RELATIONSHIP ENGAGEMENT AND ACADEMIC DROPOUT IN MOOCS: SYNTHESIS OF AN EXPO FACTO RESEARCH
RELACIÓN ENGAGEMENT Y LA DESERCIÓN ACADÉMICA EN LOS MOOCS: SÍNTESIS DE UNA INVESTIGACIÓN EXPO FACTO

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	ABSTRACT
	The study of student engagement in the MOOCs context is very important in the scientific community of higher and postgraduate education as it contributes to improving academic performance. However, its high academic dropout rate is known internationally. For this reason, the objectives of this study are to determine, based on a theoretical study, which engagement variables influence academic dropout in MOOCs, and to describe, based on the analysis of a questionnaire, the evaluations of the participating teachers. To achieve this end, the following research questions were posed: What are the most studied variables regarding engagement that contribute to reducing the dropout rate in MOOCs? What, in the opinion of university professors, are the variables that contribute to reducing the dropout rate in MOOCs? To achieve these objectives, a mixed research approach (systematic review and survey) was implemented, and instruments were designed and validated to obtain information. The intentional sample was comprised of university professors from two countries. The results showed that the main variables are data privacy, the design of forums, education democratization, gamification, satisfaction, and perceived quality. The article concludes with didactic and pedagogical recommendations to enhance engagement.
	RESUMEN
	El estudio del engagement del estudiantado en el contexto de los MOOCs cobra vital importancia en la comunidad científica de la educación superior y posgraduada pues contribuye a elevar el rendimiento académico. Sin embargo, es conocido a nivel internacional su alta deserción académica. Por tal motivo, los objetivos de este estudio son determinar a partir de un estudio teórico cuáles son las variables del engagement que influyen en la deserción académica en los MOOCs y, describir a partir del análisis de un cuestionario las valoraciones de los docentes participantes. Para ello se platearon las siguientes preguntas de la investigación: ¿cuáles son las variables más estudiadas desde el engagement para contribuir a disminuir la tasa de deserción en los MOOCs? ¿Cuáles son, a criterios de docentes universitarios, las variables que contribuyen a disminuir la tasa de deserción en los MOOCs? Para

lograr los objetivos, se desarrolló una investigación mixta (revisión sistemática y una encuesta) y se diseñaron y validaron instrumentos para la obtención de información. La muestra de tipo intencional, la conformaron profesores universitarios de dos países. Los resultados muestran que las principales variables son: la privacidad de los datos; el diseño de foros, la democratización de la educación, la gamificación, la satisfacción y, la calidad percibida. Se concluye el artículo con recomendaciones didácticas y pedagógicas para desarrollar el engagement.

Introduction

Massive Open Online Courses (MOOCs) are on the rise due to the need for professional and career advancement. Although there is a diversity of terminologies such as: cMOOC, madeMOOC, xMOOCs (eXtendedMOOCs) adaptiveMOOCs, synchMOOCs, gMOOC, tMOOC (transferMOOC), sMOOC (Social Massive Open Online Course), or the iMOOC (intelligent MOOC) by trend, empirical research uses the term MOOCs (Mellati & Khademi, 2020) with its diverse pedagogies and emerging technologies (Estrada-Molina et al., 2024; Ratnasari et al., 2024).

They are an educational tool for several reasons (Mellati & Khademi, 2020; Fernández Alemán & Estrada-Molina, 2024; Williams, 2024), for example

- Global access: MOOCs allow anyone with internet access to participate in courses taught by renowned institutions around the world. This democratizes access to quality education, eliminating geographic and economic barriers (Silva & Lisbôa, 2024).
- Flexibility: MOOCs offer flexibility in terms of time and location. Learners can access course content at any time and from anywhere, allowing them to tailor learning to their own needs and commitments (Rahimi & Cheraghi, 2022).
- Variety of topics: MOOCs cover a wide range of topics, from science and technology to humanities and the arts. This allows students to explore new fields of study or develop specific skills relevant to their career or personal interests (Lazarinis et al., 2024).
- Interactive learning: Many MOOCs use interactive technologies, such as videos, quizzes, discussion forums, and hands-on assignments, to encourage student engagement and improve knowledge retention (Saputro et al., 2024).
- Constant updating: Since MOOCs are delivered by academic institutions and experts in various fields, course content is usually up-to-date and reflects the latest developments and trends in each area of study (Turan & Yılmaz, 2024).
- Skills development: MOOCs not only provide theoretical knowledge, but also offer opportunities for the development of practical and professional skills, such as programming, graphic design, business management, among others (Florou et al., 2024).

