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RESEARCH ARTICLE

Typology of motivation and learning intentions of users in MOOCs: the MOOCKNOWLEDGE study

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Abstract
Participants in massive open online courses show a wide variety of motivations. This has been studied with the elaboration of classifications of the users according to their behavior throughout the course. In this study, we aimed to classify the participants in the MOOCs according to the initial motivations and intentions, before long interaction with the online device. Using a survey of 1768 participants in 6 MOOCs, we classify the participants according to: internal motives, external motives and intention of persistence. Three profiles of involvement in the course were identified: poorly motivated (16.7%), self referential (28.8%) and highly committed (54.5%). All three profiles showed significant differences in self-reported learning experiences at the end of the course. The intensity of the initial motivation was positively related to the satisfaction and perceived quality of the training experience. According to our analysis, identifying motivational profiles before starting the course allows to diagnose in advance the educational use and the diversity of individual training itineraries.

Keywords Open education · Massive open online courses · Types of participants · Initial motivations · Self-regulation skills · Learning intention · Cluster analysis

Introduction

Massive online open courses (MOOCs) are online educational resources addressed to a large number of participants, generally for free and with no access restrictions (Cesareni et al. 2014; Israel 2015; Jansen et al. 2015). The content has didactic objectives and a specific curricular design. It is specifically elaborated to be used for a variable period of time and to facilitate flexible learning patterns, at any time and place.

The views expressed in this article are purely those of the authors and should not be regarded as the official position of the European Commission.

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MOOCs are offered by a variety of providers,[1] some implementing them as part of initiatives to promote open education and lifelong learning, and others simply incorporating them into university curricula, as credits. The courses usually develop content through video lessons, discussion forums and small assessment tasks. In some cases, they are designed and implemented to create communities of practice that generate knowledge and gain added value from the interaction between participants (Watson et al. 2016; Zhang 2016; Zhang et al. 2016).[2] They can also be effectively integrated with face-to-face sessions (Israel 2015).

The term MOOC was coined by Dave Cormier and Bryan Alexander in 2008, in a pioneering experience developed at the University of Manitoba, Canada (Moe 2015). This experience was influenced by the movement to promote open educational resources (OER) in the 1990s and the publication of teaching materials as open content, initiated with the launch of the *OpenCourseWare* (OCW) project of the Massachusetts Institute of Technology (MIT) in 1999 (Alario-Hoyos et al. 2017; Greene et al. 2015; Jansen et al. 2015).

The most significant development occurred in 2011, when Stanford University began experimenting with free online teaching, originally in the form of master classes in virtual format directed at a large number of students (Greene et al. 2015). Specialized platforms such as Coursera, Udacity and edX were then developed, supporting the expansion of MOOCs around the world. In Europe, several platforms such as *FutureLearn*, *Iversity* or *MIriadaX* were developed, along other initiatives that promote cooperation among MOOC providers such as *OpenUpEdu* (Jansen et al. 2015). At the political level, the communication of the European Commission "Opening Up Education: Innovative Teaching and Learning for All through New Technologies and Open Educational Resources" (European Commission 2013) supports the implementation of open education in the European continent.

MOOCs were originally proposed as a way to bring good tertiary education closer to a population with limited resources, overcoming economic, geographic or time availability barriers, among others. However, in practice, only a minority of MOOC users have limited access in terms of educational opportunities. The bulk of the participants are people with higher education, qualified jobs and from developed countries. They typically enroll in this type of courses to acquire or recycle knowledge and to develop their professional skills, either to improve their work performance or to change their professional career (Castaño-Muñoz et al. 2017; Greene et al. 2015; Liu et al. 2015; Loizzo and Ertmer 2016; Schmid et al. 2015).

The contribution of MOOCs for education innovation has also been questioned, given they often reproduce traditional teaching practices, or simply adapt the usual methods to the online format (Alario-Hoyos et al. 2017; de Freitas et al. 2015; Margaryan et al. 2015). Accordingly, the need for a thorough evaluation of how MOOCS work in practice and how the different needs of the students are met is needed. In this study, we examine students'

[1] Some of the most well-known platforms emerge at the university level, such as Coursera <http://www.coursera.org/> and Udacity <https://www.udacity.com/> at Stanford University, and edX <http://www.edx.org> at MIT and Harvard University. Subsequently, they have extended their services to other universities.

[2] Literature has distinguished between xMOOC, which gives priority to student-content interaction, and cMOOC, which promotes student–student interaction. The xMOOCs focus on content transmission and often resort to video lessons followed by brief exams. The cMOOCs are based on the active role of the students in the learning process and emphasize the autonomy, creativity, and participation of learners, who deploy their capacity to generate new content.

experience in a selection of 6 MOOCS, specifically looking at the individual differences in terms of learning intention, motivation and behavior.

Background

The dropout rates of participants in MOOCs range from 90 to 95 percent of the students enrolled, putting into question their educational value (Alario-Hoyos et al. 2017; Jordan 2014; Loizzo and Ertmer 2016; Perna et al. 2014). This has led to study of the peculiarities involved in participating in this type of courses. Accordingly, we next review previous research on the role of self-regulation competencies and motivational aspects in educational performance. We also examine individual differences, summarizing the main classifications of user types according to their degree of involvement in training activities.

