretical articles may be classified as qualitative on the basis that they consider the state of the question in a reflexive and discussion-based form (Álvarez and San Fabián, 2012; Dorio, Sabariego, and Massot, 2012). Articles using a quantitative methodology are the most numerous (48.3%), followed by documentary ones (28.1%); qualitative ones represent 19.1% and mixed one represent 4.5%.

With regards to the design used in the research projects that led to the publication, the data show that there are more ethnographic (37.1%) and experimental (33.7%) ones; while the evaluation based ones are addressed least often (3.4%) (Figure 1).

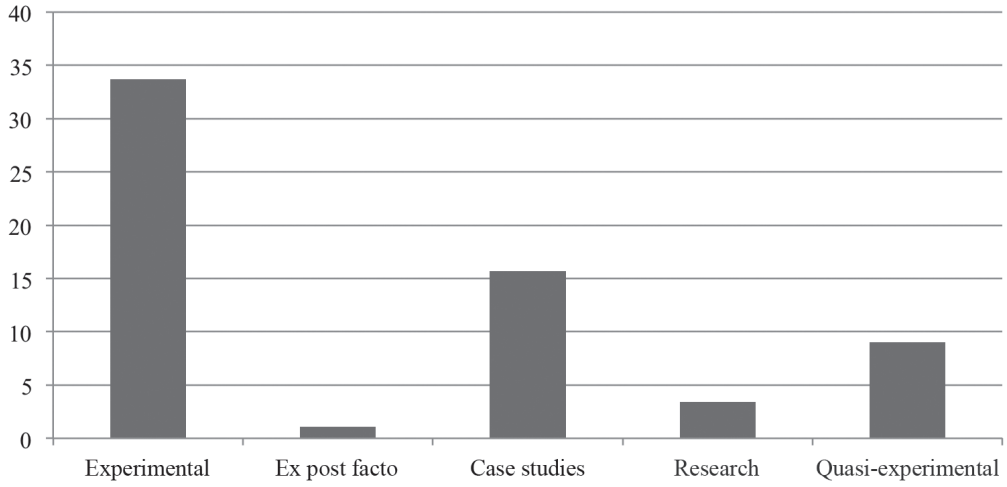

FIGURE 1. Articles by research design used.

If we take into account the instrument used to collect information in the articles analysed (Table 4), we find that the instrument used most often is questionnaires (50.6%), followed by analysis of documents (38.2%); the Delphi technique is used least often (1.1%). We should also note that over half of the instruments proposed are not used in the articles analysed about MOOCs in technology journals.

TABLE 4. Articles by instrument used.

	Frequency	Percentage %
Questionnaires	45	50.6
Interviews	4	4.5
Narrative records	3	3.4
Rating scales	2	2.2
Delphi technique	1	1.1
Document analysis	34	38.2
Sociograms	0	0
Attitude scales	0	0
Participant observation	0	0
Anecdote records or diaries	0	0
Research groups	0	0

	Frequency	Percentage %
Checklists	0	0
Automatic procedures	0	0
Semantic differential	0	0
Total	89	100

Source: Prepared by the authors.

Considering the educational stage on which the analysed article focuses, we can see that that the «other» category occurs most frequently (60.7%), as it includes those articles focus on several educational levels. This category is followed by university (32.6%). Meanwhile, post-university represents 11.5% and the academic contributions studied focus the least on the pre-university and adult categories (1.1% each).

With regards to the categories or thematic areas that were restructured concerning MOOCs (Figure 2), 33.7% of the 89 articles analysed refer to the design of content and materials; 22.5% to the category of others; 18% to the issue of the application of MOOCs; 7.9% to learning theories and MOOCs; 5.6% to motivation and involvement of students; 3.4% to institutional benefits; 2.2% to pedagogical methodologies and strategies and to economy in MOOCs; and 1.1% each to analysis and/or presentation of MOOC platforms; communication tools in MOOCs and comparison with other virtual educational strategies.

