


Gamification Increases Completion Rates in Massive Open Online Courses

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ABSTRACT

Massive open online courses (MOOCs) aim at unlimited participation and open access via the web. There are concerns about the actual value of such courses. This is predominantly due to higher dropout rates. According to studies, only 7-13% go on to complete these courses. The high dropout rate in MOOCs is a challenge for education providers. This paper aims to explore reasons for high dropout rates within MOOCs and how they can be minimized. With this in mind, two research questions have been set for this study: 1) Why do MOOC participants not complete their courses? 2) How can the course completion rate be increased? Implementation of the strategies investigated in this paper can increase completion rates in MOOCs. In conclusion, after analyzing the collected data, the final results have shown that gamification increased the completion rate of MOOCs.

KEYWORDS

Continuing Education, Distance Education, Dropout Rate, E-Learning, Lifelong Learning, MOOC, Online Education, Online Learning

INTRODUCTION

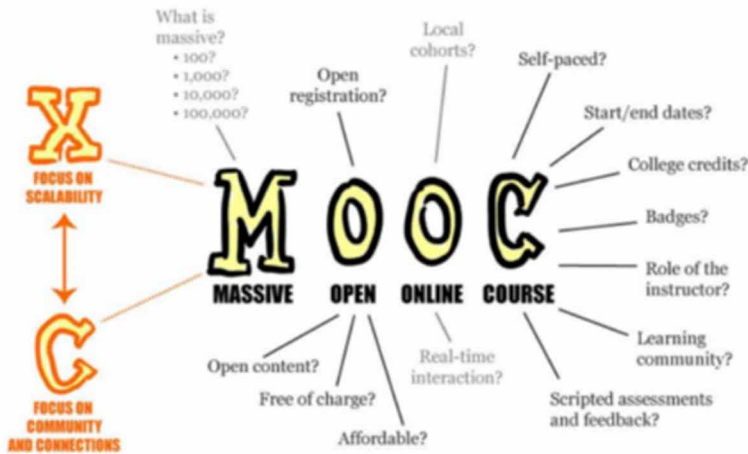
Among the various e-learning courses offered, one option is the MOOC model, which is “a course aimed at unlimited participation and open access via the web” (Kaplan & Haenlein, 2016) “with a publicly shared curriculum and open-ended outcomes” (McAuley et al., 2010). In addition to traditional course materials, such as filmed lectures, texts and problems, many MOOCs provide interactive user forums to support community interactions among students, professors and teaching assistants. MOOCs integrate the connectivity of social networking, the facilitation of an acknowledged expert in a field of study and a collection of freely accessible online resources. MOOCs build on the active engagement of several hundred to several thousand attendees who self-organize their participation with regards to learning goals, prior knowledge and skills as well as common interests (McAuley et al., 2010). Figure 1 shows basic characteristics of a MOOC.

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Figure 1. Meaning of Massive Open Online Courses (Plourde, 2013)



MOOCs are often offered through virtual education platforms that have been custom built for the provision of such courses, such as Udacity, edX and Coursera (Ong & Grigoryan, 2015; Pang et al., 2014; Yuan & Powell, 2013). Yuan & Powell and Daniel et al. are two studies, among others, which view the MOOC phenomenon as the outcome of both the techno-media convergence process as well as the massification of tertiary education (Yuan & Powell, 2013; Daniel et al., 2015). MOOCs are viewed by some more as an opportunity for public institutions in the education sector with smaller budgets and less as a threat, alluding to the access advantages that such courses could bring to certain groups in society, such as retirees or employees looking for professional development (Ong & Grigoryan, 2015). This view of MOOCs as an opportunity to advance lifelong learning is equally held by official European bodies, viewing them as agents of change in higher education (De Freitas et al., 2015; European Commission, 2013; European Parliament, 2015).