Self-regulation competences and motivational aspects

MOOCs provide a flexible learning context, in which students decide when, how and from where they access the material, what content they develop and in what activities they participate (Banerjee and Duflo 2014; Bulger et al. 2015; Castaño-Muñoz et al. 2017; Liu et al. 2015). Consequently, the individual's ability to regulate his or her own learning process and adjust behavior to context is critical. Self-regulation is based on the student's ability to establish his/her own objectives, deploy effective learning strategies and seek help in case of need (Littlejohn et al. 2016).

Students manage themselves without close supervision by teachers, utilizing their time according to their own interests and in a context of weak commitment, given in most cases they have not paid any registration fees (Radford et al. 2014).[3] Adequate performance seems to be connected with the sense of belonging to the users group (Bulger et al. 2015), along with language management and adaptation to cultural diversity in a heterogeneous group of participants (Literat 2015; Rambe and Moeti 2017).[4]

Participants in MOOCs are guided by elements of intrinsic motivation, related to learning and accomplishment of the task, or extrinsic, aimed at obtaining a certificate or achieving specific professional purposes. Thus, the objectives of the students range from achieving tangible results at the end of the course such as acquiring expertise in a particular field of competence (with a long-term commitment) to developing personal contacts through active involvement in the discussion forums (Bulger et al. 2015). The diversity of personal goals is reflected in the indicators of persistence and completion of the course (de Barba et al. 2016). Many students consider MOOCs as a context for open and informal learning. As yet, interest in achieving a pay rise or find a new job can be a decisive factor in the completion of the course (Castaño-Muñoz et al. 2017).

From the point of view of design, this has resulted in the incorporation of interactive elements or "gamification" (Deterding et al. 2011), the incorporation of content of a

[3] In some cases, it has been observed that the payment of an enrollment fee in order to obtain a certificate attesting the completion of the course may function as a protective element of abandonment (Alario-Hoyos et al. 2017).

[4] The combination with face-to-face study groups seems to promote a sense of community and the exchange of social support, contributes to participant motivation, and reduces dropout rates (Bulger et al. 2015; Xing et al. 2015; de Freitas et al. 2015; Liu et al. 2015).

practical nature (Hew 2014) or payment of symbolic costs of inscription (Alario-Hoyos et al. 2017).

Given the enormous diversity of motivations to enroll in a MOOC, the dropout rate cannot be seen as the only parameter of success in the implementation of MOOCs. There are students who make a selective use of the course, only making use of the content which is of interest to them (Cesareni et al. 2014; Henderikx et al. 2017; Schmid et al. 2015). Beyond the certificate, some participants explore new ways of learning, experiment with online interaction, seek entertainment, and try to meet a personal challenge or simply enjoy learning (Liu et al. 2015). This diversity of behaviors has led to the development of different user typologies.

User profiles in MOOCs

The low completion rates of MOOCs are widespread. However, disengagement and abandonment of this type of courses depend on the profile of the user. Although in an aggregate way there is a process of progressive disengagement, the evolution is different depending on the type of learner. For example, there are users who prefer to focus on video lessons from the beginning, while others undertake course evaluation and follow-up tasks (Kizilcec et al. 2013). It is likely, that both types of users differ not only in the probability of completing the course, but also in their trajectory of participation throughout the course.

The classification of users in different profiles has usually been made based on the degree of commitment to the activities offered by the course. Learner behavior varies from the selective use of resources to the completion of all tasks. It ranges from passive observation to generation of new content, active participation and interaction with other users. This difference in individual profiles means that some students will be motivated throughout the course, while others are progressively disconnected.

The different typologies, among other profiles, may be distinguished as observers, occasional users, passive consumers and active participants (Table 1). The diversity of profiles identified in the previous research (Cisel et al. 2015; Greene et al. 2015; Hill 2013; Kizilcec et al. 2013; Koller et al. 2013; Milligan et al. 2013; Tabaa and Medouri 2013) may be classified in seven levels, namely: registration in a course with no follow-up; exploration of course materials; evaluation of activities and forms; starting a course actively but disengage later; completion of a course with passive consumption of educational materials; completion of a course through active participation; and generation of new content for the benefit of the community of users. Each of these levels is described in Table 1.

The completion rates of MOOCS are usually very low, and $< 10\%$ of the participants get an accreditation of having completed the course (Daniel 2012; Kizilcec et al. 2013). Many students enroll and do not even start the course. The drop-out rate is also very significant in the early stages of the course. A small group of highly active learners is usually responsible for most of the content and interaction that occurs in the implementation of the course (Cisel et al. 2015). Accordingly, identifying user profiles will enable the detection of the risk of abandonment and is an indirect indicator of motivational aspects.

