Building Engagement for MOOC Students - Introducing Support for Time Management on Online Learning Platforms

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ABSTRACT

The main objectives of massive open online courses (MOOC) are to foster knowledge through free high quality learning materials procurement; to create new knowledge through diverse users' interactions with the providing platform; and to empower research on learning. However, MOOC providers are also businesses (either profit or not-for-profit). They are still in the early stages of their development, but sooner or later, in order to secure their existence and assure their longterm growth, they will have to adapt a business model and monetize the services they provide. Nevertheless, despite their popularity MOOCs are characterized by a very high drop-out rate (about 90% [33, 22, 26]), which may turn out to be a problem regardless of the adapted business model. Hence, MOOC providers can either assume the scale benefits to be sufficiently high to ignore the problem of low MOOC completion rate or tackle this problem.

In this paper we explore the problem of the high drop-out rate in massive open online courses. First, we identify its main cause by conducting an online survey, namely bad time organization. Secondly, we provide suggestions to reduce the rate. Specifically, we argue that MOOC platforms should not only provide their users with high quality educational materials and interaction facilities. But they should also support and assist the users in their quest for knowledge. Thus, MOOC platforms should provide tools helping them optimize their time usage and subsequently develop metacognitive skills indispensable in proper time management of learning processes.

Categories and Subject Descriptors

L.10.6 [**Applied computing**]: Education—*Distance learning*; L.10.7 [**Applied computing**]: Education—*E-learning*; J.1.4 [**Human-centered computing**]: Human computer interaction (HCI)—*HCI theory, concepts and models*; H.4 [**Information Systems Applications**]: [Miscellaneous]; M.1.4 [**Social and professional topics**]: Professional topics—*Computing education*

General Terms

Design, Human Factors, Performance, Theory

Keywords

MOOCs; time management; metacognitive skills

1. INTRODUCTION

Arguably the idea of distance learning is as old as the concept of learning itself. Nevertheless, even though the evidence of distance education courses dates back to the early 18th century [16], the widespread use of computers and high Internet accessibility alone has significantly changed its character and given it its contemporary shape. Only recently can we witness a new revolution in distance learning – the advent of massive open online courses (MOOCs).

The main goal of MOOCs is to provide open access to high quality education, to support the process of learning and knowledge creation through social interactions and to advance research on learning [42]. Despite the huge popularity of MOOCs, their future and potential impact on the education domain as a whole is still difficult to predict [7]. MOOC platforms, their pedagogical paradigms and their business models are still in the early stage of development. Thus, different development directions can be adapted.

2. MOTIVATION — BUSINESS MODEL

Every day thousands or even millions of people around the world use MOOC platforms with different purposes in mind. Some just browse the available content and test offered functionalities. Others look for very specific pieces of information (like the well explained example of EM algorithm implementation). Yet others engage in learning processes in the full sense of this word, by following all criteria for a course (watch videos, read assigned articles, prepare homework, etc.). However, it is likely that only a few of these learners ever considered how it is financed.

For the time being, most of the big players (like Coursera or edX) are generously supported (eg. MIT and Harvard

University jointly have allocated 60 million dollars for edX development) [22, 24]. Nevertheless, MOOC providers are businesses and as such they bear the costs of the goods' and services' production and distribution. In this case, it would comprise *inter alia* the costs of content creation, platform implementation, and the purchase and maintenance of infrastructure (eg. servers). Hence, sooner or later MOOC providers will have to adapt a business model and monetize the services they provide.

Thus far, the following revenue models have been considered: 1) introduction of small charges for certification or selected courses registration; 2) head hunting service offers; 3) creation of products networking students with potential recruiters and employers (eg. conferences or workshops organization); 4) selling data on students' performance in different tasks [22, 24].

MOOC platforms can make available globally Ivy-League quality education, provided there is access to the Internet. Sound pedagogical foundations underlie their design. Furthermore, MOOC platforms take advantage of the newest research findings to provide their students with as engaging an experience as possible (eg. retrieval questions in videos [19, 18] or peer assessment [25, 36, 34]). Nevertheless, MOOC platforms struggle with the problem of an exceedingly high 90% drop-out rate [33, 22].