For the purpose of this literature review, the researchers have focused on MOOCs and their completion rate. The authors have set two research questions. Firstly, **why do MOOC participants not complete their courses?** Secondly, **how can the course completion rate be increased?**

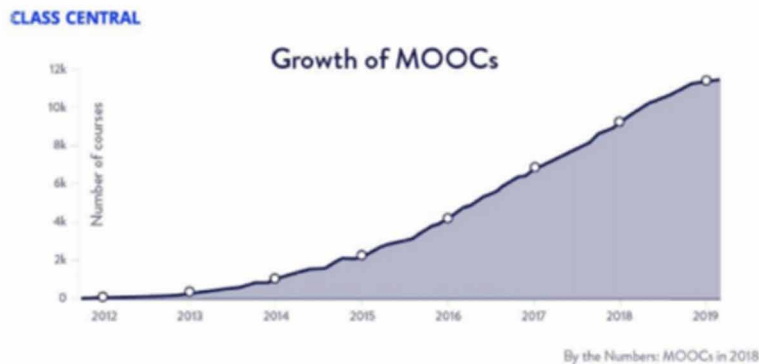
BACKGROUND

Higher education institutions have become more receptive to integrating new technologies into their teaching and learning processes over the last decade. One of these new technologies has been MOOCs (Costa et al., 2018). Figure 2 illustrates the rapid growth of MOOCs from 2012 to the end of 2018 (Shah, 2018).

Taking the perspective of the supply side, Hollands and Tirthali looked into why institutions offered MOOCs, with a qualitative study of 83 interviews with leaders of 29 US institutions. They identified 6 main objectives (Hollands & Tirthali, 2014):

1. expanding the institutional scope and attracting a larger number of students (size),
2. building and maintaining their brand (prestige),
3. improving their finances by reducing costs or increasing income,
4. improving their educational results,
5. innovating in teaching and learning and
6. conducting research on teaching and learning processes.

Figure 2. Growth of MOOCs from 2012 until the end of 2018 (Shah, 2018)



MOOCs by nature have some common characteristics: short videos, quizzes, peer base and/or self-assignment and online forums (Glance et al., 2013), yet there are pedagogical differences in courses even in the same platform (Bali, 2014). Offering or participating in a MOOC has benefits for each party; however, concerns are arising on the real value behind MOOCs. This is predominantly due to higher dropout rates. **Usually, only a 7-13% pass rate or sometimes even less than that go on to complete these courses** (Jordan, 2014).

A Stanford study investigated different engagement levels of the participants from three different MOOCs and found that there were typically four different types of MOOC learners: **Completing, Auditing, Disengaging and Sampling Learners** (Kizilcec et al., 2013):

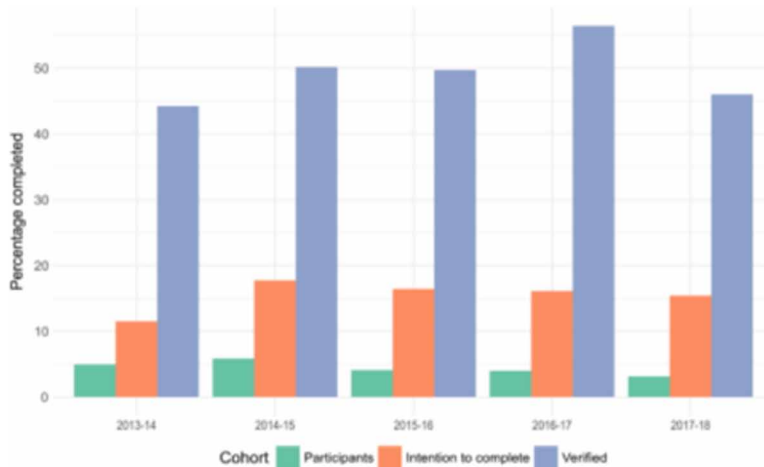
- Completing MOOC Learners who completed the majority of the assessments offered in the class.
- Auditing MOOC Learners who only watch video lectures.
- Disengaging MOOC Learners who did assessments at the beginning but disengaged in the first three weeks of the course.
- Sampling MOOC Learners who watched video lectures for only one or two assessment periods.

MOOCs High Dropout Rate

Reich and Ruipérez-Valiente attempt to explain why MOOCs mainly failed to achieve their stated goal of revolutionizing education, prompting the major MOOC providers to shift their attention to a more conventional role of assisting universities in bringing their academic programs online. What the authors add to the understanding of the MOOC landscape is an analysis of data from all MIT and Harvard University courses taught from 2012 to 2018 through edX, which quantitatively backs up what has been suspected. The data covers 5.63 million learners from 12.67 million course registrations (Reich, Ruipérez-Valiente, 2019).