Moreover, the use of MOOCs is not solely dependent on the motivation of the learners and the way in which they self-regulate throughout the course. The level of participation depends on the student's initial intentions and goals, even before enrollment (Koller et al. 2013). Students can sign up with the objective to obtain a certificate. However,

Table 1 Seven levels of user engagement in MOOCs

	Cisel et al. (2015)	Kizilcec et al. (2013)	Hill (2013) Tabaa and Medouri (2013)	Milligan et al. (2013)	Koller et al. (2013)
1. Learners register in the course without accessing later			*Ghosts* students that register to the course but at no time sign in		
2. Learners who explore the course materials	*Bystander* they did not submit homework and watched < 10% of the videos	*Sampling* learners who watched video lectures for only one or two assessment periods	*Observers* students that explore course materials		*Browsers* users with low level of commitment, they register for curiosity and leave at the beginning or in the first weeks
3. Learners who do a few activities to check how the course works.	*Auditing* they did not submit evaluation tasks but watched at least 10% of the videos	*Auditing* learners who did assessments infrequently, if at all, and simply watched the video lectures	*Non-completers* (or drop-in visitors) students that attempt to use different course resources but do not complete the whole course.		
4. Learners who start the course but leave progressively because of lack of motivation or lack of time	*Disengaging* users who completed at least one course evaluation task	*Disengaging* learners who did assessments at the beginning of the course but eventually decreased in engagement		*Passive participants* students that show frustration and dissatisfaction with the course	

Table 1 (continued)

	Cisel et al. (2015)	Kizilcec et al. (2013)	Hill (2013) Tabaa and Medouri (2013)	Milligan et al. (2013)	Koller et al. (2013)	
5. Learners who complete the course through the passive consumption of content	*Completers* users who obtain the final certificate, either with a basic or advanced completion of the course activities	*Completing* learners who completed the majority of the assessments offered in the class	*Passive participants* students that use course material but do not participate in course homework and projects	*Lurkers* participants that actively follow the course but do not actively engage with other learners	*Committed learners* users who dedicate a significant number of hours to the course, carrying out activities and relating to other participants	*Passive participants* users who engage through watching lecture videos, and participate little in forums and other tasks
6. Learners who complete the course through active participation			*Active participants* students that attend lectures, accomplish the homework, interact with other participants and complete evaluation forms	*Active participants* students that maintain active blogs and twitter accounts, regular discussion in the course and interaction with other learners		*Active participants* users complete homework assignments, quiz, exams, and finish the course to obtain the accreditation
7. Learners who generate and share new content for the benefit of the community of practice						*Community contributors* users who actively participate and generate new content, engage in discussions in forums and provide subtitles in other languages

they can also access a MOOC out of curiosity, to explore how the course is structured or to get ideas with which to develop their own content. Individual differences in learning intentions can determine accordingly how they relate to the MOOC. That is, intentions provide a meaningful context for understanding individual differences.

The MOOCKNOWLEDGE study: learning intentions and retention in MOOCs

The strategies to improve the retention of participants in a MOOC should be framed in the context of students' intention, so as to make a realistic analysis of the situation (Koller et al. 2013). However, until now the typologies of users have not been based on a previous analysis of the motivation and behavioral intention but on the collection of data of the trainees during their participation in the course. In this study, we aim to develop a classification of MOOCS users based on behavioral intentions and motivations before starting the teaching–learning process. Second, we evaluate the perceived quality of the MOOCS learning experience based on these initial goals.

The MOOCKnowledge project is an initiative of the European Commission's Joint Research Centre (JRC) to build a database on the motivations, intentions and learning experiences of online courses offered by multiple providers.

The project focuses on describing the motivational disposition and intention of the participants in the MOOC, as well as the results in terms of learning experience. It is based on two psychosocial theories: (1) the reasoned-action approach is based on the idea that attitudes towards behavior, perceived norms and perceived behavioral control can determine people's behavioral intention (Fishbein and Ajzen 2011); and (2) the theory of self-determination distinguishes between intrinsic and extrinsic motivation (Ryan and Deci 2000). The theoretical model of the MOOCKnowledge study was previously validated with the data of the pilot phase of this project (Kalz et al. 2015).

According to the theory of reasoned action, the intention to participate in a MOOC is greater among those who associate personal, professional or learning benefits to the behaviour of participating in it. The fact of perceiving that friends and family have a favourable attitude toward studying a MOOC also influences the intention to participate in this type of course. In addition, the internal locus of control also positively influences the intention of behaviour.

Second, the theory of self-determination focuses on extrinsic or intrinsic factors that have a motivating effect. For example, participants in a MOOC may be motivated by extrinsic factors, such as achieving a job promotion, or by intrinsic factors, such as interest in learning.

The combination of both theories allows exploring basic psychosocial aspects, related to attitudes, group pressure, motivation and behaviour intentions.

Research questions

The purpose of this study was to characterize the different types of learning motives and intentions of participants in a MOOC just after enrollment at the initiation of the course. The research questions were:

1. What are the types of participants in the MOOCs according to the motivation and intentions they declare when initiating them?

2. What are the socio-demographic characteristics of each type of user?
3. How does the quality of learning experience vary according to student profile?

Method

Courses and participants

In this study, we relied on the survey administered to participants in six different MOOCs in 2014. The courses referred to history (MOOC 1), the use of ICT in education (MOOC 2 and MOOC 6), data analysis (MOOC 3), entrepreneurship (MOOC 4), and psychology anxiety control (MOOC 5). MOOC 1 was mainly targeted to general audience, MOOCs 2 and 6 were targeted to teachers, MOOC 3 to workers or unemployed individuals, MOOC 4 to individuals who aim to start their own business, and MOOC 5 to students but also other individuals who aim to control their anxiety.