Following the acquisition of information about a course offer (awareness phase) only a fraction of people decide to enroll in a course (registration phase). Then, only a number of them engage in any activity in the course (activity phase) and even less produce meaningful progress (progress phase). Finally, only a small fraction finish the course (about 27% of high school, 8% of undergraduate and 5% of graduate participants [21]). This drastic decrease of engagement in a course through time and different phases, due to its similarity to marketing purchasing model, is called *funnel of participation* [8].

The described phenomenon of the low completion rate presents a problem for MOOC platforms which have to monetize their services. Taking into consideration the huge scale of MOOCs (a course can attract thousands or even hundreds of thousands of people [13, 31]), they can exploit scale benefits [22]. However, solving the problem at its root, by reducing the withdrawal rate, would create a more sustainable solution. Thus, we argue to analyze the problem closely before turning to economies of scale.

3. WITHDRAWAL REASONS ANALYSIS

Due to the relative novelty of MOOCs and resulting data scarcity, the problem of MOOCs' low completion rate has not been widely examined in literature. To the best of our knowledge, thus far only one extensive study in this area has been performed [1]. Nevertheless, the applicability of its results might be limited in our context as the authors focused on advantageous MOOC course features. Thus, they could not account for some external (not related to the courses) aspects influencing participants' final decision of dropping out from courses. As a consequence, we decided to collect our own dataset to analyze the problem.

In order to study MOOC participants' withdrawal reasons and the rate of occurrence of each reason in their overall population we carried out a survey. The survey was run in an online scenario. The participants were recruited via *CrowdFlower*[1] (a crowdsourcing platform). It included 508 participants who, apart from providing basic demographic information (gender, education level etc.) and information on MOOC experience (eg. MOOC provider name), were asked to indicate the reasons for their MOOC withdrawal decision. The participants were provided with 12 sample reasons chosen based on great MOOC features indicated by Adamopoulos [1], readers of a Web site devoted to open education [9] and adapted to our context. To minimize the possible bias related to the order of reasons in the question, the suggested possibilities were randomized (order counterbalancing). The participants were also encouraged to indicate other reasons for their withdrawal decision.

It is impossible to effectively verify if the participants recruited through the crowdsourcing platform were ever fully engaged in any MOOC or used any MOOC platform. Nevertheless, their responses reflect their opinion formed based on the experience they gained in other learning processes throughout their lives. Moreover, the scale of the study allows us to draw conclusions from the data [5].

The results demonstrate (Table 3) that the main reason for the high MOOC withdrawal rate is bad time management. This reason was indicated by as much as 68.9% of the survey participants (the *Time* and *Lost rhythm* responses were grouped together). Other significant factors influencing participants' MOOC withdrawal decisions were mainly related to the attractiveness and suitability, or lack thereof, for a given student.

Poor time management being the main factor causing high MOOC withdrawal rate is not surprising. Temporal dimensions set the conditions in which people have to operate. The amount of time available each day is inelastic. Time can be neither transferred nor stored. A substantial part of it must be dedicated to sleep. What is more, scaling the amount of time available a day at the expense of sleep is ineffective. Sleep deprivation has been proven to affect cognitive functions [20, 2] and subsequently memory consolidation and recall [35, 3, 38]. Moreover, such deprivation may cause serious health problems [12, 6, 27]. Simultaneously, the pace of life is constantly accelerating [40]. People maintain increasingly busy lives, which makes time one of the most prominent constraints they have to deal with.

4. PROPOSED SOLUTION

The role of time and the need of its good organization has been widely recognized in business circles for decades [14, 11]. A lot of software has been developed to support time management processes. Recently, due to the ever changing environment, growing incertitude and deepening information overload, time management techniques have become critical in every single organization [11].

Time is also a crucial component of learning [10]. Without spending time on a task, no progress can be ever achieved. Nevertheless, students often don't organize their learning time in the right way (eg., they procrastinate, underestimate the amount of time needed to complete a task, try to do too much, waste their time [41, 39, 17, 32]). Hence, time management has been also acknowledged as being crucial in the education field, specifically in the learning models [39, 29] whose construction is usually further enriched with psychology and neuroscience findings [43, 41].

