Factors for academic success in the integration of MOOCs in the university classroom

Factores de éxito académico en la integración de los MOOC en el aula universitaria

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Abstract:

This paper shows the results of a longitudinal study on the integration of MOOCs in university classrooms and their influence on academic performance. The relationship between performance and course design and the type of student participation is discussed. Performance has been assessed through evidence of learning, while the design and influence of the type of participation have been examined using standard instruments: TAM (Technology Acceptance Model) and IMMS (Instructional Materials Motivation Survey). Evidence obtained shows that participation in a MOOC improves learning results, and that both the type of course design (defined by an intensive use of social networks and e-activities) and active participation have an influence on academic success.

Keywords: Research, higher education, MOOC, performance, student participation.

Resumen:

El presente trabajo muestra los resultados de un estudio longitudinal de integración de un MOOC en aulas universitarias presenciales y su influencia en el rendimiento académico. Se discute la relación del rendimiento con el diseño del curso y con el tipo de participación de los estudiantes. El rendimiento se ha evaluado a través de evidencias de aprendizaje, mientras que el diseño y la influencia del tipo de participación se han controlado a través de instrumentos estandarizados (TAM, Technology Acceptance Model, e IMMS, Instructional Materials Motivation Survey). Se obtiene evidencia de que la participación en un curso MOOC mejora los resultados de aprendizaje, y que tanto el tipo de diseño del curso (definido por una utilización intensiva de redes sociales y realización de e-actividades), como una participación activa influyen en el éxito académico.

Descriptores: Investigación, enseñanza superior, MOOC, rendimiento, participación de los estudiantes.

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1. Introduction

Since they first appeared, Massive Open Online Courses (MOOCs) have aroused great interest in the academic community and higher education, and not just because of the astonishing number of students from all around the world who take these courses for free, but also because of their great potential for defining new learning models and teaching methods that might change how traditional universities conceive education. Indeed, the extent of this is such that Brooks (2012) described them as the campus tsunami, the phenomenon that will change the university suddenly and for ever (García Aretio, 2015).

This interest that MOOCs have awoken in the academic community has resulted in the existence of a large number of works that have moved to the information and academic worlds (Aguaded, Vázquez-Cano, & López-Meneses, 2016). Research that cannot, however, hide the criticisms made by many researchers who note that high-impact academic production is in a nascent and little-developed phase, and pays more attention to a theoretical approach than to empirical accounts (López-Meneses, Vázquez-Cano, & Román, 2015). This position is shared by Cabero (2015) who advocates expanding research into the real educational possibilities of MOOCs, beyond favourable or unfavourable opinions that are not evidence-based.

This starts by reviewing the trends in research on MOOCs as well as the academic studies relating to the integration of MOOCs into the curriculum. Secondly, the research carried out is presented with its objectives, methodology, results, and discussion.

2. Trends in research on MOOCs

The body of work published since 2012 has, in Breslow's opinion (2016), gone through two different stages: the initial research completed between 2012 and 2013, and the rapid increase in academic publications from that moment, which has expanded both the agenda of research topics and the study methodologies used.

Accepting this viewpoint, although expanding the initial research stage to the years 2010 and 2011, early studies revolve around the very concept of the MOOC; despite its youth this is a concept with many meanings that is undergoing constant transformation. So, despite MOOCs using a flexible teaching style with little standardisation, different authors suggest distinguishing between «connectivist» c-MOOCs and more «traditional» x-MOOCs. This difference directs the earliest research along three different lines: a) comparative studies between representative Artificial Intelligence (AI) courses at Stanford (Udacity, Coursera) and the c-MOOC formats (Rodriguez, 2012); b) studies related to connectivist courses (Kop & Fournier, 2011; Kop and others, 2011), more focussed on the transformative effects on the conventional structures for generating knowledge than on the rigorous measurement of learning outcomes; and c) initial studies on the first xMOOCs by MIT and Harvard, relating to the management of the resources and the learning models of different types of student (Breslow and others, 2013).