In summary, MOOCs are important because they democratize access to quality education, offer flexibility and variety of topics, encourage interactive learning, keep content up to date and promote the development of skills relevant to today's job market.

MOOCs have transformed educational communication or educommunication by introducing new models of teaching and learning that take advantage of digital tools and online platforms (Mena et al., 2024). Some highlights about MOOCs from an educational communication perspective are:

- Global interaction: MOOCs allow global interaction between students and teachers from all over the world. This enriches the learning process by exposing participants to diverse cultural perspectives, experiences and knowledge (Rulinawaty et al., 2023).
- Two-way communication: Through tools such as discussion forums, chat rooms and videoconferencing, MOOCs encourage two-way communication between learners and facilitators. This creates a collaborative learning environment where participants can ask questions, exchange ideas, and receive direct feedback (Duan & Wu, 2023).

- Personalization of learning: By allowing students to access course content at any time and from anywhere, MOOCs provide the opportunity to customize the learning process to individual needs. Participants can proceed at their own pace and review the material as many times as necessary to fully understand it (Cheng, 2023).
- Use of multimedia media: MOOCs leverage a variety of multimedia, such as videos, infographics, animations and simulations, to present content in a visually appealing and effective way. This improves knowledge retention and student engagement with the material (Wei et al., 2023).
- Continuous evaluation: Through online quizzes, practical assignments and group projects, MOOCs offer opportunities to assess students' progress on an ongoing basis throughout the course. This regular feedback helps participants identify areas for improvement and stay motivated in their learning (Eglseer, 2023).
- Social learning: MOOCs foster social learning by connecting students to a global community of peers with similar interests and goals. This facilitates collaboration, resource sharing and the building of professional networks that can last beyond the course itself (Molina, 2023).

MOOCs have revolutionized educational communication by offering new forms of interaction, personalization, content presentation and assessment that enrich the learning process and promote active student participation.

In this educational field of higher and postgraduate education, one of the lines of research is the reduction of academic attrition in MOOCs, one of its educommunicative variants being the study of engagement (Anghel et al., 2023).

Engagement, or commitment, plays a fundamental role in MOOCs, as it is a key factor in the success of online learning. Some ways in which engagement and MOOCs are related are:

- Course interactivity: MOOCs can offer a variety of interactive activities, such as videos, quizzes, discussion forums and hands-on assignments, which encourage active student participation. These activities keep participants engaged with course content and promote greater knowledge retention (Gamage et al., 2020).
- Personalization of learning: MOOCs allow students to access course content at any time and from anywhere, giving them the flexibility to tailor learning to their own needs and preferences. This personalization increases engagement by allowing participants to follow their own pace and focus on the topics that are most relevant and interesting to them (Cheng, 2023).
- Feedback and feedback: MOOCs offer opportunities to receive feedback from both course facilitators and other participants. This constant feedback helps students evaluate their progress, identify areas for improvement, and stay motivated in their learning (Dalipi et al., 2021).
- Collaborative learning: MOOCs facilitate collaborative learning by connecting students to a global community of peers with similar interests and goals. This promotes social interaction, the exchange of ideas, and the building of professional networks that can increase engagement and enrich the learning experience (Sastre et al., 2018).
- Gamification: Some MOOCs use gamification techniques, such as points, levels and rewards, to motivate students and increase their engagement with the course. These strategies make learning a more fun and rewarding experience, which can improve engagement and academic performance (Gené et al., 2014).

Engagement is critical to the success of MOOCs, as it promotes active participation, increased knowledge retention and a more satisfying learning experience for students. MOOCs offer a variety of tools and strategies to foster engagement and keep participants motivated in their online learning process.

