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Originally published in: Khalil, H. & Ebner, M. (2014). MOOCs Completion Rates and Possible Methods to Improve Retention - A Literature Review. In Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2014 (pp. 1236-1244). Chesapeake, VA: AACE.

MOOCs Completion Rates and Possible Methods to Improve Retention - A Literature Review

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Abstract: Many MOOCs initiatives continue to report high attrition rates among distance education students. This study investigates why students dropped out or failed their MOOCs. It also provides strategies that can be implemented to increase the retention rate as well as increasing overall student satisfaction. Through studying literature, accurate data analysis and personal observations, the most significant factors that cause high attrition rate of MOOCs are identified. The reasons found are lack of time, lack of learners' motivation, feelings of isolation and the lack of interactivity in MOOCs, insufficient background and skills, and finally hidden costs. As a result, some strategies are identified to increase the online retention rate, and will allow more online students to graduate.

Introduction

Over the past year, Massive Open Online Courses (MOOCs) have received a great deal of attention from the academic community as well as the press (Gaebel, 2013). MOOC is a model for delivering learning content online to virtually any person with no limit on attendance who wants to take the course. Participants can be students enrolled at the institution hosting the MOOC or anyone worldwide with Internet access. A MOOC throws open the doors of a course and invites anyone to enter, resulting in a new learning dynamic, one that offers remarkable collaborative and conversational opportunities for students to gather and discuss the course content. The "open" students, who pay nothing to participate, can join in some or all of the course activities, which might include watching videos, posting on discussion boards and blogs, and commenting via social media platforms (Thompson, 2011). In a MOOC, learners construct their own knowledge and develop their personal learning network from nodes and connections in the digital environment. Assisted by computing technologies such as RSS and an aggregator that regularly summarizes the learning events of notes that have occurred on the massive network of materials, links, blogs, and discussion forums, each learner remixes the content and interactions in ways that are personally meaningful to him or her, repurposes it to suit his/her needs and objectives, and feeds it forward and shares the remixed, repurposed content with others (Siemens, Downes, Cormier, & Kop, 2010.)

Massive Open Online Courses (MOOCs) can rapidly change the role of higher education, executive education and employee development in general. They are attempts to create free or even open access online courses that provide no constraints on class size (Sharples et al, 2012). MOOCs have the potential to enable free (university-level) education on an enormous scale. However, a major concern often raised about MOOCs is that although thousands enroll for courses, a very small proportion finally completes such courses. The release of information about enrollment and completion rates from MOOCs points out a very low completion rates (Balsh, 2013). Generally speaking, for most of the courses, completion rate is defined as people who earned a certificate or passed the course (Jordan, 2013). Of course, one can't compare MOOC completion rates with those of traditional online or on-campus courses. Since MOOC students

neither pay tuition nor earn university credits, the motivation for completing a course is largely intrinsic. The statements of accomplishment earned might have value for some students, but they are not equivalent to course credit.

According to a visualization of MOOC completion rates assembled by Katy Jordan (2013), the 50 investigated MOOCs have generated 50.000 enrollments on average, with the typical completion rate hovering below 10%. Put it somewhere around 7.5%, or 3.700 completions per 50.000 enrollments. Meyer (2012) reported that the dropout rates of MOOCs offered by Stanford, MIT and UC Berkley were 80-95%. For example, only 7% of the 50.000 students completed who took the Coursera-UC-Berkeley course in Software Engineering. There is a similar reported dropout rate in Coursera's Social Network Analysis class where only 2% of participants earned a basic certificate and 0.17% earned the higher level programming with distinction certificate. For this low completion rate, it is widely useful to improve the retention rates of MOOCs by finding out why students drop out of courses. Therefore our research work aims to investigate the reasons that may cause students drop-out or withdraw of their MOOCs, and suggest strategies that may improve retention. As such, this study asks the following research questions:

1. Why do students drop out of MOOCs?
2. What are the techniques that increase retention rate for MOOCs?

Retention Rates for MOOCs

In the age of lifelong learning, MOOCs are a means of providing learning and development to virtually everyone, anytime, anywhere in the world with internet access (Ryan, 2013). The promise of MOOCs is that they will provide free access, cutting edge courses that could drive down the cost of university-level education and potentially disrupt the existing models of higher education. Furthermore anyone is allowed to choose courses from interest on his/her favorite university. However, Markoff (2013) has shown that although thousands enroll for MOOCs, only a very small number actually complete the MOOCs .