The MOOCs included a course of an Israeli university, a course of an international project with European funding, three courses of Spanish Universities via a big MOOC platform, and a course of a Dutch university using its own platform. In 2014, none of the MOOCs were eligible to provide direct course credits or for recognition via ECTS credits. The MOOCs were offered in the language of the platform country (Hebrew, Spanish, Dutch, and English in the case of the European project) attracting mainly MOOC-language speakers. Regarding its duration, they lasted between 20 and 60 h, which were spread over 5–8 weeks with a weekly workload of 3–7 h. Finally, it is worth to note that the MOOCs were independently designed by different providers and consequently they do not follow a common structure or pedagogical design.

Between October and December of 2014, a total of 3629 initial participants in the MOOCs responded to an online questionnaire, during the first week of training. Subsequently, after completing the course, 1038 completed a survey to assess their learning experience in the MOOC in which they had participated. This second survey took place in the last week or just a few days after finishing the MOOC. The participation was voluntary and informed consent was obtained from all individual participants included in the study.

For the analysis that follow, we discarded the participants who had not completed the set of 120 items of the motivations and intentions section in the initial questionnaire, which reduced the sample to a total of 1768 participants, distributed as follows among the six MOOCs: MOOC 1 (n = 157), MOOC 2 (n = 174), MOOC 3 (n = 356), MOOC 4 (n = 324), MOOC 5 (n = 727) and MOOC 6 (n = 30). Applying the same criteria, in the second survey we have information of 269 students.

The sub-sample of 1768 respondents was composed of 805 men (45.6%) and 962 women (54.4%). The average age is 39.89 (12.96). The majority of respondents have completed some type of university studies (80.82%), either first or second cycle. Almost 60% is employed (59.89%). More than half of the respondents report a salary below 15,000 euros per year (54.4%).

Instruments and procedure

We used a pre-post design in which the participants were surveyed just at the beginning and just at the end of the course. The pre-MOOC questionnaire has a central module on motivations and intentions, based on the theory of reasoned action (Fishbein and Ajzen 2011) and the theory of self-determination (Ryan and Deci 2000). The rest of the modules were designed to gather information about participants' interaction with information technologies, training and professional development, and socio-demographic aspects, among others.

The post-MOOC questionnaire has a central module on learning experiences, in which users evaluated the quality of the training, the usability of the platform and general satisfaction, among other aspects. In addition, information was collected on socio-demographic aspects, as well as their qualitative opinion on the development of the course.

The completion of the pre-MOOC questionnaire lasted approximately 40 min, while the post-MOOC questionnaire took about 25 min on average. These are instruments that generally show adequate indicators of theoretical consistency, validity and reliability (Kalz et al. 2015). A full description of the design of the study and the rationale of the instruments is available in Kalz et al. (2015).

Participants were asked to provide the initials of their names and surnames, to build an ID code that would allow matching responses of the waves of questionnaires planned. Participants also provided their e-mail in the first survey and gave express consent so that it could be used for subsequent planned surveys. They were offered guarantees that the data would be analyzed keeping the information confidential.

Items based on the reasoned-action approach and the self-determination theory were evaluated with short and simple sentences, which the respondents scored on a scale from 1 (e.g. extremely unimportant) to 7 (e.g. extremely important). The following are some examples of the items used: "taking a MOOC will increase my opportunities for a promotion" (belief in positive results), "creating a MOOC will reduce my free time with family and friends" (belief in negative results), "my friends and acquaintances have completed one or more MOOCS "(subjective norm),"taking a MOOC is fun" (intrinsic motivation), "I intend to complete one or more MOOCs in the next six months" (intention of conduct, preparation), etcetera. The scales showed a moderate to high consistency in general, with Cronbach's alpha between .654 and .966 and 84.6% of the subscales above .844.

In this study, we first performed an analysis of k-means clusters with the 1768 respondents with the pre-MOOC questionnaire.[5] The resulting classification is used to compare the learning experience of 269 users in the post-MOOC questionnaire, based on the profiles identified in the first phase. Despite having a wide list of items, the grouping of the respondents based on a few criterion variables is an efficient strategy, especially if we take into account the high co-linearity and certain tendency to the highest scores of the scale for the whole sample. Classification into clusters is partly "discovered" and partly "created" according to theoretical criteria: it allows an interesting balance between the empirical base and the interpretation guided by theoretical models. The k-means procedure provides efficient solutions with relatively simple calculations (Aldenderfer and Blashfield 1984).

[5] Although the cluster analysis technique has been used previously to classify learners in MOOCS (Cabedo Gallén and Tovar Caro 2018), the innovation that we propose with our study consists of the classification according to the learning intentions of the participants.