State of the Art. Engagement and Academic Attrition in MOOCs

The relationship between engagement and academic performance in MOOCs is a topic of great importance, as the level of student engagement can significantly influence their success in the course. Some key points about this relationship are:

- Motivation and effort: Engagement is closely related to the motivation and effort students are willing to invest in the course. Highly engaged participants tend to devote more time and energy to study, which can translate into better academic performance (Badali et al., 2022).
- Participation: Engaged learners tend to participate more actively in course activities, such as watching videos, completing practical assignments, participating in discussion forums, and collaborating with other participants. This involvement can improve their understanding of the material and their ability to apply it in practical situations, which is reflected in improved academic performance (Liyanagunawardena et al., 2014).
- Knowledge retention: Engagement is also related to long-term knowledge retention. Students who are engaged in the course tend to pay more attention to the content and participate in review and practice activities, which helps them consolidate what they have learned and recall it more easily during subsequent assessments (Khalil & Ebner 2014).
- Interaction with feedback: Engagement can influence how learners interact with the feedback and feedback provided by course facilitators. Engaged participants tend to value and actively use feedback to improve their academic performance, whereas those with lower levels of engagement may overlook this important information (Goopio & Cheung, 2020).
- Persistence and completion of the course: Engagement can also affect persistence and course completion rates. Highly engaged students are more likely to persevere throughout the course, overcome challenges, and successfully complete all required activities and assessments (Xing, 2018).

Therefore, there is a positive relationship between engagement and academic performance in MOOCs. Students who are highly engaged in the course tend to show greater motivation, participation, knowledge retention, interaction with feedback, and persistence, which translates into better overall academic performance.

Several quantitative and qualitative studies have been conducted in relation to engagement and MOOCs, but few have studied how they influence academic attrition (Estrada-Molina & Fuentes-Cancell, 2022; Sanz-Martínez et al., 2019). In this regard, several pioneering studies (Er et al., 2019) establish the main causes of attrition. These refer, as expressed in the systematic study Estrada-Molina & Fuentes-Cancell (2022), to motivation; time availability; attitude; interest; tutoring; interactivity and feedback; accessibility of educational resources; engagement, among others (p. 112). In this sense, motivation plays a crucial role in the commitment to a MOOC course, mainly due to the following factors

- Autonomy and choice: MOOCs typically offer a wide range of topics and approaches, allowing students to choose courses that align with their personal or professional interests and goals. This autonomy in choice increases intrinsic

motivation, as students feel more engaged when they are studying something that genuinely interests them (Ding & Shen, 2019).

- Relevance and applicability: Students are more motivated when they perceive that what they are learning is relevant and applicable to their life or career. MOOC courses that offer practical and applicable content increase students' motivation by showing them how they can use what they are learning in real situations (Wang et al., 2023).

- Interactivity and participation: MOOC courses that encourage interaction among students and with the instructor tend to increase engagement. Participation in collaborative discussions, activities, and projects can increase motivation by providing opportunities for social learning and constructive feedback (Chen et al., 2018).

- Feedback and recognition: Regular and constructive feedback is essential to keep student motivation high. MOOC courses that provide timely feedback on student progress, as well as recognition for achievements, reinforce intrinsic motivation by demonstrating to students that their effort and dedication are valued (Ramirez-Fernandez, 2015).

- Clear and challenging objectives: Setting clear and challenging goals can increase motivation by providing students with a sense of direction and accomplishment. MOOC courses that set clear expectations and provide opportunities to achieve meaningful goals can foster greater student engagement (Von Schmieden et al., 2022).

The latent concern of academic attrition in MOOCs leads the scientific community to study its causes, focusing its attention on engagement. This term is a construct that integrates in the configuration of personality, what is related to commitment, interest, participation, emotion, enthusiasm and motivation of the student body which, in this educational context, refers to learning and school permanence in the context of MOOCs. As expressed by Deng et al. (2020) and Deng (2023) this construct is structured as social, emotional, cognitive, and behavioral engagement. In this context of engagement in MOOCs to help reduce attrition, studies that analyze the following engagement variables stand out: data privacy, peer review, e-activities design, motivation and intrinsic communication (Kasch et al., 2021; Khalid et al., 2020).