[1] *CrowdFlower*, `http://crowdflower.com/`.

Table 1: Massive Open Online Course (MOOC) Withdrawal Reasons

Reason	[%]
Time (eg. bad time organization, conflicting real life responsibilities, too much time consuming course)	51.38
Lost rhythm (eg. left behind due to illness or work travel)	17.52
Too difficult course (too much background knowledge required)	16.73
Hidden costs (eg. access to required literature)	15.55
Not engaging course (eg. not attractively presented, boring)	15.35
You were learning but didn't submit any work	11.42
Too basic course (not challenging)	11.02
You were only interested in some of the offered materials (eg. lecture notes, books, software licences)	10.43
You were just "shopping around" - trying different courses with intention to keep only some of them	9.65
Poor course design (eg. not clear instructions or rules, gaps in the schedule)	8.86
Clunky community or communication tools (eg. badly organized or moderated online forum, disrespectful peers)	4.72
Poor assignments evaluation techniques (eg. unjust peer reviews, automatic code evaluation accepting only specific entries)	4.53
Other (eg. not helpful for the given user, life change, family reasons, required discussions on forum)	3.35

The effectiveness of learning models has been proven scientifically. It has been shown *inter alia* that the use of a learning model can lead to higher academic achievements, produce positive behavioral changes as well as increase engagement and motivation [30, 43]. What is more, people equipped with metacognitive skills (developed through the application of such models) can exercise a higher level of control over their lives. Therefore, the mastery of learning models is considered critical not only for students and professionals alike but for all people. Nevertheless, few people have been introduced to them or have been taught the metacognitive skills needed for their full command. Even fewer are prepared to use them independently [43]. Moreover, up to now little technological support has been offered to help people develop the skills and habits required by the learning models (eg. prioritization, scheduling, monitoring and evaluation). Simultaneously, research shows that these processes can be effectively taught and learned [43].

The above described problem constitutes an opportunity for MOOC platforms.

Firstly, MOOC providers put a lot of emphasis on the production process, the creation of educational materials (eg. video lectures), as well as on tools supporting knowledge exchange and creation (eg. discussion fora). Concurrently, they pay less attention to the delivery process. Course duration, its start and end dates, or inside course activities are usually planned in advance and managed while the course progresses. Thus, MOOC providers engage in time management activities and, as they should be a bilateral process, MOOCs expect their students to do the same on their own. Nevertheless, a lot of people struggle to attain the suitable level of self-discipline needed to become the *managers of their own learning*. This is especially true in the online learning context, in which students face no consequences if they fail to finish a course and in principal no social pressure is subsequently exerted on them.

Secondly, one of the most important roles of contemporary educational institutions is to prepare their students to live in increasingly changing environments. The only way to achieve this goal is to develop life-long learning skills which would, in turn, allow students to more easily adapt to new circumstances. However, MOOC platforms, potentially the *future of education* [7], offer their students practically no guidance concerning this matter.

Therefore, we argue that MOOC platforms can be centered around time management and learning theory research and improve their delivery models by providing their users with tools supporting time management and the development of metacognitive skills crucial to applying them. Consequently, MOOC platforms might help students optimize their learning processes, increase their engagement and reduce the drop-out rate.

4.1 Flexibility and automation

MOOC platforms provide high quality education to anybody with an Internet connection. Even though Internet access is still a significant limitation in some parts of the world, being the only constraint, its availability opens up education to the masses. As a consequence, students attending MOOC courses are greatly diversified. Primarily, substantial differences in age, origin and individual educational background can be observed [33]. It is also plausible to assume that such a population can adopt diverse lifestyles and have various learning styles. Moreover, different styles of time management work for different people. Taking all of the above into consideration, it is clear that the tools supporting students in their time management activities will have to be very flexible to meet the needs and expectations of such a diversified population. Consequently, they will have to *inter alia* account for different levels of time management, permit the gradual development and refinements of schedules and allow for modifications (also in main goals and priorities).