Table 2 Distribution of cases and final centers of the conglomerates

Variables for classification	Cluster 1 (n = 296)	Cluster 2 (n = 509)	Cluster 3 (n = 963)
Intrinsic motivation (learning, success)	4.32	5.11	6.12
Extrinsic motivation (social pressure, certificate)	3.11	2.24	5
Intention (persistence)	3.45	6.06	6.31

The procedure converged in seven iterations

Second, to answer our third research question we used a selection of indicators on satisfaction with MOOC, perceived quality, intensity, and usability. In the follow-up questionnaire, the items were also evaluated on a scale of 1 to 7, and high internal consistency indicators were obtained: satisfaction with the MOOC (α = .897), perceived quality (α = .844), perceived intensity (α = .926), perceived usability (α = .844). Some examples of the 54 items used to evaluate learning experiences were the following: "I am satisfied with the achievement of my learning goals in the MOOC" (satisfaction); "The quality of the video lessons was good" (perceived quality); "The amount of assessment tasks was adequate" (perceived intensity); "It is easy to learn to use the virtual learning environment of this MOOC" (usability).

The behavior was evaluated through three items exploring the degree of interaction during the development of the course (e.g. "to what extent has the MOOC facilitated the student–student interaction") (α = .634) and 8 items based on the educational activities carried out (e.g. "watched all the lecture videos") (α = .643). Finally, the questionnaire included seven different questions about obtaining certificates (participation, completion, performance, etc.) that were added through the calculation of the average of the items. The data was analyzed with SPSS Statistics v24.

Results

In the pre-MOOC questionnaire, the respondents generally attribute positive results to the performance of MOOCs (M = 5.35, SD = 1.10), they are more motivated by intrinsic aspects (M = 5.57, SD = 1.16) than extrinsic (M = 3.89, SD = 1.157), they express an intention to carry out online courses (M = 5.94, DT = 1.29), and intend to maintain this behavior in the immediate future (M = 5.76, DT = 1.31).

Below we present the results of the cluster analysis (with data from the first survey, at the start of the course), and the differences observed between profiles (with data from the second survey, upon completion).

User profiles of MOOCs

With the data of the pre-MOOC survey, we carried out a cluster analysis to classify the participants based on the individual differences in motivation and learning intention. For this, we apply the k-means procedure with a maximum of ten iterations and a convergence criterion of .02. As grouping variables we used an indicator that summarizes the four items that value internal motivations (e.g. "I participate in a MOOC to acquire knowledge and skills"), an indicator based on five items for external reasons (e.g. "I participate in a

MOOC to get a certificate") and an indicator based on five items on the intention of persistence in the MOOC (e.g. "I will do everything possible to participate and complete one or more MOOCs in the next 6 months"). The items that constitute each indicator are presented in "Appendix I" section. Both the correlation table ("Appendix II" section) and the exploratory analysis show a greater discriminating power with these three indicators and allowed to effectively address the multicollinearity of the set of items evaluated. In a first exploratory phase, solutions were tested between 2 and 4 categories, with several combinations of the items of the model. The solution of three conglomerates was adjusted to the theoretical expectations of the investigation and showed an adequate distribution of cases by categories (Table 2).

More than half of the participants (54.5%) show a high level of motivation and declare their intention to initiate and complete a MOOC (Cluster 3). It is a group of students who define themselves as very committed before starting the training process. In clear contrast with this profile are respondents (16.7%) who obtained low scores in the three criterion variables (Cluster 1). This group, a priori, is not interested in getting involved in a MOOC. Finally, a third conglomerate corresponds to people with high internal motivation, who intend to complete the full MOOC, but who obtain the lowest scores in external social pressure to participate (Cluster 2). This subgroup, which we have called self-referential, is 28.8 percent. Table 3 summarizes the profile of the three conglomerates.

To characterize the members of each profile, we crossed the three conglomerates with the socio-demographic variables. Comparisons of means were also made with the variables of the theory of reasoned action and the theory of self-determination (Table 4). Statistically significant differences were found between the three profiles.

The profile of *highly committed* respondents scored higher than the other two groups in (1) the attribution of positive results to MOOCs, (2) the perception of normative pressure to participate in the courses and (3) the affirmation of extrinsic motivations.

On the other hand, respondents with *little interest* (1) score significantly lower on the intrinsic motivation indicators and (2) they declare themselves less available to start a MOOC and persist in carrying it out.[6]

Finally, the profile of *self-referenced* respondents (1) scores lower than the other two groups in the attribution of negative results to MOOCs, and (2) they feel less pressured by the opinion of family and friends.

The three profiles differ systematically in all the items that evaluate (a) the digital competences, (b) the learning experiences and (c) the satisfaction of the training needs in the MOOCs studied in the past; as well as in (d) perceived self-efficacy in relation to those in which they may participate in the future. Specifically, from cluster 1 to cluster 3 respondents declare themselves gradually more competent, more satisfied and more confident in their own capacities.[7]Regarding the two profiles with higher motivation (clusters 2 and 3), the only significant difference seems to be that *committed* users are younger than *self-referential* ones ($F_{2,1762} = 23.652$, $p < .01$) and it is more likely to earn a salary below 12,000

[6] It is the only profile with more men than women, against the gender distribution of the sample. Specifically, more than half are men, while for the whole sample it does not reach 46%. However, for the group of participants, no statistically significant differences were observed with respect to gender (Chi square = 4.892, p = .087).

[7] This observation corresponds to ten different comparisons of means, in all cases with a significance level of ANOVA of $p < .0001$, and post hoc comparisons with the Scheffé test of $p < .05$. As regards the 30 subsequent post hoc comparisons, only one is not significant: the one corresponding to the item "digital competences previously acquired in MOOCS", with respect to conglomerates 2 and 3.