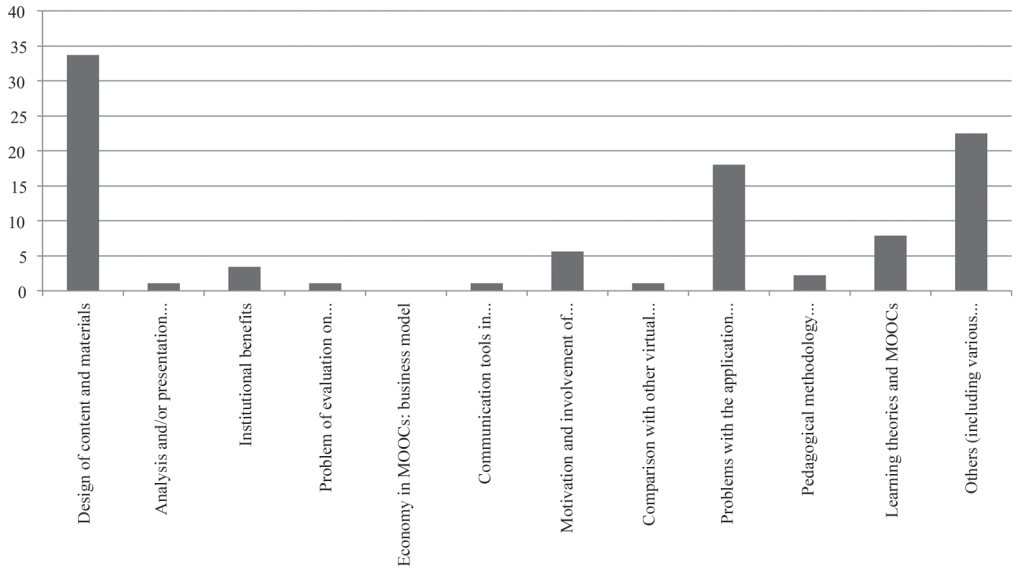

FIGURE 2. Articles on MOOCs by thematic area.

When analysing thematic areas by year, we can see how in 2013 in the articles analysed in the educational technology journals, «Problems with the application of MOOCs» is the most common topic (42.9%); followed by «Others, defined as the category that includes various topics for each contribution that are not covered by the proposed areas» (28.6%); likewise, in this year, we find the same number of articles on «Designing content and materials»; «Methodology and pedagogical strategies»; and, «Learning theories and MOOCs» (all with 14.3%).

On the other hand, «Designing content and materials» (52.4%) was the topic most frequently addressed in 2014; along with «Others» (14.3%); «Methodology and pedagogical strategies»; and, «Learning theories and MOOCs» with 9.5% each. The areas with the fewest contributions in this year are: «Analysis and/or presentation of MOOC platforms», «Institutional benefits», «Economy in MOOCs: business model», «Communication tools in MOOCs», and «Problems with the application of MOOCs» (all with 4.8%).

Likewise, in 2015, the year from which the greatest number of articles was found (Table 5), we can see that the topics that have the most contributions are: «Designing content and materials» (33.3%) and «Problems with the application of MOOCs» (26.7%); as well as the category of «Others» (20.0%). Meanwhile, only one publication was found for each of the following topics «Institutional benefits» and «Problem of evaluation in MOOC courses: evaluation techniques and strategies» (2.2% each).

Likewise, for the period analysed in 2016 (first two months), the contributions most often found fall under the category of «Others» (30.8%); this is followed by «Designing content and materials»; «Methodology and pedagogical strategies»; «Learning theories and MOOCs»; and, «Motivation and engagement of students» (all with 15.4%).

TABLE 5. Distribution of topics by year.

	2012		2013		2014		2015		2016	
	f	%	f	%	f	%	f	%	f	%
Designing content and materials	1	33.3	1	14.3	11	52.4	15	33.3	2	15.4
Analysis and/or presentation of MOOC platforms	0	0	0	0	1	4.8	0	0	0	0
Institutional benefits	0	0	0	0	1	4.8	1	2.2	1	7.7
Problem of evaluation in MOOC courses: evaluation techniques and strategies	0	0	0	0	0	0	1	2.2	0	0