At the end of this initial stage we can find noteworthy works that present different categories with which to analyse earlier research. Liyanagunawardena, Adams and Williams (2013) review the literature on MOOCs from 2008 to 2012, although several of the studies they select do not focus on empirical research. They identify four main topics as the most important: (1) the need to explore the perspectives of all parties interested in MOOCs (students, creators, teachers, institutions, etc.), taking into account the advantages and disadvantages of each viewpoint; (2) the cultural tensions within MOOC pedagogies, resources, and learning environments; (3) the ethical aspects of the use of the data generated by MOOCs; and (4) analysis of students' effective strategies for handling information overload and self-paced learning.

Kennedy (2014), in a review of literature from 2009 to 2012, recommends focussing on three main areas in future research into MOOCs: 1) a better understanding of students, their types of behaviour, and the social nature of the learning; 2) the major differences in pedagogical approach between the two classical MOOC models; 3) the implications of MOOC courses being included in formal education institutions.

The amount of research created since 2013, which in just one year exceeded what was published over the previous four years, means it is advisable to organise the information into clear categories. In this vein, Jordan (2014a) presents an online sketch of the research literature on MOOCs including over 250 entries, to which she associates keywords and tags. Participation by students in a MOOC course stands out from the tag cloud, followed by measurement and evaluation (advances in automatic evaluation, peer evaluation, etc.), dropout rates, and demographic characteristics of the students.

A different work is presented by Gasevic, Kovanovic, Joksimovic, and Siemens (2014), whose results reveal the principal topics that comprise the framework for future MOOC research: 1) participation by students and academic performance; 2) MOOC and curriculum design; 3) self-paced learning and social learning; 4) analysis of social networks and online learning; and 5) motivation, attitude, and academic success.

Following the methodology proposed by Liyanagunawardena and others (2013), Sangrà González-Sanmamed, and Anderson (2015) perform a meta-analysis of the research on MOOCs carried out in the 2013-14 period, focussing on the publications that present results of research into the subject of MOOCs. They identify a total of 228 pieces of research in the period of the two years studied. They conclude that the topics researched most often in this period were those relating to the evaluation of pedagogical strategies and, especially, students' motivation and engagement.

In their research review, Castaño, Maiz, & Garay (2015a) understand that the pedagogical design of MOOCs, the interactions between students and the learning perspectives and their associated variables (motivation, attitudes) appear as the major research lines (Barak,

Watted, and Haick, 2016; Littlejohn, Hood, Milligan, & Mustain, 2016; Alario-Hoyos, Muñoz-Merino, Pérez-Sanagustín, Delgado Kloos, & Parada, 2016). The areas that stand out alongside this perspective focussed on learning, include questions relating to cost, universal access to higher education (Karsenti, 2013; Hollands & Tirthali, 2014; Sangrà and others, 2015), the problem of student retention rates (Jordan, 2014b), and the problem of integrating MOOCs into formal university studies (Kennedy, 2014; Hollands & Tirthali, 2014; Sangrà and others, 2015).

Finally, Veletsianos & Shepherdson (2016) perform an analysis of experimental research into MOOCs, and after reviewing the source of the academic works and the most cited references, they conclude that the main lines studied are the following:

1) Research focussing on students (83.6% of studies). Topics relating to course completion and student retention stand out.

2) Research focussing on questions of design (46.4%). Topics relating to the design, creation, and implementation of MOOC courses stand out.

3) Research on the context and impact of MOOCs (10.9%). This includes research on perceptions, the usefulness of MOOCs as an educational medium and economic impact.

4) Research focussed on the figure of the instructor (8.2%). This line has had very little development and has generally been linked to the perspectives and experiences of the instructor.