First, even as supporters pointed out that many people attended MOOCs for knowledge or skill development rather than a certification, one of the major knocks against MOOCs from the start was the low rate at which learners finished the courses. Reich and Ruipérez-Valiente show that completion rates in MIT and Harvard MOOCs did not increase but fell from 2013-14 to 2017-18 for three cohorts: 1) all participants; 2) those with a stated intention to complete; 3) those who paid to take verified courses. Figure 3 shows the completion rates for the three aforementioned groups: the rate for all course participants, for all learners who indicated in the survey that they intended to complete a course, and for all learners who paid for a verified track (Reich, Ruipérez-Valiente, 2019).

Figure 3. Percentage of course completion by year and cohort of learners (n = 5.63 mln learners) (Reich, RUIPÉREZ-VALIENTE., 2019)



Among all MOOC participants, 3.13% completed their courses in 2017-18, down from about 4% from the two previous years and nearly 6% in 2014-15. Among the “verified” students, 46% completed in 2017-18, compared to 56% in 2016-17 and about 50% the two previous years (Reich & RUIPÉREZ-VALIENTE, 2019).

Sanchez-Gordon, Calle-Jimenez and Luján-Mora in “Relevance of MOOCs for Training of Public Sector Employees” describe three challenges that need to be addressed for the successful implementation of MOOCs in education: **enrollment, completion rate and web accessibility** (Sanchez-Gordon et al., 2015). In the study, the authors focus on the rate of completion.

Completion Rate

Completion rate is defined as the proportion of enrolled participants who earn a certificate of completion. The average MOOC completion rate is around 13% (Jordan, 2014). Since there are often several thousand registrants in a MOOC, this average completion rate still translates to a high number of participants completing the course.

Nevertheless, to adequately interpret these massive enrollment numbers, it is important to consider emerging behaviors in MOOC registrants (Table 1).

The following strategies may maximize the completion rate in MOOCs (Kizilcec et al., 2013):

- Working adults have difficulty following an 8 to 12 weeks course, which is the norm for university-led MOOCs. Reducing the length of the MOOCs to between 2 and 6 weeks will increase completion rates (Pappano, 2012).
- Keep the weekly time commitment in the range of 2 to 6 hours.
- Provide Internet access so the course can be taken at work.
- Design a clear syllabus.
- Create a social learning community.
- Assessing the performance of participants can reflect the efforts and contribution of civil servants, therefore creating for them the motivation to improve and participate in the training (Tien Vi, 2019).

In this study, the authors focus on gamification as a strategy to increase the completion rate.

Table 1. Different strategies of MOOC participants (Milligan et al., 2013; Hill, 2013)

Strategy	Characteristics
No-shows	enrol but never log in once the course opens; these can be as much as 50% of enrollment
Lurkers	enrol but just to observe or sample a few items at most; many of these participants do not complete week 1
Drop-ins	become active only for a selected topic within the course but do not intend to complete the entire course; some of these are focused attendees who use a MOOC to meet external goals
Passive participants	view the course as content to consume and expect to be taught; these students typically watch videos, perhaps take quizzes but tend not to take part in activities or class discussions
Active participants	these whose intention is to fully participate and complete a MOOC

Gamification in MOOCs

The term gamification itself is quite recent. In 2002, Nick Pelling, a British game developer, coined and used it to describe his idea of enhancing the enjoyability and the speed of “electronic transactions” with “game-like accelerated user interface design” (Nepal et al., 2015). An often cited definition of gamification was elaborated by Deterding et al. in 2011 who referred to it as “the use of game design elements in non-game contexts” (Deterding et al., 2011). According to Nah et al., the most used game design elements in education are Points, Levels, Badges, Leaderboards, Prizes and Rewards, Progress Bars, Storylines and Feedback (Nah et al., 2014). Gamified learning environments are considered to be the next competitive key value in higher education institutions (HEIs) (Niman, 2014).

Through the use of game mechanisms, gamification techniques can **improve participant motivation and engagement, commitment, and loyalty among students, leading to a higher number of proactive participants** (Gené et al., 2014).