	2012		2013		2014		2015		2016	
	f	%	f	%	f	%	f	%	f	%
Economy in MOOCs: business model	0	0	0	0	1	4.8	0	0	1	7.7
Communication tools in MOOCs	0	0	0	0	1	4.8	0	0	0	0
Motivation and engagement of students	0	0	0	0	0	0	3	6.7	2	15.4
Comparison with other virtual educational strategies	0	0	0	0	0	0	1	2.2	0	0
Problems with the application of MOOCs	0	0	3	42.9	1	4.8	12	26.7	0	0
Pedagogical methodology and strategies	0	0	1	14.3	2	9.5	2	4.4	2	15.4
Learning theories and MOOCs	0	0	1	14.3	2	9.5	2	4.4	2	15.4
Others (including various topics for each contribution that are not covered by the proposed areas).	2	66.7	2	28.6	3	14.3	9	20.0	4	30.8
Total	**3**	**100**	**7**	**100**	**21**	**100**	**45**	**100**	**13**	**100**

Source: Prepared by the authors.

With regards to the distribution of topics by type of research in the articles studied, we can see that quantitative methods are fundamentally used for the following topics: «Designing content and materials» (44.2%), «Others» (20.9%), «Motivation and engagement of students» (11.6%), «Institutional benefits» (4.7%), «Economy in MOOCs: business model» (4.7%), and «Problems with the application of MOOCs» (4.7%). The areas where this methodology is least used are the following: «Problem of evaluation in MOOC courses: evaluation techniques and strategies», «Communication tools in MOOCs», and «Learning theories MOOC» (all 2.3%).

With regards to the qualitative methodology (Table 6), we find the greatest numbers of articles in «Problems with the application of MOOCs» (52.9%) and «Designing content and materials» (35.3%); the least covered areas are «Comparison with other virtual educational strategies» and «Pedagogical methodology and strategies» (both 5.9%).

The mixed methodology appears equally in two thematic areas relating to MOOCs, specifically «Designing content

and materials» and «Problems with the application of MOOCs» (both with 50%).

Finally, the documentary methodology is primarily present in the category of «Others», understood as the category that includes various themes in each contribution that are not listed in the proposed areas (44%), and «Learning theories and MOOCs» (24%). These are followed by «Designing content and materials» and «Problems with the application of MOOCs» (12%).

TABLE 6. Distribution of topics by type of research.

	Quantitative		Qualitative		Mixed		Documentary	
	f	%	f	%	f	%	f	%
Designing content and materials	19	44.2	6	35.3	2	50	3	12
Analysis and/or presentation of MOOC platforms	1	2.3	0	0	0	0	0	0
Institutional benefits	2	4.7	0	0	0	0	1	4
Problem of evaluation in MOOC courses: evaluation techniques and strategies	1	2.3	0	0	0	0	0	0
Economy in MOOCs: business model	2	4.7	0	0	0	0	0	0
Communication tools in MOOCs	1	2.3	0	0	0	0	0	0
Motivation and engagement of students	5	11.6	0	0	0	0	0	0
Comparison with other virtual educational strategies	0	0	1	5.9	0	0	0	0
Problems with the application of MOOCs	2	4.7	9	52.9	2	50	3	12
Pedagogical methodology and strategies	0	0	1	5.9	0	0	1	4
Learning theories and MOOCs	1	2.3	0	0	0	0	6	24
Others (including various topics for each contribution that are not covered by the proposed areas).	9	20.9	0	0	0	0	11	44
Total	**43**	**100**	**17**	**100**	**4**	**100**	**25**	**100**

Source: Prepared by the authors.

When dividing the thematic areas (Figure 4) by the design used for compiling the information provided in the articles analysed, we find that the experimental design occurs most frequently in «Designing content and materials» (50%), while the areas where this process is least used are «Analysis and/or presentation of MOOC platforms», «Problem of evaluation in MOOC courses: evaluation techniques and strategies», «Economy in MOOCs: business model» and «Problems with the application of MOOCs» (3.3% each).

The only topic that uses the ex post facto design is «Economy in MOOCs: business model», specifically the article called *Comparing the effectiveness of digital contents for improving learning outcomes in computer programming for autodidact students* in the *Journal of E-Learning and Knowledge Society*.

The case study research design appears mainly in the «Designing content and materials» (50%) topic; in contrast, this process for carrying out information collection is least used in the areas of «Communication tools in MOOCs», «Pedagogical methodology and strategies» and «Others» (all 7.1%).