3. The integration of MOOCs into face-to-face university teaching

Perhaps because the very emergence of MOOCs (Fini, 2009) was linked to university teaching, or maybe because it is something that raises questions the institutions (their structure, their pedagogical, management, and business model) as well as the teachers and their roles and competencies (Sangrà and others, 2015), the interest of universities and institutions in incorporating them is undeniable.

A good example of this interest is the report prepared by the European Commission (European Commission, 2014) which, after recognising that the debate surrounding digital learning is dominated by MOOCs, states that the impact of technology will be even greater in future and that governments must stimulate and support greater integration of new technologies and of the pedagogical approaches associated with it in the conventional offer.

The Conferencia de Rectores de las Universidades Españolas (Spanish University Rectors' Association – CRUE, Gea, 2015) also underscored the involvement of MOOCs in the teaching provided in universities and in the accreditation processes for the knowledge acquired in the course and their validity for academic purposes. It proposes two ways of considering them as a type of teaching: as another type of online course (with similarities in implementation and evaluation) and as teaching resources. The student can follow them autonomously and they can be used in face-to-face classes.

As we have seen, the research community too, has been interested in incorpo-

rating MOOCs within the formal education institutions since they first appeared. Yuan and Powell (2013) note that it is possibly an error to consider MOOCs to be a new isolated development about which strategic decisions must be taken, given that they form part of a broader landscape of changes in higher education, underlining their potential for improving teaching and encouraging innovation and new pedagogical practices. On the other hand, Hollands & Tirthali (2014) believe that MOOCs should be understood in formal formative settings more as educational resources to complement teaching in the classroom than as independent courses in themselves, and that they should possibly be aimed at specific audiences. Along the same lines, Dillenbourg, Fox, Kirchner, Mitchell, & Wirsing (2014) identify the question of integrating MOOCs into university education as the main challenge to confront in these moments.

The uses to which MOOCs are being put in universities differ notably from their original design, and bring them closer to classical trends in traditional higher education (Haywood, 2016). They are being used as online courses for face-to-face students (MIT News, 2014), as credits for university students, or as educational content that is worked on using «flipped classroom» methodology (Karlsson & Janson, 2016), etc. In this sense, research points to the use of hybrid and blended MOOCs as a method for using MOOCs in formal teaching settings (Castaño, Maiz, & Garay, 2015b; Delgado-Kloos, Muñoz-Merino, Alario-Hoyos, Estevez-Ayres, & Fernández-Panadero, 2015; Israel, 2015).

Israel (2015) reviewed the different methodologies for using blended MOOCs in face-to-face teaching in higher education, addressing their effectiveness in students' learning. This focus on students' learning is interesting, and in Reich' opinion (2015) is a neglected variable in research on MOOCs. We agree with Reich (2015) that, beyond the factors that affect the completion rates for students and student retention on the courses, future studies must pay more attention to what students learn rather than simply what they do.

Israel (2015) distinguishes between five different integration models that, in all cases, lead to the following conclusions: 1) a positive but modest impact on the students' learning outcomes; 2) no evidence of a negative effect on any of the subpopulations studied; and 3) a low level of student satisfaction with the experience of introducing a MOOC course in face-to-face teaching.

On the other hand, and taking into account Holotescu, Grossekc, Cretu, & Naaji's differentiation (2014), the integration models studied suffer from a lack of synchronisation between the MOOC courses and the face-to-face teaching itself. That is to say, the academic content of the MOOC course is basically used as a digital resource. The students access these resources but the tasks, discussions, and evaluations are part of the university course itself, not the MOOC course. This is, therefore, a lax integration of MOOCs into university teaching, given that the social activity of the MOOC is lost from view. In other words, not just studying the material, but also participating actively participating in the social part of the learning: solving

tasks, discussion forums, peer evaluations, additional materials, participation in the learning community, and so on.

It is, however, significant that various pieces of research identify the social effects of participating in a MOOC as one of the influential factors in both improving learning outcomes and course completion and student retention on it (Rosé et al, 2014; Yang, Wen, Kumar, Xing, & Rosé, 2014; Brooks, Stalburg, Dillahunt, & Robert, 2015).