Few research studies have examined the experiences and effects of gamification techniques in MOOCs as quality innovative learning. Freire et al. (Freire et al., 2014) and Romero and Usart (Romero & Usart, 2013), discuss some MOOC experiences using Serious Games as integrated activities.

METHODOLOGY

This paper focuses on the reasons for the dropout rates in MOOCs and how they can be addressed. The authors have set two research questions. Firstly, **why do MOOC participants not complete their courses?** Secondly, **how can the course completion rate be increased?**

The research hypothesis is that gamification can significantly increase MOOC completion rates.

The authors have worked with secondary data and a literature review based on peer-reviewed articles from research databases predominantly from Scopus and Web of Science. Secondary data is data that was collected by others for another primary purpose. During the secondary research, authors may draw data from government documents, scientific papers, statistical databases and other sources (Panchenko & Samovilova, 2020).

Over 70 peer-reviewed papers have been collected and data from them was extracted and analyzed. The chosen articles were retrieved by searching for the combination of the following keywords: “Gamification” AND “MOOC” OR “MOOCs” OR “Massive Open Online Course” OR “Massive Open Online Courses”.

A chi-square statistic was implemented to check the research hypothesis. The chi-square statistic is a way to show a relationship between two categorical variables, in this case, MOOCs with gamification vs. MOOCs without gamification.

RESULTS

The collected data have been analyzed thematically and the success factors have been grouped in the table below (Table 2). When two or more sources are compared and contrasted—again, even if representing qualitative, quantitative, or mixed research—then cross-case qualitative analyses are justified (Onwuegbuzie et al, 2012). Based on this, the researchers grouped all data collected in the table and compared how MOOCs completion rate increased. In the first column there are written titles of investigated courses; in the second column number of registered students; in the third column number of completed registrants; the fourth column presents the completion rate, the fifth one indicates if gamification was implemented; the sixth one presents the year when the course took place and in the final column the source of the data is inserted.

Statistical Analysis

The authors pooled data from all studies summarized in Table 2 into a meta-Chi square 2*2 table (Table 3). In total, **123,453 participants underwent MOOC with gamification, out of which 13.7% completed the MOOC**. On the other hand, a total of **490,686 learners underwent MOOC without gamification where only 1.7% of them completed the MOOC**. Results from the meta Chi-squared test (Table 3) demonstrated that gamification significantly increases the rate of MOOC completion with a p-value < 0.00001.

The chi-square statistic is 36072.5132. The p-value is < 0.00001. Significant at $p < .05$. The chi-square statistic with Yates correction is 36069.4748. The p-value is < 0.00001. Significant at $p < .05$.

DISCUSSION

In comparison to traditional face-to-face education as well as distance education – where students often have to meet certain admission requirements and primarily follow full educational programs – a MOOC is a relatively short course (generally 5–12 weeks) which is accessible anytime, anywhere, and to anyone. It is therefore recognized that it should not be compared to a traditional learning context for completion and dropout rates (Huin et al., 2016; Walji et al., 2016).

Dropout rates have been long researched and studied in academia. One particular piece of research by Tinto differentiated between two levels of dropouts: 1) those who leave a single educational institution without an end qualification; 2) those who attend several educational establishments and leave without an end qualification from any of them (Tinto, 1975). He proposed a model for explaining student dropout that includes a combination of individual and organizational variables influencing dropout. In 1986 this theoretical model was taken and applied by Sweet in a study based on a distance education context. Furthermore, Garrison argued that research on dropouts in distance education was too focused on understanding and predicting but without taking into consideration the very nature of distance education. To this end, Garrison put forward a recommendation to focus on the student's perspectives and developing situation specific models and theories before trying to generalize (Garrison, 1987). This is also in line with recommendations by Tinto (1975): 'A [...] more important limitation [...] is the tendency to ignore the perspective of the individual' (Tinto, 1975).

This paper assumes that the research of Tinto from 1975 on dropout rates at higher education institutions is relevant to this present day study on MOOCs. In his research, Tinto points out that the individual motivation of course participants is crucial in regard to course dropout rates. The authors have noticed that this observation by Tinto is applicable to dropout rates in MOOCs. However, unlike the courses, Tinto observed, with many MOOCs there is no institution or representative of the institution compelling participants to complete the course: completion stems solely from the participants' self-motivation. It has been observed that participants focus more on taking as much from the MOOC as they need rather than completing the course (Henderikx et al., 2017).