Genesis of the Research Expo Facto

Taking into account the theoretical and empirical studies mentioned above, we developed during January 2020 to March 2023 an educational research to deepen the causes that influence from engagement to academic attrition in MOOCs. To this end, theoretical studies (Estrada-Molina & Fuentes-Cancell, 2022; Estrada-Molina et al., 2021; Fuentes-Cancell et al., 2021;) and case studies (Granda Dihigo et al., 2023; Estrada-Molina 2022; Estrada-Molina et al., 2022) were conducted with diverse samples from university faculty in two countries (descriptive level). Although we have published some studies referring to partial and individual results, in this descriptive article we intend to group and compare the theoretical and empirical results obtained, thus contributing to didactics in higher education related to the design of MOOCs.

Method

The research is descriptive, mixed and expo-facto. An expo-facto type of educational research (Mateo, 2004) is a type of study that is conducted after the events

have occurred, which means that the researcher has no control over the independent variables, since they have already occurred naturally. This type of research focuses on observing and analyzing the effects of certain independent variables on a dependent variable, without the direct intervention of the researcher.

This type of research is useful when it is not ethical or practical to manipulate the independent variables experimentally. However, it may be more difficult to establish clear causal relationships due to the lack of experimental control.

On the other hand, descriptive research is a research method that focuses on describing and characterizing a phenomenon or situation as it is, without manipulating variables or looking for causal relationships. Its main objective is to provide a detailed and accurate representation of the characteristics, behaviors or phenomena observed in a particular context (Sampieri, 1988).

In descriptive research, researchers collect data through techniques such as surveys, observations, interviews or document analysis. They then analyze and present these data in a systematic way to describe the essential characteristics of the phenomenon studied.

This type of research is common in many disciplines, including psychology, sociology, education, public health, and market research, among others. Although descriptive research does not seek to establish causal relationships or explain why certain phenomena occur, it provides a solid base of information that can serve as a starting point for further research, including exploratory or experimental studies that seek to better understand the relationships between variables.

Therefore, the objectives of this study are to to determine, based on a theoretical study, which are the engagement variables that influence academic attrition in MOOCs and, based on the analysis of a questionnaire, to describe the evaluations of the participating teachers. To this end, the following research questions were posed.

Question 1. what are the most the most studied variables from the engagement perspective to contribute to decrease the dropout rate in MOOCs?

To answer this question, a systematic review was carried out applying the PRISMA protocol to research published in journals indexed in Scopus or WoS.

Question 2. what are, according to university professors, the variables that contribute to reduce the dropout rate in MOOCs?

In this question, a validated questionnaire was applied, consisting of the variables identified as results of Question 1.

Context. Population and Sample

The study was conducted at two points in time:

- First moment. Second academic year of the Master in Virtual Education "2019-2021 edition". Universidad de las Ciencias Informáticas (UCI), Cuba, during October 2020 to February 2021 in the context of the subject: Network training methods.
- Second moment. Third academic year of the Academic Master's Degree with a professional career in Education. Mention ICT-mediated Learning Management "2022-2023 edition". Universidad Técnica de Manabí (UTM), Ecuador, during January-February 2023 in the context of the subject: Fundamentals of virtual education.

In the first instance, the population and sample consisted of the 43 university professors enrolled in the Master's Degree in Virtual Education. The second sample consists of 26 teachers from Ecuador enrolled in the academic Master's degree with a

professional career in Education, mentioning ICT-mediated Learning Management (Table 1).

Table 1
Sample distribution

Demographic data	Sample 1 (43) Master's Ed. Virtual. Cuba	Years as university teachers Sample 1	Sample 2 (26) Academic Master's Degree in Ed. Mention ICT-mediated Learning Management. Ecuador	Years as university teachers Sample 2
Women	23	M = 7.5	17	M = 8.1
Men	20	M = 8.1	9	M = 7.6
Total	43	M = 8.0	26	Me = 7.5

Research Techniques and Instruments

In relation to the first research question, the PRISMA protocol was applied and an in-depth analysis of the content of the evidence obtained in the theoretical analysis was used. For the validation of the content, Cohen's Kappa coefficient (k=0.826) was applied to the evaluations of the teacher researchers, obtaining 96% coincidence (Cohen, 1960).