Furthermore, arguably the main barriers for people to engage in time management activities are a lack of self-discipline or motivation and time-consumption [15]. Planning, scheduling, prioritizing, monitoring, or evaluating all takes time and patience. Moreover, such endeavors can be challenging (eg. people working in online environments might experience some difficulty specifying exactly how much time they spend on work-related activities and how much on checking private mail, social networks or surfing the Web). Thus, tools helping students manage their time will have to also assist their users in data provision, support tedious tasks automation (eg. by leveraging the MOOCs community and the crowd) and work when only partial information is provided.

4.2 System features

Many different approaches for time management have been proposed in management and education theory literature. Nevertheless, some common elements (shared by the majority of them) can be distinguished. Those constitute (see eg. [41, 43, 11]): 1) planning, 2) practicing and monitoring, 3) evaluating phases.

The first phase (planning) usually comprises the following processes: the proximal goals setting, tasks and activities in tasks identification, prioritization, definition of strategies to achieve the goals, time allocation and scheduling.

Tools provided by MOOC platforms should support each and every of the above listed processes. For example, the goals setting facilities ought to account for the level of involvement in the MOOCs and different course' activity specification. What is more, it should allow for reason identification (such as *for additional qualifications* or *for on-campus course preparation*). However, the major contribution can be offered by the 1) tasks and activities identification, 2) time allocation and 3) scheduling features.

Firstly, MOOC platforms should offer the possibility to specify the tasks needed to accomplish the goals (specifically courses to take and external resources to check). Moreover, they ought to allow for the identification of the processes constituting them (particularly the courses' activities, such as watching video or doing programming assignments) and further the subprocesses comprising them (eg. analyzing the provided dataset, visualizing it, calculating the centrality measures, interpreting the results and answering the questions in the case of completing a problem set in a network analysis class). The users should also be able to categorize all of the indicated goals and processes via their types' specification (eg. watching videos, submitting quizzes) and then organize them in different hierarchies (eg. from the least to the most demanding or based on its relative importance for the user).

To support the users in this usually difficult and time-consuming task, MOOC platforms could leverage the crowd and the MOOC community as well as use some automatic tools. By that means, they would be able to provide their users with action plans; identifying in them activities and subprocesses and thus suggesting hierarchies based on users' profiles. The effectiveness of such a solution might seem unlikely. Nevertheless, it has already been proven scientifically in the general case that externally-created (using crowdsourcing, community wisdom, collaborative refinement and automatic tools based on specifically-crafted NLP similarity algorithm for reusing plans) action plans help people complete more tasks more quickly [23]. The solution could be even more efficient in MOOC platforms contexts as, with time, they would collect big datasets which should also allow for more personalized tasks and activities recommendations (eg. based on educational background, interests or linguistic capabilities).

Secondly, MOOC platforms should also provide support for predictive time allocation. To fulfill the planned tasks and meet deadlines specified in them, every single process constituting a task and a task itself should have assigned to it a time budget. Nevertheless, students often underestimate the amount of time needed to complete a task and start working too late [41, 39, 32, 17]. Simultaneously, MOOC teachers' suggestions are based on their own teaching experience. Thus, due to the great diversification of MOOC students (different educational background, varying linguistic skills, different styles of learning, varied achievement groups [33, 21]) they might be highly inaccurate.

However, MOOC platforms already possess huge behavioral datasets as well as demographic and educational background information on their users. These datasets are constantly growing and with the introduction of tools supporting time management, they will likely become more detailed and accurate[2]. Those data on individual performance could be used to predict the time needed to complete a task in a previously set plan. Similar (according to *inter alia* age, educational background, linguistic skills and performance in different tasks), users could be clustered together. The time needed to complete a specific type of task could be averaged out for those users and used in suggestions for a new user similar to them who is planning to complete this type of task. Those data could also help identify groups of users with a high risk of dropping out from a MOOC and target them.

Thirdly, MOOC platforms should assist their users in scheduling. Schedule creation can be very time-consuming and frustrating but the workload on a user could be greatly reduced thanks to automatic solutions. MOOC platforms should particularly account for the analysis of students' life cycles and for the support of probabilistic queries answering schedules [37].