In this work we have opted to integrate a cooperative open MOOC with face-to-face teaching that is synchronised with the course (Holotescu and others, 2014) and we consider the following variables: academic performance, design of the MOOC course, and type of participation by the students.

4. Methodology

The objective of this work is to analyse the impact on academic performance of integrating a cooperative MOOC into university classes. With this aim the following research questions were formulated:

1. Is a MOOC integrated into a university degree module effective for students' learning?
2. Do social factors contribute to academic success in a MOOC?
3. What type of participation in the MOOC results in the highest level of academic performance?

A longitudinal study was performed, based on the experience of integrating a MOOC over three academic years. The MOOC course on which this work is based was designed placing the emphasis on cooperation because this factor was the most highly valued by experts, consulted using an two round Delphi study with the objective of defining the design of the MOOC, in relation to learning on massive open online courses (Castaño and others, 2015a). Consequently, the tasks set throughout the course, called e-activities, had to be shared on social networks so that the rest of the participants could be aware of them and make other contributions about them.

This course can therefore be classified as a cooperative MOOC. From this perspective, cooperative MOOC courses are an attempt to react to the heterogeneity of the participants in a MOOC by delivering an x-type course while integrating some of the advantages of connectivist courses (Fidalgo, Sein-Echaluce, & García Peñalvo, 2013): intensive use of social networks, creation of learning communities (Delgado-Kloos and others, 2015), and use of personal learning environments (Castaño & Cabero, 2013; Torres & Gago, 2014).

The MOOC was designed for the students from the fourth year of the Degree in Primary Education at the University of the Basque Country, although because of its very definition it was opened online to anyone who was interested in the subject, as can is the case in other MOOC experiences (Siemens, 2012; Knox, Bayne, Macleod, Ross, & Sinclair, 2012).

Synchronised integration of the MOOC course into the module, was therefore, chosen (Holotescu and others, 2014). In other words, the students not only access and study the materials, but they also participate actively in the social element of learning: solving tasks, discussion forums, peer

evaluations, additional materials, participation in the learning community, and so on.

This was a course lasting five weeks that comprised five modules on topics relating to e-learning, web 2.0, PLEs, MOOCs, digital content, and educational experiences based on m-learning. In all of the cases the original cooperative design of MOOC courses was respected, but the means of communication and for creating networks of cooperation between the participants were adapted to the characteristics of the platforms that hosted it. The MOOC was published each academic year on a different platform: on the first occasion Metauniversidad was used based on Chamilo, a free software solution for managing e-learning distributed under the GNU/GPLx3 licence; the second edition was on MetaMOOC on the free code EdX platform, and thirdly on MiriadaX.

The number of people registered on the MOOCs was 2,358 (744 in the first edition, 481 in the second, and 1,133 on the third). The research sample comprised one sub-population defined by fourth year students taking the university courses intended for training primary school teachers over three successive academic years. This comprises 150 subjects, 53 students from the first edition, 43 who took part in the second, and 54 in the third.

As for academic performance, the teaching team ranked each of the e-activities performed by the students, obtaining average grades, independently of the results that each platform offers. As well as the evaluations performed by the teaching team to classify the students' academic performance in each of the three editions of the MOOC, the overall grade for the module was also taken into account.

For collecting the data the IMMS (Instructional Materials Motivation Survey) scale was also used, adapted the MOOC context. This questionnaire, which uses a Likert scale, consists of 36 items from four categories (attention, confidence, satisfaction, and relevance) and is based on Keller's ARCS model of motivation (1987). Specifically, the proposal by Di Serio, Ibáñez, & Delgado (2013) was used, with a documented reliability coefficient of 0.96, adapting it slightly to the field of MOOCs. Four questions about the type of design were added, taken from the TAM (Technology Acceptance Model) questionnaire (Wojciechowski & Cellary, 2013) and the type of participation by students, according to their own perception, based on the proposal by De Waard (2013): lurking, moderately lurking, active, individualist, and collaborative.