Rivard (2013) pointed out that hundreds of thousands of people across the world are signing up for MOOCs in the first glance. Courses offered by MOOC providers are in general free and don't earn students any college credit. There are also no enforced prerequisites as there are for sometimes for normal college or university courses. In spite of this only few students complete the course and get a certificate. Of 104.000 students who enrolled in the 2011 online machine-learning class which was an earlier version of the later Coursera course, 46.000 submitted at least one assignment, 20.000 completed a substantial portion of the course and 13.000, or 12.5%, passed (Rosanna Tamburri ,2012). In a study of Bioelectricity MOOC by Duke University (Belanger & Hornton, 2013) approximately 12.000 students enrolled and about 3200 of these students attempted a quiz within the first week. Only 700 students of those 3200 earned perfect scores finally, a "dropout rate" of 94 percent. Another study given by Bruff (2013) mentioned a MOOC, launched on March 4, 2013, on Pattern-Oriented Software Architectures for Concurrent and Networked Software (POSA) by Doug Schmidt. The course ran for ten weeks with about 31.000 enrolled students. These are students who did something beyond enrollment – watch a video, take a quiz, visit the discussion forum. There were 23.313 active students, 20.933 of them (90%) watched at least one lecture video, 5.702 (24%) took at least one quiz, 2.072 (9%) submitted at least one assignment for peer grading, and 942 (4%) posted at least once in the discussion forums. Of the 23.313 active students, 1.051 (4.5%) earned a standard statement of accomplishment and 592 (2.5%) earned a statement of accomplishment "with distinction", so a total of 1.643 (7%) students earned some form of statement. In the same way Jordan (2013) a PhD student at the Open University of the UK described their effort to synthesize MOOC completion rate data – from xMOOCs in particular and mostly from Coursera. The average completion rate of her examined xMOOCs is 7.6%, with a minimum of 0.67% and a maximum of 19.2%. The 19.2% appears to be an outlier "Functional Programming Principles in Scala*"* from Switzerland's École Polytechnique Fédérale de Lausanne, offered on the MOOC platform Coursera. While the lowest rate of completion was "A History of the World since 1300*"* from Princeton University, offered also on the MOOC platform Coursera.

Research Methodology

This study aims to investigate the reasons that may cause students drop-out or withdraw of their MOOCs, and suggest strategies that may improve retention. The framework of research used descriptive

research methodologies to provide an accurate description of reasons that may cause drop out. The data source of this research was from 42 MOOCs analyses of the course completion rates, content, documents, and class discussions. These 42 offered through most popular platforms (Coursera, Edx, Udacity, MITx, and Moodle). The completion rate data of these MOOCs according to Jordan's (2013) research is pointed out in Table 1.

Table 1: Completion rate date according to Jordan's (2013) research

MOOC	Students enrolled	Students completed	Percentage of Completion	Platform
Equine Nutrition	23322	8416	36.1%	Coursera
Astrobiology	39556	7707	19.5%	Coursera
Functional Programming Principles in Scala	50000	9593	19.2%	Coursera
Computing for Data Analysis	50899	6420	12.6%	Coursera
introduction to Machine Learning	104000	13000	12.5%	Coursera
Databases	60000	6500	10.8%	Coursera
Image and video processing - From Mars to Hollywood with a stop at the hospital	40000	4069	10.2%	Coursera
Internet History, Technology and Security	46000	4595	10.1%	Coursera
Gamification	81600	8280	10.1%	Coursera
Introduction to Philosophy	98128	9445	9.6%	Coursera
Critical Thinking	75884	6909	9.1%	Coursera
Mathematical Biostatistics Bootcamp	21916	2087	9.5%	Coursera
Sports and Society	19281	1626	8.4%	Coursera
Introduction to Mathematical Thinking	27930	1950	7%	Coursera
Software Engineering for SaaS	50000	3500	7%	Coursera
Introduction to International Criminal Law	21000	1432	6.8%	Coursera
Drugs and the Brain	66800	4400	6.6%	Coursera
Listening to World Music	36295	2191	6%	Coursera
Data Analysis	102000	5500	5.4%	Coursera
Pattern-Oriented Software Architectures for Concurrent and Networked Software	30979	1643	5.3%	Coursera
Introduction to Genetics and Evolution	33000	1705	5.2%	Coursera
Computational Investing, Part 1	53205	2554	4.8%	Coursera
An Introduction to Operations Management	87000	4000	4.6%	Coursera
Greek and Roman Mythology	55000	2500	4.5%	Coursera
E-learning and Digital Cultures	42844	1719	4%	Coursera
Introduction to Astronomy	60000	2141	3.6%	Coursera
Introduction to Sociology	40000	1283	3.2%	Coursera
Social Network Analysis	61285	1410	2.3%	Coursera
Human-Computer Interaction (studio track)	29105	791	2.7%	Coursera
Bioelectricity - a quantitative approach	12000	313	2.6%	Coursera
Human-Computer Interaction (studio track)	29105	791	2.7%	Coursera
A Beginner's Guide to Irrational Behaviour	142839	3892	2.7%	Coursera
Think Again: How to Reason and Argue	226652	5322	2.3%	Coursera
Social Network Analysis	61285	1410	2.3%	Coursera
Medical Neuroscience	44980	756	1.7%	Coursera
A History of the World since 1300	83000	605	0.7%	Coursera
Stat2.1x Introduction to Statistics - Descriptive Statistics	52661	8181	15.5%	EdX
3.091x Introduction to solid state chemistry	28512	2082	7.3%	EdX
6.002x Circuits and Electronics	46000	3008	6.5%	EdX