Table 3 Three profiles of participation commitment before starting a MOOC

Profile	Description	Characteristics
Low interest (n = 296, 16.7%)	Medium–low levels of motivation and intention of completing the course	They are less motivated by intrinsic factors and score lower in the intention to initiate and persist in the completion of a MOOC
Self-referential (n = 509, 28.8%)	Declare intention to persist, more motivated by internal factors than by external factors	They stand out for attributing less negative consequences to participation in MOOCs. They also feel less influenced by family and friends
High commitment (n = 963, 54.5%)	High levels of extrinsic motivation, intrinsic motivation and intention of persistence	They believe that participating in MOOCS has positive results. They are more motivated by extrinsic factors and perceive that in their environment participating in these types of courses is positively valued

Table 4 Differentiation of profiles: comparison of means according to membership conglomerate

	Total		Cluster 1 (n = 296)		Cluster 2 (n = 509)		Cluster 3 (n = 963)		*F*	p
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*		
Beliefs—positive outcomes	5.35	1.10	4.65	1.08	4.73	1.18	5.89	.70	339.253	.0001
Beliefs—negative outcomes	2.29	1.11	2.42	1.07	1.97	.87	2.43	1.19	40.958	.0001
Evaluation positive outcomes	5.35	1.03	4.84	1.00	4.81	1.19	5.79	.67	234.010	.0001
Evaluation negative outcomes	3.15	1.07	3.07	.98	2.80	1.14	3.35	1.00	43.547	.0001
Descriptive normative behaviour	3.91	2.15	3.78	2.02	3.44	2.14	4.21	2.14	22.355	.0001
Descriptive normative beliefs	3.97	1.72	3.38	1.47	3.24	1.72	4.54	1.58	130.806	.0001
Descriptive normative control	2.15	1.56	2.06	1.35	1.55	.99	2.50	1.75	90.265	.0001
Intrinsic motivation	5.57	1.16	4.44	1.25	5.50	1.07	5.95	.93	191.999	.0001
Integrated motivation	5.53	1.25	4.32	1.31	5.11	1.22	6.12	.81	349.193	.0001
Identified motivation	5.82	1.13	4.64	1.30	5.51	1.12	6.34	.66	322.599	.0001
Introjected motivation	3.46	1.42	2.87	1.19	2.87	1.04	3.95	1.47	157.385	.0001
Extrinsic motivation	3.89	1.57	3.11	1.23	2.24	.86	5.00	.90	1718.261	.0001
Absence of motivation	1.84	1.17	2.39	1.18	1.69	.91	1.75	1.24	41.880	.0001
Intention (readiness)	5.94	1.29	4.00	1.48	6.22	.83	6.38	.78	353.782	.0001
Intention (persistence)	5.76	1.31	3.45	1.14	6.06	.74	6.31	.70	837.580	.0001

We emphasize (shaded) the three criterion variables of the analysis of conglomerates: intrinsic motivation, extrinsic motivation and intention of persistence. After verifying the lack of homogeneity of variances, the Welch ANOVA test was applied to contrast the differences of means. The post hoc comparisons were made with the Scheffé test

Table 5 Participation in the follow-up survey and learning experiences according to the belonging conglomerate

Profile	Participation in the follow-up		Learning experiences
	T1	T2 (%)	
Low interest	296	29 (9.79)	They have scores below the average in satisfaction, quality and intensity of the learning experience
Self-referential	50	68 (13.35)	
High commitment	963	172 (17.86)	They show significantly higher scores in satisfaction with the MOOC, as well as in the perceived quality and intensity of the training

Column T1 indicates N of each cluster in the original classification, with the data from the first survey. Column T2 indicates the N of each cluster in the second survey, along with the percentage of respondents with respect to the original N in each category

euros per year. This seems to confirm that these are three clearly differentiated preparation profiles for MOOCs.

In the next section, we examine if this is reflected in the learning experiences that students have later.

Table 6 Comparison of learning experiences and behavior according to conglomerate

	Total		Cluster 1		Cluster 2		Cluster 3		
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*K-W*
Learning experiences									
Satisfaction with MOOC	5.46	.74	5.06	.74	5.39	.69	5.56	.74	2*
Perceived quality	5.68	.91	5.30	.90	5.54	.92	5.80	.89	13*
Perceived intensity	5.51	1.17	5.06	1.09	5.13	1.21	5.73	1.12	0*
Perceived usability	5.68	.64	5.54	.60	5.60	.66	5.74	.64	72
Use of the MOOC									
Social interaction	4.45	1.36	3.84	1.37	4.45	1.18	4.56	1.41	48*
Activities developed	5.02	1.10	4.78	1.03	4.89	.94	5.12	1.18	154
Certification	1.04	.97	.93	.92	1.07	.97	1.05	.98	777

*p<.05

Comparison of learning experiences in the three profiles

In the last week or just a few days after finishing the MOOC, 269 of the 1768 students in the initial sub-sample (that is, 15.21% of the total) completed a questionnaire to evaluate their learning experience. The participation in this second survey was significantly different depending on the initial profile (13.319, $p < .001$) (Table 5). The lower the initial commitment of the respondents, the less likely they participated in the second survey. Although we do not have a retention indicator in the MOOC, it is possible that the completion of this second questionnaire indirectly reports a differential probability of abandonment in the three motivational profiles.