In relation to the design of the questionnaire applied to the two samples of university professors in Cuba and Ecuador (question 2), a Likert-type scale of five values was designed (1 = Not at all, 2 = A little, 3 = Somewhat, 4 = Quite a lot and 5 = A lot) composed of the variables established in the scientific literature and the result of question 1 of the research. The expert technique (n = 33) was used for the content validity of the questionnaire. The experts are Doctors of Education Sciences and come from Spain, Ecuador and Mexico. The overall questionnaire (internal consistency) has a Cronbach's Alpha (α) value equal to 0.87. For the validity of understanding, two pilot studies were conducted, the first in 2021 with seven professors from the institution itself (UCI-CUBA) and 19 students (UCI-Cuba) and the second, with 10 students of the academic master's degree with a professional career in Education, mentioning ICT-mediated Learning Management, (UTM-Ecuador).

The Kaiser-Meyer-Olkin test applied to the questionnaire was adequate (KMO = ,862) and Bartlett's test of sphericity showed adequate figures ($\chi2$ = 3059.53; p < ,001). The questions were structured in three parts. First, from a qualitative perspective, the teachers had to assess which variables, from an engagement perspective, contribute to reducing the academic dropout rate in MOOCs. Subsequently, from the quantitative point of view, they had to score according to a five-value Likert scale (1 = Not at all, 2 = A little, 3 = Somewhat, 4 = Quite a lot and 5 = A lot), the 15 variables that were identified as the theoretical result of the research (Question 1). Finally, they were to propose some recommendations for developing engagement in MOOCs.

To measure the results of the questionnaire, the following measures were used: mean (M) and standard deviation (σ).

Investigation Procedure

The research consisted of three phases. First, to answer Question 1, a systematic review was conducted to identify the most studied variables from the engagement perspective to help reduce the attrition rate in MOOCs. Subsequently, in relation to Question 2, a questionnaire was designed, validated and applied to 69 university teachers from Cuba and Ecuador (Table 1), who are enrolled in two university master's degrees

and who in turn took a course whose professor is the author of the research. All teachers (student participants) agreed to voluntary participation in the research.

Results

Question 1. what are the most studied variables from engagement to contribute to decrease the dropout rate in MOOCs?

To summarize the results obtained in the systematic review and previously published, the main variables are (Estrada-Molina & Fuentes-Cancell, 2022).

- General education "students of various ages". The most commonly used variables are: data privacy; forum design; democratization of education; gamification; satisfaction and perceived quality.
- University education. In this scenario, the following variables stand out: e-activities design; intrinsic and extrinsic motivation; personal learning networks; and peer review.
- Postgraduate education. The following variables are highlighted: communication and social media; e-activity design; motivation and intrinsic communication (p.117).

Question 2. what are, according to university professors, the variables that contribute to reduce the dropout rate in MOOCs?

Qualitative Results

The following are some random comments on the opinions or evaluations of the university professors in the applied samples.

- I believe that, among the engagement variables are: learning strategies and psychological factors related to virtual exams (teacher 1, sample 1, Cuba).
- The variables may be diverse, but the most influential are the design of e-activities and extrinsic or intrinsic motivation (teacher 15, sample 1, Cuba).
- Engagement is definitely related to attrition in MOOCs with peer review, motivation, interactivity and e-activities design being the most influential (teacher 33, sample 1, Cuba).
- In Ecuador, based on my teaching experience, we do not use MOOCs, although we do use various virtual courses, and one of the engagement factors or variables that have the greatest impact is the design of electronic activities (teacher 15, sample 2, Ecuador).
- In MOOCs, from an engagement perspective, I believe that the influential variables are student autonomy, study planning and motivation (teacher 20, sample 2, Ecuador).
- Engagement, whether social, cognitive or attitudinal, influences retention or dropout in MOOCs or virtual courses in a general sense. The design of learning activities, personal satisfaction, gamification and interactivity are the most influential variables. (teacher 25, sample 2, Ecuador).

Quantitative Results

In the application of the questionnaire based on the variables obtained in the theoretical study (question 1), the design of forums, democratization of education, design of e-activities, intrinsic communication, personal learning networks and motivation are the most influential variables (Table 2).