5. Results

Having performed the data analysis, the results are presented below following the order of the defined research questions. With regards to the first question (1. Is a MOOC integrated into a university degree module effective for students' learning?), the answer is affirmative. It can be stated that participating in a MOOC integrated into a module in a synchronised way improves students' academic performance, especially for those students who obtain lower grades.

To perform this analysis the students were divided into four blocks in relation to the grade received through a k-means clustering analysis. The first block comprises those with the highest average grade, 8.995

on the MOOC and 8.6967 on the module; those in the second block average 8.3281 on the MOOC and 7.8290 on the module; those in the third block average 8.085 on the MOOC and 7.1074 on the module; and those in the fourth block 7.443 and 5.9743 respectively. In contrast with these results, it was found that the overall average grades are 8.460 on the MOOC compared with 7.8613 on the module. Therefore, the average grade obtained on the MOOC course exceeds that from the module for all four groups of students by half a point (0.5). The greatest difference is found between the students from the fourth group whose average on the MOOC exceeds by almost one and a half points (1.4687) the grade obtained on the face-to-face degree course. In contrast, the students with the narrowest gap are those from group 1 (0.2983), followed by those from group 2 (0.4991), and finally those from group 3 (0.9776). Therefore the difference in grades between those obtained on the MOOC and those from the module increases as the average mark for the module becomes lower.

After performing the ANOVA analysis to confirm this result it is possible to verify that each group scores significantly higher than the next one. In other words, group 1 significantly higher than group 2, this group scores more than group 3, and so on successively (see Table 1).

TABLE 1. Cluster analysis and multiple comparisons.

(I) Cluster case number	(J) Cluster case number	Mean difference (I-J)	Standard error	Sig.	95% confidence interval	
					Lower limit	Upper limit
1	2	.7411*	.04900	.000	.6105	.8717
	3	1.2498*	.06259	.000	1.0829	1.4166
	4	2.1375*	.10389	.000	1.8605	2.4144
2	1	-.7411*	.04900	.000	-.8717	-.6105
	3	.5086*	.05742	.000	.3556	.6617
	4	1.3964*	.10086	.000	1.1275	1.6652
3	1	-1.2498*	.06259	.000	-1.4166	-1.0829
	2	-.5086*	.05742	.000	-.6617	-.3556
	4	.8877*	.10812	.000	.5995	1.1759
4	1	-2.1375*	.10389	.000	-2.4144	-1.8605
	2	-1.3964*	.10086	.000	-1.6652	-1.1275
	3	-.8877*	.10812	.000	-1.1759	-.5995

Based on observed means
The error term is the root mean square (Error) = .065
*. The mean difference is significant at .05
Source: prepared by the authors

Figure 1 shows the correlation established between the performance groups (k-means cluster) and their average grades on the MOOC and on the module. Group 1, the one with the highest grades, has the smallest difference between the mark for the MOOC course and the grade for the module. However group 4, that is defined as the group with the worst grades, is the one that shows the greatest difference between the mark for the MOOC and the overall mark for the course. Therefore it is shown that an effect occurs between the groups where the higher scoring groups lift the lower scoring ones. So, while group 1 does not have anyone to lift it, group 4 has three groups ahead of it who help it, something that has a positive influence on their results, which improve when they take the MOOC.