CS50x - Introduction to Computer Science I	150349	1388	0.9%	EdX
Introduction to Inforgraphics and Data Visualization	2000	140	7%	Moodle
Introduction to Artificial Intelligence	160000	20000	12.5%	Udacity

Moreover, the researchers used available research publications related to such area of work provided by experienced online learning colleagues. Some carefully chosen documents turned up with specifically related to completion rate of MOOCs.

Finally the authors examined interactivity in different MOOCs to study about how this happens in large courses (Khalil & Ebner, 2013a) and how participants as well as lecturers think about (Khalil & Ebner, 2013b). However, the single results are putted together and discussed afterwards.

Results and discussions

Why do Students Dropout of MOOCs?

The high drop out rate in MOOCs has been attributed to many factors like:

Lack of time: Belanger & Thornton (2013) reported that completing MOOCs takes too much time. Time is a significant factor, which may prevent students from completing the course requirements. Many students pointed out that watching online lectures and completing homework assignments and quizzes was simply too much to incorporate into their schedules. In a class discussion, one of students posted the following thread in "Introduction to Mathematical Thinking" course offered on Coursera platform: "*I really love this course and many other courses on Coursera. But it does not look like I will be finishing it on schedule because I do not have enough time to do the homework in addition to viewing the videos and sifting through forums within the enforced deadline. Realistically, at this point, I can already see what will be happening: I will end up downloading the videos, watching it on the sideline and reenrolling again in the future to be able to do the homework."*

In addition, Bruff (2013) suggested that some students want to move through the course week by week, others want to have freedom to explore the content during the entire run of the course, and others want to get all the lecture videos and assignments right up from the very first beginning.

Learners' motivation: Motivation to participate in MOOCs is a significant area of interest. One of the most important factors that may prevent students from completing MOOC is learners' motivation. According to (Yuan & Bowel, 2013) there are many factors that influence students' motivation to learn; these include future economic benefit, development of personal and professional identity, challenge and achievement, enjoyment and fun. What motivates the MOOC learner? Surveys conducted by researchers at Duke University show that student motivations typically fell into one of four categories (Belanger and Thornton, 2013):

- To support lifelong learning or gain an understanding of the subject matter, with no particular expectations for completion or achievement.
- For fun, entertainment, social experience and intellectual stimulation.
- Convenience, often in conjunction with barriers to traditional education options.
- To experience or explore online education.

On the pre-course survey, fun and enjoyment were selected as important reasons for enrolling by a large majority of students (95%) and on the post-course survey, most reported that they have a general interest in the topic (87%). Students used the online course to help them decide if they want to take college/university classes (15%) while a significant minority of students claimed that they could not afford to pursue a formal education (10%).