The major bottleneck in scheduling can be relieved by identifying working time and free time. The analysis of students' life cycles would help them identify time slots they could dedicate to learning. It would also serve the identification of the probability of schedule disruption due to an unexpected life event. This analysis could be supported with a simple widget available for PCs and mobile devices which, via one or two clicks, would record the time type, working or free time. To protect users' privacy, no details on time usage (eg. what and where a user does) would have to be disclosed. Furthermore, as people have difficulties specifying the effects of different events on a schedule and adding slack requires experience, MOOC platforms ought to also provide support for interactive uncertainty analysis on schedules as presented, for example in [37]. Thus, they should compute and visualize the probability of meeting deadlines and the effects of different *what-if scenarios* (eg. how the schedule would change if 1 day was lost due to an incident).

The second phase of time management, practicing and monitoring, consists of carrying out the scheduled activities around set priorities and adjusting the schedule, priorities and even goals to a changing situation. MOOC platforms should support this phase by sending reminders, solving potential conflicts and visualizing progress.

The pace of life is constantly growing. As a consequence, our lives are becoming increasingly busy. In such circumstances, it is very easy to forget something. MOOC platforms should thus allow for custom reminder settings which would effectuate, in a sent email, a message about on a favorite social network site or a text message on a cell phone. Moreover, it is also probable that some unexpected incidents will provoke inevitable changes in a student's schedule. Any

[2]Hitherto, MOOCs platform possess only partial data on time spent on a task. For example, for programming assignments they get only submission times. Based on that they can only estimate how much time a user spent on the given programming assignment.

change, in a busy schedule can create conflicts, situations when, most probably, it wouldn't be possible to complete all scheduled activities. In such cases, MOOC platforms ought to be able to suggest the order in which tasks should be tackled (eg. using the set priorities and time management rules like *put first things first* [11] or leave the most enjoyable things to the end [41]). It is also crucial to visualize progress, as such visualization may lead to a spontaneous increase in self-efficacy and increase motivation to work [41, 15, 4, 28, 43].

The final stage of time management is the evaluating phase, which comprises of self-reflection. This is crucial in building self-satisfaction, motivation and self-efficacy as well as in the identification and elimination of time wasters and bad habits [41, 15, 4, 28, 43]. To support the users in the evaluation of their own performance, MOOC platforms should provide them with reports on their progress on each course and offer an overall progress report. The reports could be further enriched with gamification elements, such as badges or points for successful task completion and achieved goals, a comparison of their performance in time management with those of other similar users and the whole user population.

Time management should also be endorsed by teachers through the MOOCs they provide. What is more, in a lot of MOOCs, materials are released on a weekly basis. If course construction allows, it would be also beneficial to make material available ahead of time. Thus, users having some periods filled with work (eg. during the examination sessions) could complete some activities in advance and not risk falling behind. In this case, the possibility to proceed could be blocked if previous topics were not completed. Furthermore, communicating high expectations is crucial to motivate students to work. Nevertheless, teachers could provide some additional incentives for students who have missed some deadlines or have fallen behind (eg., additional reading material, a dataset to play with or a video available only for students who finished the course). These could encourage them to continue despite a temporary rough track.

Finally, MOOC platforms could provide their users with tips on effective learning environment organization and if possible offer support for personal knowledge management (like eg. links' organization, creation of glossaries or even mind maps).

5. CONCLUSIONS

The high MOOC drop-out rate constitutes a serious problem for MOOC platforms facing the necessity to monetize the services they provide. Thus, we believe it is critical to find a solution for the low MOOC completion rate.

In this paper, we have addressed the problem of the high MOOC drop-out rate. We examined the main reasons for this by conducting an online survey and we identified bad time management as the principal cause among MOOC withdrawal decisions. Furthermore, we proposed support for time management on MOOC platforms and changes in the MOOCs' organization as more effective solutions for high MOOC drop-out rates. The effectiveness of the proposed solutions, even though not yet tested empirically, is well supported and thoroughly covered in related published findings. Thus, we believe effective support for time management and changes in MOOC organization to be nighly effective recommendations for MOOC providers.

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APPENDIX

Data collected during the survey are available to the scientific community and can be accessed at: `https://nawrot.users.greyc.fr/resources/`.