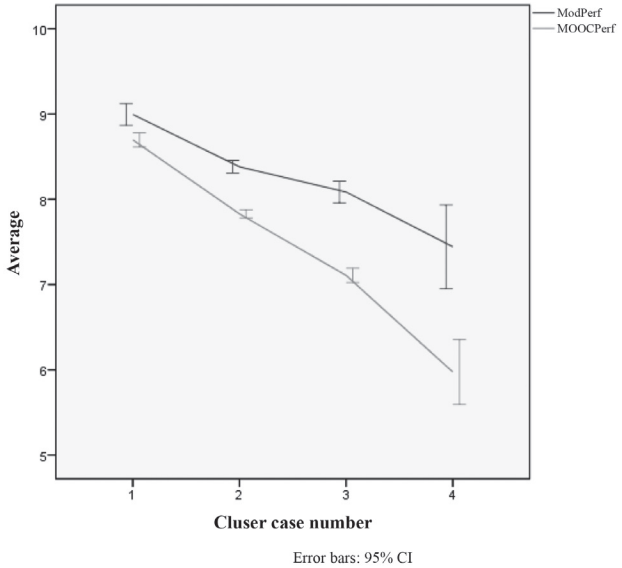

FIGURE 1. K-means cluster performance on MOOC and module.

It is shown that taking a MOOC that is integrated into the degree module has a positive influence on improvement in academic results, especially, with those students who obtain lower scores.

The second research question (2. Do social factors contribute to academic success in a MOOC?) proposes examining the social group of participation, the basic characteristic of a cooperative MOOC. To answer this question, three editions of a massive open online course were analysed in a longitudinal study. In this analysis it has been noted that there are significant differences in the academic performance of the students between the first two editions and the third edition of the MOOC (0.047 and 0.001 respectively). We should recall that the first and second edition were designed with a more collaborative style, in contrast, the third edition was more focussed on activities that promoted less interaction between the participants.

With regards to the average marks obtained it can be seen that there is little difference between the first two editions, the mean result being almost the same: 7.88873 in the first one and 8.0849 in the second. In contrast, both of them differ considerably from the average result obtained in the third (7.5452) where the design focussed less on collaboration. The overall average that is obtained for academic performance taking into account all three editions is 7.8613, and students obtain the best results in the second edition (8.0849).

Following the analysis of the results from the four variables of the IMMS questionnaire (confidence, attention, satisfaction, and relevance), students from the first edition of the MOOC have the best opinion of the characteristics of the course. In the analysis of the data from this first edition (see Table 2) and in relation to the other two editions, significant results are obtained for three of the four IMMS variables: attention (0.000 and 0.039), relevance (0.002 and 0.008), and satisfaction (0.001 and 0.023). Likewise, participants in the first edition rate the general design of the course significantly more positively in comparison to the second (0.03) and the third editions (0.029).

TABLE 2. Multiple comparisons. Tukey's HSD.

Dependent variable	(I) Year	(J) Year	Means difference (I-J)	Standard error	Sig.	95% confidence interval	
						Lower limit	Upper limit
Design	1.00	2.00	2.248*	.671	**.003**	.66	3.84
		3.00	1.862*	.722	**.029**	.15	3.57
	2.00	1.00	-2.248*	.671	.003	-3.84	-.66
		3.00	-.386	.734	.859	-2.12	1.35
	3.00	1.00	-1.862*	.722	.029	-3.57	-.15
		2.00	.386	.734	.859	-1.35	2.12
Attention	1.00	2.00	4.047*	1.046	**.000**	1.57	6.52
		3.00	2.690*	1.091	**.039**	.10	5.27
	2.00	1.00	-4.047*	1.046	.000	-6.52	-1.57
		3.00	-1.357	1.120	.448	-4.01	1.30
	3.00	1.00	-2.690*	1.091	.039	-5.27	-.10
		2.00	1.357	1.120	.448	-1.30	4.01
Confidence	1.00	2.00	2.065*	.749	**.018**	.29	3.84
		3.00	-.029	.787	.999	-1.89	1.83
	2.00	1.00	-2.065*	.749	.018	-3.84	-.29
		3.00	-2.095*	.807	.028	-4.01	-.18
	3.00	1.00	.029	.787	.999	-1.83	1.89
		2.00	2.095*	.807	**.028**	.18	4.01