Feelings of isolation and the lack of interactivity in MOOCS: Palloff and Pratt (2003) believes that feelings of isolation are the inherent result poor course design. Physical isolation can be overcome by focusing more on social interactions. Many researchers pointed out the importance of interaction in high quality MOOCs (Mcauley, Stewart, Siemens and Cormier, 2010; Waard, 2011; Levy and Schrire; 2012; Fisher, 2012; Khalil & Ebner, 2013a). They confirmed the role of interaction and communication in MOOCs as learners construct their own knowledge and develop their personal learning network from the nodes and connections in the digital environment. Mak, Williams, and Mackness (2010) indicated that interaction in MOOCs helps students to develop their own ideas, express themselves, establish a presence,

and make thoughtful long-term relationships. Without regular communication and interaction they lose their focus. In addition, miscommunication and the lack of prompt, clear feedback from the instructor can contribute to the student's feelings of frustrations. Problems that could be solved in just a few minutes in the classroom, or on the phone, can take hours or even days to solve via email. Murray finds that communication is even more important than course content. Martz, et al. (2004) also mentioned that prompt and personalized communications with the faculty have a significant impact on students' satisfaction. But interaction can be time-consuming and difficult for faculty to sustain, especially with larger class sizes. In our own study (Khalil & Ebner, 2013b) 35% of students stated their level of satisfaction in MOOCs as less satisfied or not satisfied. They reported their dissatisfaction due to the lack of instructor interaction. They had also complaints about online discussion forums with MOOC fellow students that weren't nearly as helpful as traditional in-class exchanges. When students have problems in a normal classroom, they can turn to the other students, the teacher, or administration for almost immediate support and feedback. The asynchronous nature of many MOOCs, combined with unusual study patterns, and global time zones, means that students may not receive the support they need in a timely fashion, reinforcing their feelings of isolation. In "Computational Investing, Part I" course a student posted this discussion thread "*I was excited about this course before it started but it has been down hill from the very first lecture. The instructor seems to have no interaction with his students, he doesn't answer our questions or reply our discussions and I hope coursera will ensure that this is never repeated. Based on this course, I would never bother to look into any other course offered by this instructor*".

Insufficient background knowledge and skills: Insufficient background knowledge and skills are an important cause of low completion rate (Belanger and Thornton, 2013). Many students are not able to complete the course because they haven't enough background and skills. Students' complaints often about an assumed "knowledge base" that was often essential to understanding the course material. Murray (2001) also recognizes the possibility that students may lack the required skills to be successful in online courses. Students not only require the technical skills to get online, but they also need to possess strong reading, writing and typing skills, since so much of the interaction in online courses is typically text-based. Students with poor typing skills may find themselves frustrated, and unable to participate, especially if the course requires frequent use of synchronous "chat" programs as part of the learning process. In a thread posted in discussion forums in "Model thinking" course offered by Coursera, a student find difficulty to complete the course because the course need a certain background or skills. He wrote "*I am just trying to find out which background I should go after to understand because I couldn't get past the second quiz of week 1. I realize that this quiz requires a certain culture or background which I don't seem to have*".

Hidden costs: Hidden costs may cause low completion rate of MOOCs. Students were surprised to see that, despite MOOCs' reputation as a free online educational resource, they were sometimes required to purchase pricey textbooks recommended by professors. In a thread discussion in "Introduction to Computational Finance and Financial Econometrics " course available on coursera , a student posted the following thread "*The first book is not yet published and the other two are copyrighted books. You can't expect legal (free text of them in public domain). But you can check out the previews of these books in books.google.com. Few pages are intentionally removed from such previews but you have to live with them if you wantto use free legal text*".

In addition, O'Reilly (2013) indicated that some students of MOOC have to pay for their certificates.

What are the techniques that increase retention in MOOCs?

While there are many suggestions and recommendations in literature that are offered to increase retention (Fisher & Han, 2008), the most favored techniques that may increase the retention in MOOCs are the following:

Accommodating students on different time tables: Bruff (2013) suggested that instructors should accommodate different student pacing as much as they could, however there were some limitations for this technique. For instance, peer-graded assignments require students to participate with some synchronicity. All student work must be submitted before any student work can be distributed for peer grading, and all peer assessments must be finished before the results of those assessments can be shared back with students. One could move through the material at any pace and still receive a standard statement, but achieving the "with distinction" statement required more of a week-by-week pacing.