Table 2. Overview of completion rate in MOOCs with and without gamification

MOOC	Number of registrants	Number of participants who completed the course	Completion rate	Gamification	Year of starting the course	Reference
1. "Energy saving"	12,929	2019	15.62%	yes	2017-2018	Romero-Rodriguez, Ramirez-Montoya, Gonzalez, 2019
2. "Distribution of electrical energy"	5,549	639	11.52%	yes	2017-2018	Romero-Rodriguez, Ramirez-Montoya, Gonzalez, 2019
3. "Smart Grid: Electrical networks of the future"	6,608	821	12.42%	yes	2017-2018	Romero-Rodriguez, Ramirez-Montoya, Gonzalez, 2019
4. "Smart Grid: Technical fundamentals"	5,498	743	13.51%	yes	2017-2018	Romero-Rodriguez, Ramirez-Montoya, Gonzalez, 2019
5. "Electric power transmission"	5,961	1,074	18.02%	yes	2017-2018	Romero-Rodriguez, Ramirez-Montoya, Gonzalez, 2019
6. "Conventional, clean energy, and its technology"	18,693	2,770	14.82%	yes	2017-2018	Romero-Rodriguez, Ramirez-Montoya, Gonzalez, 2019
7. "Electric power: Concepts and principles"	15,978	1,807	11.31%	yes	2017-2018	Romero-Rodriguez, Ramirez-Montoya, Gonzalez, 2019
8. "Energy: Past, present, and future"	13,224	2,106	15.93%	yes	2017-2018	Romero-Rodriguez, Ramirez-Montoya, Gonzalez, 2019
9. "Carbon markets"	6,710	910	13.56%	yes	2017-2018	Romero-Rodriguez, Ramirez-Montoya, Gonzalez, 2019
10. "Energy markets"	10,255	846	8.25%	yes	2017-2018	Romero-Rodriguez, Ramirez-Montoya, Gonzalez, 2019
11. "The new electricity industry in Mexico"	8,975	1,224	13.64%	yes	2017-2018	Romero-Rodriguez, Ramirez-Montoya, Gonzalez, 2019
12. "Energy reform and its opportunities"	12,744	1,928	15.13%	yes	2017-2018	Romero-Rodriguez, Ramirez-Montoya, Gonzalez, 2019
13. "6.002x: Circuits & Electronics"	154,763	7,157	4.63%	no	2012	Vaibhav, Gupta, 2014
14. "8.02x Electricity and Magnetism"	about 40,000	1,721	4.3%	no	2013	Vaibhav, Gupta, 2014
15. "Information Theory"	10,953	15	0.14%	no	2014	Lyu, Chan, Yeung, 2018
16. "Introduction to Entrepreneurship"	45	12	26.67%	yes	2013	Romero, Usart, 2013
17. "Bioelectricity: A Quantitative Approach"	12,725	313	2.46%	no	2012	Belanger, Thornton, 2013
18. "Gratis Online Lernen. GOL-2014"	1,003	176	17.54%	no	2014	Khalil, Ebner, Admiraal, 2017
19. "Gratis Online Lernen. GOL-2015"	476	94	19.74%	no	2015	Khalil, Ebner, Admiraal, 2017
20. "Gratis Online Lernen. GOL-2016"	284	74	26.05%	yes	2016	Khalil, Ebner, Admiraal, 2017
21. "First-Year Composition 2.0"	21,934	238	1.09%	no	2013	Georgia Institute of Technology course via Coursera, 2013
22. "A History of the World since 1300"	83,000	605	0.73%	no	2012	Princeton University course via Coursera, 2012
23. "Technicity"	21,000	400	1.9%	no	2013	Ohio State University course via Coursera, 2013
24. "Generating the Wealth of Nations"	28,922	500	1.73%	no	2013	University of Melbourne course via Coursera, 2013

continued on following page

Table 2. Continue

MOOC	Number of registrants	Number of participants who completed the course	Completion rate	Gamification	Year of starting the course	Reference
25. "Writing II - Rhetorical Composing"	30,000	500	1.67%	no	2013	Ohio State University course via Coursera, 2013
26. "Introduction to Sociology"	40,000	1,283	1.21%	no	2012	Princeton University course via Coursera, 2012
27. "E-learning and Digital Cultures"	42,844	1,719	4.01%	no	2013	University of Edinburgh course via Coursera, 2013
28. "Surviving Disruptive Technologies"	16,000	700	4.38%	no	2013	University of Maryland College Park course via Coursera, 2013
29. "ICT in Primary Education: Transforming children's learning across the curriculum"	9,000	315	3.5%	no	2014	University of London course via Coursera, 2014

