Understanding persuasive technologies to improve completion rates in MOOCs

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ABSTRACT
Advances in computing technologies are revolutionising education. Specifically, advances in Human-Computer Interaction impact the media and methods of delivery, facilitating a conceptual shift from traditional face-to-face instruction towards a paradigm with delivery increasingly tailored to student needs. Massive Open Online Course (MOOC) providers have now the possibility to both predict and facilitate student success by applying learning analytics techniques on the large amount of data they hold about their learners. More than ever before, key information about successful student behaviour and context can be discovered and used in digital interventions on, for example, students at risk. This is a complex issue which is receiving increased attention in Higher Education and specifically amongst MOOCs providers. This position paper discusses the relevant challenges in the use of learning analytics in MOOCs in conjunction with persuasive technologies in order to improve completion rates.

CCS Concepts
• **Human-centered computing~=→Interaction design theory, concepts and paradigms** • Human-centered computing→Visual analytics • **Applied computing→E-learning** • *Social and professional topics→Informal education*

Keywords
MOOCs; persuasive technologies; completion rates; student success.

1. INTRODUCTION
Advances in computing technologies are transforming all areas of human activity at an unprecedented pace; however this effect is most evident in education, where computers continue to modernise the media and methods of delivery, facilitating a conceptual shift from traditional face-to-face instruction towards a paradigm with delivery increasingly tailored to student needs.

Massive Open Online Courses (MOOCs) are a natural consequence of this phenomenon, in which anyone can be enthused to learn almost anything, anywhere, anytime and at their own pace. As they engage in their learning, participants leave a rich data trail of their activities, offering a unique opportunity to providers to study such data in order to both predict and facilitate learners' success (by applying, for example, learning analytics techniques). As key information about successful learner behaviour and context becomes discoverable and richer, it holds the potential to be used for identifying participants "at risk" (of becoming disengaged), and implement appropriate interventions in a timely manner to support them in their path to success.

2. THE PROBLEM WITH MASSIVE OPEN ONLINE COURSES
Despite the clear benefits of engaging in MOOCs, addressing participant attrition rates remains the biggest challenge, i.e. the number of participants who abandon a given course over the number of participants who enrol. Attrition in MOOCs can be characterised by Clow's "funnel of participation" [1]. This model reflects the following empirical observation: there is a much larger proportion of participants who typically drop out since first awareness of the course and their registration (the widest part of the 'funnel'), with respect to a very small proportion who continue their progression through activities until completion (the narrowest part). Whilst this behaviour is consistent with other forms of online engagement, particularly in the cases where is very little initial investment or commitment required (as in MOOCs), it is still perceived by stakeholders as an issue worth addressing to increase the effectiveness of the courses offered. What can be done to retain learners? The first step towards any intervention is to seek an understanding of what learners do – and this can be done by studying their participation via learning analytics on their digital traces.

3. LEARNING ANALYTICS
Learning analytics are widely regarded as the analysis of student records held by an educational institution (often including course management system audits and statistics on online participation or similar metrics), in order to inform stakeholders decisions. Also known as academic analytics, these are considered as useful tools to study scholarly innovations in teaching and learning. According to Baepler and Murdoch [2], the term was introduced by the developers of the virtual learning environment Blackboard, later becoming used to describe the actions "that can be taken with real-time data reporting and with predictive modeling" which in turn helps to suggest likely outcomes from certain behavioural patterns [2].
A similar term, "Educational Data Mining" emerged separately to refer to the processing of educational data using machine learning algorithms to discover knowledge, as important correlations may be observed which can offer interesting insights. An example is the discovery of positive behaviours, such as whether students participating in an online forum with more than a given number of

posts may complete the course with higher probability.

4. PERSUASIVE TECHNOLOGIES

In the context of behaviour change, the term "nudge", as used by Balebako et al. [3] was first introduced by Thaler and Sunstein [4], and it refers to unobstrusive persuasion of individuals into adopting a desired behaviour. In this context, a nudge is defined as "any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their […] incentives". An effective nudge therefore influences behaviour without raising too much awareness of the intervention: a key factor for its success is that the individual exercises free will when making choices; otherwise the new behaviour may not last. Nudges are, essentially, a sophisticated behavioural intervention to "guide and enable choice" and may do so by persuading, providing information or using social norms and salience [5]. Nudges work because they affect the interaction between two systems: the reflective system (where goals and values guide human actions) and the automatic system (which guide human actions without conscious awareness). This system interaction results in the observable behaviours (Theresa Marteau, in [5]).

Positive learning behaviours can therefore be encouraged through the use of persuasive technologies. Any knowledge about given learners' behaviours, complemented with those of their peers, plus that identified as the ideal, could be used as a nudge. Specially if triggered by contextual clues, positive "nudges" may lead to better achieve their learning goals. This observation is not novel, however, nor is limited to the context of MOOCs. In fact, Fogg [6] anticipated that in the future (not distant to our present) students could be nudged in exactly this manner towards learning success. In Fogg's vision of such a future, Pamela, a hypothetical student, runs an application called "StudyBuddy" on a hand-held device which by all descriptions is a smartphone of today. Through this app, four types of events are reported in succession: firstly, she is congratulated on having met that day her daily goal of studying three times (providing hence information about her own performance and how is this aligned to her personal aims); secondly, she is presented suggestions on short, specific activities to engage with (limiting choice positively); thirdly, she is presented a visualisation in which her peers who are also revising are represented in clusters (using social norms and salience) as an encouragement; and finally, Pamela's mentor is able to monitor her engagement and offers a very basic feedback to further encourage her during revision.

5. PERSUASIVE MOOCS? CHALLENGES

As seen, persuasive technologies have the potential to be employed unobtrusively to reinforce learners' positive behaviours which are consistent, for example, with perseverance in a MOOC. However, as we have argued in this position paper, the successful application of these technologies presupposes a very good understanding of the learners' behaviour. Whilst such an understanding can be sought through learning analytics, this is a challenging endeavour as the data required may be incomplete, inaccurate, and technically difficult to both collect and process in real-time. All of these obstacles need to be overcome to gain an adequate understanding of the learner actions and current context (i.e. at a given time, how an individual is engaging and how their peers are doing in the same or similar acitivities).

Once both the specific actions and the contextual information are processed, the next challenge is to make them usefully available to both learner and facilitator. This means that the user interface must help the learner navigate choices and must help instructors to provide simple, personalised feedback in a low-effort manner. This is the aim behind the development of course "dashboards", such as that being currently developed at the MOOC Observatory of the University of Southampton [7], with the ultimate goal of providing the type of user experience enjoyed by Pamela in Fogg's vision of the future.

The Holy Grail of MOOCs, to curb attrition, or to substantially widen the relatively narrow end of the aptly-named "funnel of participation" may well be found through the use of persuasive technologies, making it worthwhile to address the challenges identified in this paper.

6. ACKNOWLEDGMENTS

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7. REFERENCES

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