Consistent differences are observed in the learning experiences between the three conglomerates, with the application of the Kruskal–Wallis test (Table 6). Once again, from cluster 1 to cluster 3, respondents declare themselves gradually more satisfied with the MOOC, and score higher on perceived quality and intensity indicators. The only aspect in which no significant differences were observed refers to the usability of the MOOC.

Concerning the behavior and use of MOOC educational resources, the only significant difference was observed in the degree of social interaction developed. Specifically, the highly engaged participants reported greater student–student, student–teacher and student-content interaction than the less interested participants ($KW = -34.407$, $p = .014$). No significant differences were observed regarding watching videos, performing tasks, participating in the evaluation. There were also no differences in obtaining certificates for participating or completing the MOOC or for achieving a certain level of performance (Table 6).[8]

[8] In the case of accreditation, no significant differences are observed if we analyze each indicator of obtaining certificates separately, either relative to the participation in the course (Chi-square = 1.621, p = .445) or the completion of the course (Chi-square = 1.621, p = .445).

Discussion

The classifications of MOOCS participants have usually been based on the behavior of the students during the course development (Cisel et al. 2015; Greene et al. 2015; Hill 2013; Kahan et al. 2017; Kizilcec et al. 2013; Koller et al. 2013; Milligan et al. 2013; Tabaa and Medouri 2013). In this study, we have shown that the evaluation of motivation and intention declared at the beginning of the MOOC can also serve to identify different profiles in terms of competencies, self-efficacy and satisfaction with learning experiences.

With the data of six courses of the *MOOCKnowledge* project of the European Commission, we identified three types of motivational profiles in the users, which seem to correspond to three levels of educational involvement, from low to high: low interest, self-referential and highly committed. Although the factors of extrinsic motivation served empirically to differentiate one of the groups, the three conglomerates systematically discriminated three levels in all the outcome variables used. This is consistent with our interpretation of user typologies in terms of the degree of involvement in educational opportunities offered by MOOCs (see Table 1).

In this sense, the evaluation of motivational profiles before students register in a MOOC is useful to diagnose in advance the benefits and potential barriers that each can find. It can also serve to design or provide personalized training itineraries, putting in place strategies with which to prevent dropouts. We can formulate the hypothesis that the motivation declared at the beginning of the course is a significant predictor of differential dropout rates and, despite the bias that this introduces, it still allows to differentiate unequal learning experiences in the three types of participants. This is consistent with other studies on the perceived quality of this type of courses (Yang et al. 2017), as well as the influence of intrinsic interests on student's persistence (Higashi et al. 2017). It is also similar to the motivations observed in users of Massively Multi-User Online Role-Playing Games (Yee 2006).

Students with diverse expectations when they start also display different behavior throughout the course, from those who simply browse the available videos to those who are actively involved in the performance of all evaluation activities (Koller et al. 2013). Accordingly, the evaluation of the performance should take into account the needs that led the students to enroll in the course. That is, the degree of achievement of students who only navigate or those who are committed to obtain a good performance is related to the initial individual expectations. Given the high dropout rates and the varied degree of involvement of the participants, the level of educational impact and the pedagogical innovation, originally attributed to MOOCs, is yet to be qualified. While these types of courses have been proposed as tools to promote open education and eliminating access barriers, in practice individual motivational profiles seem to establish significant differences in the opportunities for enrollment, development, completion and benefits obtained from training.

It is interesting to note that the most positive assessment of the MOOC and of the learning experiences is made by those participants who, in addition to a high intrinsic motivation, have some kind of external pressure to complete the course. This subgroup corresponds to a profile of younger users, with lower average income. Accordingly, it seems that *having a need* to do the MOOC, whether for work or as part of career development, becomes an effective incentive for involvement in educational activities. Conversely, it has been proven that the reconciliation of studies with family life can be a barrier to meeting personal learning objectives (Henderikx et al. 2019).

The design and implementation of MOOCs is related to European policies to promote open education, which are still in the process of developing evidence-based practices (Inamorato dos Santos et al. 2017). Although the MOOCs have occupied a relevant space among the first initiatives to promote open educational resources (OER), it seems necessary to increase the diversity of educational practices as well as to experiment with new teaching–learning models. In this sense, both designers and instructors of MOOCs would benefit from paying greater attention to the motivational profile of the students. The personalization of the training itinerary, which ranges from selection to monitoring and evaluation of learners, could improve the efficiency of this type of course. Two aspects could be practical in this regard. On the one hand, the evaluation of the individual motivations and the intention of the learners *before* starting the course, could allow a more efficient use of the MOOCs. Reducing the high drop-out rate remains a challenge in this area. On the other hand, connecting the training courses with professional needs and linking them to extrinsic incentives, such as job promotion or salary improvement, could be positive even with students who already have intrinsic motivation. For this reason, the organizational or institutional context in which a MOOC is delivered may be particularly relevant for sustained participation of learners. This is consistent with the relevance of organizational factors in the process of adoption of open educational resources in universities and higher education institutions (Maya Jariego et al. 2018).