The «Designs of content and materials» topic is covered in 66.7% of the cases that use evaluative research and the category of «Others, defined as the category that includes various topics for each contribution that are not covered by the proposed areas» in 33.3% of them.

Likewise, the quasi-experimental design is used most often in the «Designing content and materials» (50%) topic, while it appears less frequently in «Comparison with other virtual educational strategies» and «Learning theories and MOOCs» (both 12.5%).

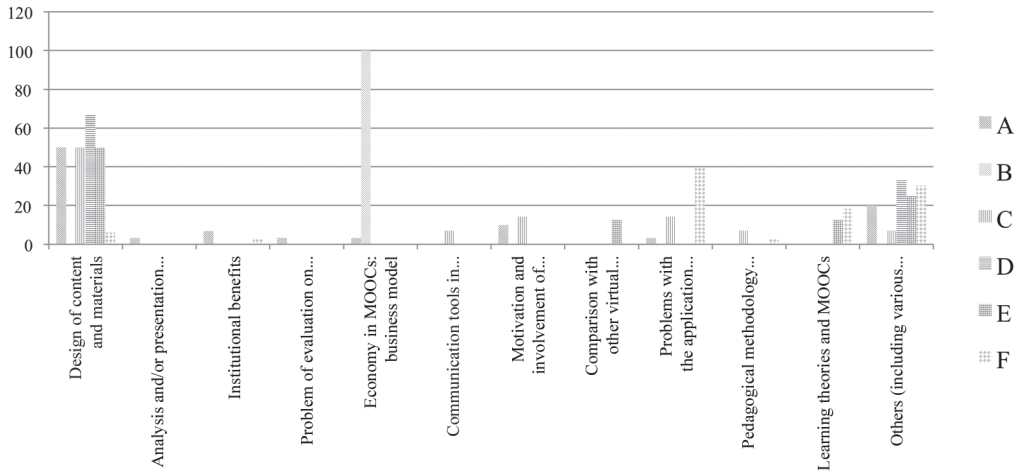

FIGURE 3. Distribution of topics by design.

Note: The categories established correspond to A: Experimental; B: Ex post facto; C: Case studies; D: Evaluative research; E: Quasi-experimental; and F: Ethnographic.

Finally, the ethnographic design is used most often in «Problems with the application of MOOCs» (39.4%); in contrast this type of data process is used least in the topics «Institutional benefits» and «Pedagogical methodology and strategies» (both 3.0%).

With regards to the instruments used in the articles from technology journals that were analysed according to the MOOC topics, we find that questionnaires are mainly used in «Designs of content and materials» (42.2%) and in «Others» (24.4%), while they are least common in «Analysis and/or presentation of MOOC platforms», «Problem of evaluation in MOOC courses: evaluation techniques and strategies», «Communication tools in MOOCs», «Problems with the application of MOOCs», and «Learning theories and MOOCs» (all 2.2%).

Interviews are used equally in four topics, namely: «Designing content and materials», «Comparison with other virtual educational strategies», «Pedagogical methodology and strategies» and «Others» (all 25%).

Narrative records and rating scales are only used in the topic of «Designing content and materials» (100% in both cases). In contrast, the Delphi technique is used in «Problems with the application of MOOCs».

The «Problems with the application of MOOCs» (Table 7) topic is mainly approached using instruments relating to document analysis (41.2%). This method is sued least for «Pedagogical methodology and strategies» (2.9%).

TABLE 7. Distribution of topics by instrument.

	1		2		3		4		5		6	
	f	%	f	%	f	%	f	%	f	%	f	%
Designing content and materials	19	42.2	1	25.0	3	100	2	100	0	0	5	14.7
Analysis and/or presentation of MOOC platforms	1	2.2	0	0	0	0	0	0	0	0	0	0
Institutional benefits	3	6.7	0	0	0	0	0	0	0	0	0	0
Problem of evaluation in MOOC courses: evaluation techniques and strategies	1	2.2	0	0	0	0	0	0	0	0	0	0
Economy in MOOCs: business model	2	4.4	0	0	0	0	0	0	0	0	0	0
Communication tools in MOOCs	1	2.2	0	0	0	0	0	0	0	0	0	0