Dependent variable	(I) Year	(J) Year	Means difference (I-J)	Standard error	Sig.	95% confidence interval	
						Lower limit	Upper limit
Satisfaction	1.00	2.00	3.784*	1.051	**.001**	1.29	6.27
		3.00	2.969*	1.110	**.023**	.34	5.60
	2.00	1.00	-3.784*	1.051	.001	-6.27	-1.29
		3.00	-.815	1.133	.753	-3.50	1.87
	3.00	1.00	-2.969*	1.110	.023	-5.60	-.34
		2.00	.815	1.133	.753	-1.87	3.50
Relevance	1.00	2.00	3.895*	1.127	**.002**	1.22	6.56
		3.00	3.655*	1.199	**.008**	.81	6.49
	2.00	1.00	-3.895*	1.127	.002	-6.56	-1.22
		3.00	-.240	1.224	.979	-3.14	2.66
	3.00	1.00	-3.655*	1.199	.008	-6.49	-.81
		2.00	.240	1.224	.979	-2.66	3.14

*. The means difference is significant at 0.05.
Source: prepared by the authors.

In contrast, for the confidence variable the best results are found among students from the second edition who value this aspect significantly better than students from the first and third editions of this MOOC (0.018 and 0.028 respectively).

In summary, students who participated in the first editions of the more collaborative MOOC had a more positive view of its design and the outcomes of participating in it. According to their perspective, the collaborative design of the MOOC contributed to improving their confidence in themselves, it was more relevant, and their satisfaction with the learning task performed was greater.

With regards to the third question (3. What type of participation in the MOOC results in the highest level of academic performance?) there is a significant relationship (0.010) between the type of participation and the academic performance obtained in the case of participants who describe themselves as «active and collaborative», these are also the students who show the best academic performance. Significant results are also obtained for the continuous variables of relevance (0.004), design (0.039), and satisfaction (0.039).

Taking the analysis a step further, a multiple regression was performed to see which of the variables studied is the most relevant for predicting academic results. By isolating the variables it becomes clear that the type of participation is less important in relation to academic performance and, as can be seen in Table 3, the only variable that directly and significantly influences performance is relevance (0.028).

TABLA 3. Relación entre rendimiento académico y variables.

Model		Non-standardised coefficients		Standardised coefficients	T	Sig.
		B	Standard error	Beta		
1	(Constant)	6.338	.434		14.606	.000
	Design	.007	.025	.032	.276	.783
	Satisfaction	-.025	.022	-.188	-1.157	.249
	Relevance	.044	.020	.348	2.218	.028
	Type Participation	.084	.047	.157	1.775	.078

a. Dependent variable: MOOCPerf
Source: prepared by the authors.

As a result, it is shown that academic performance is conditioned because the students perceive that the design of the MOOC is relevant in itself, and not so much because of the type of participation that the student displays on the MOOC course.

6. Discussion

The state of the art in research on MOOCs can be described as fragmentary, taking into account the various epistemological and ontological conceptions of the different authors regarding what should be studied. As an overview, Veletsianos and Shepherdson (2016) classify experimental research on MOOCs by four trends focussing on students, on design, on the context and social and educational impact, and on the figure of the instructor.

The research presented covers three of these major categories, as it focusses on the educational impact of a cooperative MOOC design, considering variables relating to the students: type of participation, and their academic performance.

The MOOC concept, despite being relatively new, has a range of meanings and is undergoing continuous transformation. New ideas have been added to the classical distinction between «connectivist» c-MOOCs and more «traditional» x-MOOCs, such as cooperative MOOCs (Fidalgo et al, 2013; Castaño et al, 2015a; Delgado Klos and others 2015; Israel, 2015). In this vein, the search for new pedagogical formats in university education with new digital education environments deriving from MOOCs is an emerging research topic. This, in turn, provides an opportunity to position the students' learning in these formats as one of the key variables to consider (Reich, 2015).