Table 2

Mean and standard deviation of the two study samples

Variables resulting from Question 1		Sample 1 (43 teachers-Cuba)		Sample 2 (26 teachers-Ecuador)	
		M	σ	M	σ
General Education	Data privacy	4,19	0,39	4,2	0,63
	Forum design	3,91	0,43	4,1	0,27
	Democratization of education	3,93	0,34	3,9	0,33
	Gamification	4,98	0,15	4,4	0,90
	Satisfaction	4,93	0,34	4,7	0,49
	Perceived quality	4,79	0,47	4,6	0,57
	Design of e-activities	4,84	0,37	4,7	0,49
University Education	Intrinsic motivation	4,81	0,39	4,8	0,43
	Extrinsic motivation	4,95	0,30	4,7	0,55
	Personal learning networks	4,93	0,26	4,9	0,27
	Peer review	4,00	0,00	4,1	0,27
	Communication and social media	3,98	0,15	4,0	0,20
Postgraduate education	Design of e-activities	4,93	0,26	4,9	0,27
	Motivation	4,95	0,21	5,0	0,20
	Intrinsic communication	4,98	0,15	4,9	0,27

Discussion and Conclusions

As a result of the systematic review (Question 1), it was found that the academic literature identifies 25 variables that, from the study of engagement, influence academic attrition in MOOCs. Of these, 13 are those with the greatest agreement among the authors. It is interesting to note that, in the case of university and postgraduate education (higher than undergraduate level), the most studied variables refer to the design of e-activities, intrinsic motivation and extrinsic motivation, moving away from those related to gamification.

The empirical study of the purposively selected samples shows that the majority of the university teachers surveyed

- They generally agree that the variables related to the design of e-activities, communication and motivation are the most influential.
- And, that engagement variables (investigated, but not highlighted as regularities in the scientific literature (question 1), such as: autonomy and learning planning also influence academic dropout and should be taken into account to strengthen school retention.

In the recommendations that we obtained as theoretical (question 1) and empirical (question 2) results to develop student engagement in MOOCs and thus reduce academic dropout in Higher and Postgraduate Education, we find:

a) increase the teacher's presence in the tutoring and learning feedback processes (Löh et al., 2024; Estrada-Molina & Fuentes-Cancell, 2022),

b) design e-activities that promote meaningful learning and motivating educational resources (Castillo-Abdul et al., 2021),

c) breaking the barrier of content transmission and visualization without proper interaction, interactivity and feedback between the teacher, the learning community and the student (Li et al., 2024); and

d) promote self-regulation of learning and self-efficacy of web-based learning (Shen et al., 2024; Repáraz et al., 2020).

This allowed us to verify the theory that engagement in MOOCs contributes to the development of the following aspects:

- Autonomy and choice of content and courses influencing intrinsic motivation (Ding & Shen, 2019).
- Meaningful learning and its relationship to MOOC course content through practical application of skills in real situations (Wang et al., 2023).
- Interactivity and participation among members of the educational community (Chen et al., 2018).
- Regular and constructive feedback reinforcing intrinsic motivation, effort and dedication (Ramirez-Fernandez, 2015).
- The relationship between challenging objectives, content based on meaningful learning, learning activities and formative assessment. (Von Schmieden et al., 2022).

In closing, we consider that a vital theoretical and practical aspect is perceived quality. It establishes that to promote engagement in MOOCs, coherence must be achieved between the learning objectives and goals, the design of the activities and the expectations of the student body. Perhaps, in this sense, it is important to develop 1) training pills (NOOC) as a complement, 2) constructivist alternatives (cMOOC) and 3) e-activities based on educational videos (madeMOOC).

Although this study was significant at the level of case studies, it is limited by the fact that the sample is small and, therefore, the results cannot be generalized. In any case, in our opinion, the didactic theory regarding the relationship between engagement and MOOCs is enriched and confirmed.

The research helped us to learn about faculty perspectives and clues to improve our teaching performance in MOOCs. As a line of future work, it is established to analyze and compare how peer assessment and self-assessment influence the engagement of students enrolled in MOOCs.

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