	1		2		3		4		5		6	
	f	%	f	%	f	%	f	%	f	%	f	%
Motivation and engagement of students	5	11.1	0	0	0	0	0	0	0	0	0	0
Comparison with other virtual educational strategies	0	0	1	25.0	0	0	0	0	0	0	0	0
Problems with the application of MOOCs	1	2.2	0	0	0	0	0	0	1	100	14	41.2
Pedagogical methodology and strategies	0	0	1	25	0	0	0	0	0	0	1	2.9
Learning theories and MOOCs	1	2.2	0	0	0	0	0	0	0	0	6	17.6
Others (including various topics for each contribution that are not covered by the proposed areas).	11	24.4	1	25	0	0	0	0	0	0	8	23.5
Total	**45**	**100**	**4**	**100**	**3**	**100**	**2**	**100**	**1**	**100**	**34**	**100**

Source: Prepared by the authors.

Note: The categories established correspond to 1: Questionnaires; 2: Interviews; 3: Narrative records; 4: Rating scales; 5: Delphi technique; and, 6: Document analysis.

Finally, we considered the distribution of topics by the stages on which the analysed articles focus (Figure 4). It can be seen that in the university stage the most commonly occurring area is «Designs of content and materials» (41.4%), followed by «Others, defined as the category that includes various topics for each contribution that are not covered by the proposed areas» (17.2%). Meanwhile, among articles that focus on the university stage, the least repeated areas are «Analysis and/or presentation of MOOC platforms», «Economy in MOOCs: business model», and «Communication tools in MOOCs» (all 3.4%).

The pre-university stage is only covered in «Designing content and materials», specifically in the article «*Blending for student engagement: Lessons learned for MOOCs and beyond*» from the *Australasian Journal of Educational Technology*.

Likewise, the topic «Comparison with other virtual educational strategies» only covers the adult stage.

The post-university stage mainly appears in the category of «Others» (50%), while it appears least often in the topics of «Designing content and materials» and «Learning theories and MOOCs» (25% each).

Finally, the articles that focus on «Others», as an educational stage, appear most frequently in the topics of «Design-

ing content and materials» and «Problems with the application of MOOCs» (29.6% each). Meanwhile, the topics «Problem of evaluation in MOOC courses: evaluation techniques and strategies», «Economy in MOOCs: business model» areas (1.9% each) appear least often for this stage.

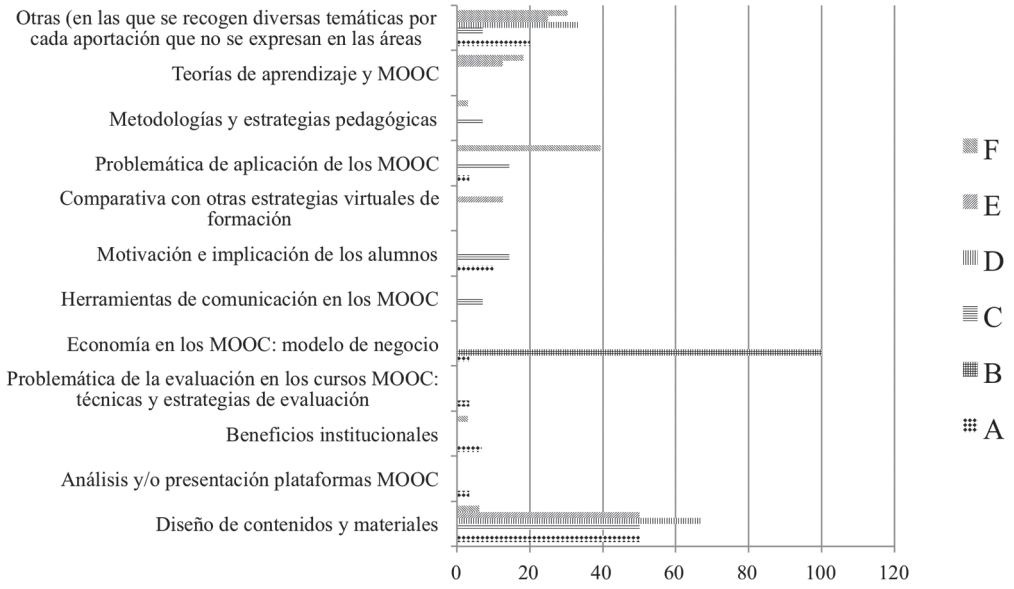

FIGURE 4. Distribution of topics by stage covered.