The efficacy of a formative proposal for a MOOC in university classrooms will depend on both the integration proposed and on the pedagogical design of the course itself. Different ways of integrating MOOC courses in university teaching have been

researched (Israel, 2015), with positive albeit modest results with regards to the students' learning. The research presented corroborates these results, and shows that participation in a cooperative MOOC integrated into a module is a factor that encourages students' learning, not only in the results from the MOOC course itself, but also in the face-to-face university module as a whole. This positive influence is especially apparent with those students who display a lower academic performance. This is because of the effect that occurs among the students on the MOOC, as the students with lower marks are lifted by the higher scoring ones. Therefore collaboration between participants on the MOOC helps those students who receive lower grades to improve on the module.

The type of MOOC integration that has been carried out in the research is an example of what Holotescu and others (2014) call a synchronization perspective, where students not only access the study materials, but also actively participate in their social group as another component in the development of the module. This is the most complex and effective way of integrating a MOOC into a face-to-face module. The results of the research confirm the efficacy of this form of integration.

The cooperative MOOC course design was maintained across the three editions, although their forms of communication and of creating social networks among participants had to be modified in accordance with the characteristics of the different platforms that hosted it. In this vein, it should be noted that participants on the more cooperative editions of the massive open online course obtained better academic results. Furthermore, these students gave significantly positive responses regarding their opinion on the design of the cooperative MOOC that promotes scenarios for creating learning networks, and that in turn can have an influence on the student's academic success in the face-to-face module that she takes.

The third variable analysed relates to the type of participation by students. The rates of completion of studies (Jordan, 2014b), retention, and the behaviour of different subpopulations of students (Reich, 2014) are variables that are studied in the literature. The latter author shows that the certifications obtained by the students vary substantially according to their intentions. This research is interested in the subpopulation of the students enrolled on a face-to-face university module who take a MOOC in which they participate along with the community interested in the subject matter.

In this study it has been found that the students who achieve the greatest academic success are those who see themselves as active and collaborative within the dynamic of the MOOC. This seems to be a logical result taking into account that in a MOOC with these design characteristics the social group is especially relevant. These results confirm the power of social factors in academic success, along the lines of what Rosé and others (2014) or Brooks and others (2015) proposed.

Taking a further step, it has been shown that even though this type of active and collaborative participation is the one that obtains the best results, the type of participation in itself is not the key factor

for predicting the student's academic success. In fact the conditioning factor for attaining high academic performance is that the participating students believe that the design of the course is relevant to the development of their learning within the MOOC and that it is also positive for their work on the module.

7. Conclusions

The integration of MOOCs in conventional classrooms offers new opportunities for searching for innovative pedagogical formats in university teaching, in both its online and face-to-face aspects. A series of factors stand out in this work that affect the academic success of this integration.

Firstly, it identifies hybrid and blended MOOCs as the priority option for improving the learning of university students. These promote the attainment of positive academic results, not only on the MOOC itself but also in the modules that include it. It also stands out that the MOOC must be integrated into the module in a synchronised way and not just as a mere complementary educational resource. Thirdly, the importance of social participation in the learning process must be emphasised, as this contributes to collaboration between the participants and the students who obtain the best results value this characteristic very positively. These students lift those who have lower results, contributing to an improvement in their learning. It is also shown that the type of participation by the students is a weak predictor variable of academic success, insofar as it is conditioned by the students perceiving that the design of the MOOC is relevant in itself. It is accordingly confirmed that relevance is the variable that has a direct and significant influence on performance.

In future studies, analysing whether studying the MOOC at the start of the module would improve students' results even further could be examined, as the effect whereby better performing students lift the results of worse performing ones would increase over time. On the other hand, different platforms were used in the different editions of the course, and so this limitation should be overcome using other more refined systems in future studies to allow for a more comprehensive comparison of results.

The future of research into MOOCs will, to a great extent, depend on new hybrid designs, in both their technological and pedagogical aspects, and on making learning and students' academic results the focal point of the research. On the other hand, this will require more sophisticated and broader methodological designs that pay more attention to the causal factors that promote learning.

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