Promoting student completion: Instructors should remember that there's in general no credit being offered for students who study MOOCs, just a statement of accomplishment "signed" by the instructor. People take MOOCs largely because they want to learn something of interest or value to them. As a result, they should be motivated to complete the course otherwise they leave it. Here are some techniques that may promote students to complete their MOOCs (Belanger and Thornton, 2013):

- Formal recognition of accomplishment - Although the market or educational credential value of this certificate is not yet clear, students cited this formal recognition of accomplishment as a factor in motivating them to enroll initially as well as to persist in completing the course requirements.
- Professional development - many students expected that the knowledge or skills would enhance their professional work, improve job performance or promote their advancement in the workplace.
- Participation in the forums and other student interaction - In addition to responses by the instructor, students frequently responded to one another, encouraged one another and shared supplementary resources. It also gives students a sense of belonging to a virtual learning community that they can turn to when they need help. In addition, (Gleason, 2004) indicated that this sense of community makes it easier if the students need to work in groups on various class projects.

Enhance "*student to students*" *and* "*student to instructor*" *interaction*: Interaction is the key to MOOC success among participants. Frankola (2012) pointed out that the best kind of interactivity not only creates a sense of community for participants; it also stimulates learning through discussing ideas and practicing skills. Student satisfaction in online courses can be significantly impacted by perceived interaction in the online environment (Wuensch et al., 2008). According to Moore (1989) "student to student" interaction refers to the exchange of information and ideas amongst students with or without the real-time presence of an instructor. To enhance "student to student" interaction, MOOC lecturers should organize "face to face" study groups in various physical locations or separate online forums for participants to promote learning and understanding through the sharing of ideas, perspectives and experiences with other participants. In addition "student to instructor" interactions refer to the interaction between students and experts, which establish an environment that encourages students to understand the content better. Wuensch et al. added, "Instructor interaction had the largest influence on student satisfaction with the distance course. Student-instructor interactions enhance student retention, self-motivation, and pass rates" (p. 525). Most dissatisfaction among students was the result of perceived poor quality of interaction with the instructors and among other students (Wuensch et al.). Khalil & Ebner (2013b) suggested the following techniques to enhance "student to instructor" interaction:

- Trained teaching assistants (TAs): As long as, it is impossible for instructors to interact with this huge number of students, TAs can assist the instructor to interact with students. TAs help students who can't complete tasks. They can answer students questions, provide their advices if students have technical problems, post some discussion topics, monitor the discussion forum on a regular basis, and can filter out questions that need an instructor response.
- Peer-based assessment: In addition, instructors can use also peer-based rather than computer-based assessment to make MOOCs more interactive. It has been shown that students are willing to step in and help others. Peer assessment is a key challenge in the delivery of MOOCs. Coursera also acknowledges "In many courses, the most meaningful assignments do not lend themselves easily to automated grading by a computer. Peer assessments in Coursera leverage a "grading rubric" to help students to assess others reliably and provide useful feedback". Cronenweth (2012) pointed out that peer assessment process is a useful form of learning for students. In addition, Wong (2013) stated that peer assessment process does a good job of exposing students to someone else's work. "That is where the learning is at." Using the previous techniques will enhance interaction and make students more satisfied of interaction in MOOCs.
- Supplemental tutoring: An option that could include assistance with specific course assignments or more general training in prerequisite skills (Castles, 2004; Lentell & O'Rourke, 2004).
- Better Development of Online Learning Skills: The typical online course may require a set of skills in addition to those required in traditional face-to-face classrooms, such as technological skills, self-directed learning and time management. These may represent a strong challenge to many students, particularly those without or less academic background. Therefore, colleges may need to provide more active support to students to help them understand the types of skills required for successful online learning and to explicitly help them develop those skills.

Originally published in: Khalil, H. & Ebner, M. (2014). MOOCs Completion Rates and Possible Methods to Improve Retention - A Literature Review. In Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2014 (pp. 1236-1244). Chesapeake, VA: AACE.

Conclusion

Massive Open Online Courses (MOOCs) have the potential to enable free university-level education on an enormous scale. However, many MOOCs initiatives continue to report high attrition rates among distance education students. As a result, it is widely agreed that it would be useful to improve the retention rates of MOOCs by finding out why students drop out of courses and to suggest strategies that that can be implemented to increase the retention rate. According to literature, accurate data analysis and own observations on running MOOCs we collected crucial factors for the high drop out rate in MOOCs: lack of time, lack of learners' motivation, feelings of isolation and the lack of interactivity in MOOCs, insufficient background and skills and hidden costs. Consequently, some techniques should be used to increase the online retention rate, and allow more online students to graduate. For example accommodating students to different timetables, promoting student completion or enhancing "student to students " and "student to instructor" interaction as well as increasing online learning skills. Finally it must be pointed out that this research work is a first contribution to improve the retention rate and that in future these suggestions must be implemented and evaluated.

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