4. Conclusions and discussion of the results

The first thing we would like to note, is that the number of publications related to the topic of MOOCs has increased over the last five years, something that shows that it is a topic that is having a significant impact in the field of education, as noted by the Observatorio de Innovación Educativa del Instituto Tecnológico de Monterrey (Tecnológico de Monterrey, 2014). In this aspect of the work we agree with the conclusions reached by Zancarano and Souza (2017) who clearly identify this in their bibliometric study, where they also identify the strong presence of authors from Anglophone countries who are interested in the analysis of MOOCs.

We should also recognise that MOOCs have gradually lost their strong initial momentum as a disruptive technology. Consequently, they no longer generally appear in the latest Horizon Reports as an impact technology in the near future in the field of education (Johnson, Adams, Cummins, Estrada, Freeman, and Hall, 2016) and articles are also now starting to appear concerning the disillusionment they have created, owing to the significant expectations they have awoken (Rohs and Ganz, 2015) and concerning the need to reflect on quality in these educational ac-

tivities (Aguaded and Medina, 2015; Mengual and Roig, 2015; Ramírez-Fernández, 2015).

We can also see this educational interest in the major research-problem lines that stand out from our work, such as: «Design of content and materials» and «Problems with the application of MOOCs»; topics that have been tackled by different recently published works on MOOCs (Vázquez and others, 2015; Zancarano and Souza, 2017), although voices are also starting to appear that call for an analysis of their possible impacts on students' academic performance (Castaño, Maíz, and Garay, 2015).

We would also like to note that not only has the volume of works increased, but more significantly, from our point of view, they have done so in the direction of increasing research on its application to the educational field. This leads us to state that the documentary and literary technological phase of MOOCs has now passed and a phase is starting that reconsiders how to incorporate them into educational practice, how to design them and what type of methodological strategies can be applied with them, in other words, what Vázquez and others (2015) referred to as the pedagogical and quality challenges that MOOCs must confront.

In this increase in publications we agree with the work of Zancarano and Souza (2017), who clearly set this out in their bibliometric study, where they also note the strong presence of Anglophone authors who are interested in the analysis of MOOCs.

Our study shows that the areas in which the application of MOOCs is becoming established are, on the one hand, universities, and on the other, educational activities intended for the further training of people who have already received an education, in other words improving it. Aspects of educational application that have been identified by the great majority of the authors who from a theoretical perspective have recently been analysing the educational possibilities of MOOCs (Bonk and others, 20015; Vázquez and others, 2015).

In these conclusion we would like to note that the type of research that stands out is the quantitative, and this would be consistent with the meta-analyses that have been performed on other technologies such as e-learning (Cabero and others, 2008), highlighting that this type of paradigm is progressively gaining importance in the field of research into educational technology.

With regards to the information collection instruments, the most commonly used one is questionnaires in the «Design of materials and content» topic. The least used ones are narrative records and rating scales, these only being used in the «Designing content and materials» topic (in both cases 100%). In contrast the Delphi technique is used in «Problems with the application of MOOCs». Although other problems are starting to appear, such as that regulating to finding theoretical enclaves with educational and psychological theories, an aspect that has started to be considered by a number of authors in recent times (Terras and Ramsay, 2015).

We must note that in a significant number of works falling within the qualitative methodology, interviews with key informants are used to collect information about the opinions that different groups (teachers, learners and administrators) have with about the educational possibilities of MOOCs and their limitations (Hollands and Tirthali, 2014; Cano, Fernández, and Crescenzi, 2015).

Finally, we would like to note that our work has the limitation of focussing on journals that can be classified as falling within the topic —educational technology— and are open access, and this leads us to note the possibility of replicating it in more general education journals that are not open access. This at the same time opens up new perspectives for the future continuation of the research, such as expanding the list of journals, taking into account the place of origin of the authors, discriminating between free and paid-for journals, or contrasting the results with those obtained in other meta -analyses that have been carried out (Liyanagunawardena and others, 2013; Sangrà, González-Sanmamed, and Anderson, 2015; Aguaded, Vázquez-Cano, and López-Meneses, 2016; Zancarano and Souza, 2017).

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