Limitations and future research

The participants in this study make up a self-selected group, since they are people who have already started a MOOC (in the initial questionnaire) and/or who have completed a significant part of it (in the final questionnaire). This can bias the sample towards users with comparatively higher levels of motivation, leaving out those who signed up but did not even start the course; those who, having started it, did not complete the set of activities; and those who were not sufficiently interested in filling out a second questionnaire about their learning experience. In fact, all the average scores in the learning experiences were located above the intermediate point of the scale. It is also necessary to consider that the response rate to the second questionnaire was different in the three profiles, possibly generating an equalization effect in the scores between categories. The second survey was used as a contrast element, to explore the empirical differences between student profiles with an indicator based on the experience of participation in the course.

In future investigations it would be of interest to evaluate the motivational aspects and the intention of behavior before the beginning of the MOOC. It would also be useful to collect data on retention and abandonment in a systematic way, for the set of initial participants. As we have seen, the analysis of user typologies can have theoretical and practical value. For example, exploring the motivations of learners with qualitative procedures can be very useful in the design and implementation of training itineraries. On the other hand, we started from the assumption that there is a type of users that largely self-regulate their learning, taking advantage of only the part of the MOOCs that are of interest for their individual objectives. For this type of users, it is not so relevant to complete the course or the level of performance obtained in it. However, with our research we have verified a large subgroup of initial participants who aims to finish in which dropping out during the MOOC due to a demotivation process is clearly a negative indicator. Therefore, it may be of interest for future research to develop strategies with which to efficiently differentiate these two different types of user behavior: the partial use of the contents of a MOOC and the drop-out due to lack of motivation to continue.

Conclusion

Our paper shows that MOOC students can be classified according to their motivations and intentions previously to MOOC start. We also find some evidence supporting that these variables may be related to the degree of involvement and satisfaction that students display throughout a MOOC. Therefore, the evaluation of the initial motivational profile is a useful tool to develop personalized training itineraries. Strategies to increase interaction and participation can be designed individually. The evaluation of the motivation before starting the course can be used to select the participants according to the degree of potential academic achievement. It is also useful to differentiate those participants who will most likely self-regulate effectively throughout the course, from those who need external support or who would benefit from specific incentives to their context of need.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Appendix I

List of items to construct the three indicators used as criterion variables in the cluster analysis

Internal motivations (4 items)
I participate in a MOOC because it is my preferred way to acquire knowledge and skills
I participate in a MOOC because it suits my tendency to try new things out
I participate in a MOOC because it suits my ambition to go with the times
I participate in a MOOC because it aligns with how I want to learn
Extrinsic motivations (5 items)
I participate in a MOOC because it is expected of me
I participate in a MOOC because otherwise I will get a lot of troubles
I participate in a MOOC because it will give me a certificate
I participate in a MOOC because I can complete my study program
I participate in a MOOC because it allows me to get good marks
Intention of persistence (5 items)
I will make every effort to take and complete one or more MOOCs in the next 6 months
I will try to take and complete one or more MOOCs in the next 6 months
I will be persistent to take and complete one or more MOOCs in the next 6 months
I do the best I can to take and complete one or more MOOCs in the next 6 months
I will go to the extreme to take and complete one or more MOOCs in the next 6 months

Each indicator is the average of the items that comprise it. Internal and extrinsic motivations are connected to self-determination theory, while intention of persistence is connected to the theory of reasoned action

Appendix II

Table of correlations of the variables of the theory of reasoned action and the theory of self-determination

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Beliefs—positive outcomes	–														
2. Beliefs—negative outcomes	.179**	–													
3. Evaluation positive outcomes	.769**	.181**	–												
4. Evaluation negative outcomes	.370**	.448**	.398**	–											
5. Descriptive normative behaviour	.273**	.127**	.268**	.199**	–										
6. Descriptive normative beliefs	.565**	.165**	.522**	.318**	.276**	–									
7. Descriptive normative control	.217**	.303**	.199**	.225**	.169**	.339**	–								
8. Intrinsic motivation	.394**	−.066**	.288**	.060*	.044	.176**	.065**	–							
9. Integrated motivation	.590**	.057*	.503**	.231**	.176**	.324**	.145**	.526**	–						
10. Identified motivation	.651**	.027	.574**	.225**	.185**	.373**	.131**	.574**	.703**	–					

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
11. Introjected motivation	.373**	.350**	.324**	.256**	.146**	.291**	.401**	.262**	.341**	.369**	–				
12. Extrinsic motivation	.624**	.263**	.582**	.300**	.236**	.453**	.366**	.257**	.451**	.485**	.543**	–			
13. Absence of motivation	−.068**	.362**	−.028	.189**	.082**	.006	.226**	−.223**	−.131**	−.194**	.198**	.080**	–		
14. Intention (readiness)	.315**	−.116**	.261**	.011	.044	.192**	−.021	.488**	.433**	.519**	.151**	.245**	−.234**	–	
15. Intention (persistence)	.337**	−.036	.282**	.052*	.021	.214**	.055*	.516**	.434**	.538**	.252**	.303**	−.221**	.824**	–

*p < .05, **p < .01

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