Table 3. Results from the Chi-squared test

	MOOCs Completed	MOOCs Not Completed	Marginal Row Totals
With Gamification	16973 (5101.03) [27630.4]	106480 (118351.97) [1190.89]	123453
Without Gamification	8403 (20274.97) [6951.61]	482283 (470411.03) [299.62]	490686
Marginal Column Totals	25376	588763	614139 (Grand Total)

A 14-week course called "6.002x: Circuits and Electronics" offered in 2012 by the Massachusetts Institute of Technology registered an enrollment of 154,763 students and only 7,157 (4.62%) of them fully completed the course (Romero-Rodriguez et al., 2019). Another example is the course "Information Theory" designed by the Chinese University of Hong Kong that registered 10,953 participants in 2014 and only 0.14% of the total completed it (Lyu et al., 2018). The high dropout rate in most MOOCs is the fundamental challenge faced by online education providers (Mamman et al., 2017).

As per Saxena and Mishra, gamification supports the development of students' motivational, cognitive, social, and emotional outlook (Saxena & Mishra, 2021). Romero-Rodriguez et al. in their study focused on the impact of gamification on the completion rate of MOOCs. They assumed that gamification, like using a system of badges, points, dashboards, challenges and leader boards, will create competition among the participants and will influence the creation of learning communities. They compared results of completion rates between MOOCs with gamification (14.43%) and MOOCs without gamification (6.16%) (Romero-Rodriguez et al., 2019). The positive impact of gamification on MOOC use has also been proven in a recent study by Aparicio et al. Their conclusions show that the factors which directly influence individual impact are use, user satisfaction and gamification. Furthermore, gamification was found to have a significant impact as a moderator between individual and organizational factors (Aparicio et al., 2019).

Last but not least, MOOCs have turned out to be useful on a bigger scale in the time of the Covid-19 pandemic when on-site learning has been significantly limited worldwide. "Enrolment at

Coursera has skyrocketed and was 640% higher from mid-March to mid-April 2020 than during the same period last year, growing from 1.6 to 10.3 million” (Shah, 2020).

CONCLUSION

The application of gamification in MOOCs opens up new learning opportunities, motivating learners to complete courses without any dropouts (Gené et al., 2014). This research has explored the implementation of gamification in MOOCs leads to increasing completion rates. Also, other recent studies prove that the implementation of gamification significantly reduces the dropout rate in MOOCs (Deterding et al., 2011; Romero-Rodriguez et al., 2019; Aparicio et al., 2019). Besides, assessing the performance of participants can reflect the efforts and contribution of learners, therefore helping to instil the motivation to improve and participate in the training (Tien Vi, 2019).

Some people assume that MOOCs will not transform higher education. Rather they will provide new support for specific niches within already existing education systems. New education technologies are rarely, perhaps never, disruptive; rather they are domesticated by existing cultures and systems (Cuban, 1986).

According to the findings, 123,453 attendees enrolled in a MOOC with gamification, of which 13.7% finished the course, while 490,686 participants took a MOOC without gamification, of which just 1.7% completed the course. Results from the data analysis demonstrated that gamification significantly increases the rate of MOOC completion. In conclusion, the authors recommend implementing gamification in MOOCs in order to increase the rate of completion.

LIMITATIONS OF THE STUDY

The study was limited by the number of investigated MOOCs ($n = 29$). Also, the completion rate was compared among MOOCs with and without gamification. Other factors, for example, individual reasons for dropouts among participants were not investigated due to limited access to such data. It was also not possible to study the reasons for dropouts due to any socio-cultural issues or language limitations of enrolled learners.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

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