EMOOCs 2016 European MOOCs Stakeholder Summit

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EUROPEAN STAKEHOLDER SUMMIT
on experiences and best practices in
and around MOOCs (EMOOCS 2016)

Editors: Mohammad Khalil, Martin Ebner,
Michael Kopp, Anja Lorenz & Marco Kalz

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Mohammad Khalil, Martin Ebner,
Michael Kopp, Anja Lorenz & Marco Kalz (Eds.)

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EMOOCs 2016 says hello and welcome to Graz, Austria!

Graz is located in central Europe and is the second biggest city in Austria, as well as the capital of Styria. Furthermore, Graz has been a university town since 1585, and is currently home to four universities with a total of more than 50,000 students. During the last decades, Graz became the main scientific center for South-East-Europe. Every year, approximately 40,000 people participate in more than 100 international conferences and enjoy the beautiful Old Town, the attractive cultural range, the quality and diversity of the restaurants as well as the excellent infrastructure of the conference venues. We are thus extremely pleased for the EMOOCs conference to take place in this beautiful city, where two exquisite Austrian universities, the University of Graz and the University of Technology of Graz, will act as local hosts.

Although many of you are familiar with EMOOCs, it is probably good to say a few words about it. This summit is based on the idea to bring MOOC-players together – researchers, practitioners, teachers, students, business people and all interested in the topic are invited to share their results, experiences or products. The event aims to support the MOOC movement in order to improve tomorrow's education in any institution. We firmly believe that an interdisciplinary exchange of ideas and research in the field of ICT and lifelong learning is of crucial importance to help solving contemporary societal problems, especially in economically strained times like ours. Furthermore, we should also not forget that we need an innovative educational and training infrastructure that is able to provide first class learning experiences to learners. In our opinion, new technology, new pedagogy and new role models in teaching and research are extremely important.

After passing through a careful round of reviews with the Program Committee, a total of 52 submissions were finally accepted. Out of these, 20 were submitted as research publications and 25 as so called experience track publications. In addition, two workshops were approved and seven posters will be presented in a specific session. 53 reviewers from around the world were involved in the review process and we would like to thank them for their valuable work.

Credits and Acknowledgements

Finally, the Conference Chairs would like to express their gratitude towards a considerable number of volunteers and helpers who have devoted their time and endless patience to the organization of this conference. EMOOCs is a powerful and ever growing e-learning association of many enthusiastic people who have organized this conference for the last four years and we are very grateful to be a small part of it.
In particular, we have to thank the chairs, who were working on a voluntary basis for a whole year to make this conference a success: .

- Chair of the Research Track: Marco Kalz, Open University of Netherlands
- Chair of the Experience Track: Anja Lorenz,
  University of Applied Sciences Lübeck
- Chair of the Institutional & Corporate Track: Carlos Delgado Kloos,
  Universidad Carlos III de Madrid
- Chair of the preconference MOOC: Mohammad Khalil,
  Graz University of Technology
- International Chair: Philip Tsang, Charles Sturt University
- Social Media Chair: David Nussbaumer, Graz University of Technology

We would also like to thank the 50+ members of the International Program Committee, who provided timely and insightful reviews without complaint and little credit. Finally, we would like to thank the staff at the Academy of New Media and Knowledge Transfer (University of Graz) and the Department of Education Technology (University of Technology of Graz) for their support in this amazing endeavor. These folks have worked incredibly hard behind the scenes to manage all the aspects of the conference. They bravely dealt with many complicated situations and handled a variety of requests from the committees. Special thanks go to Klaus Hatzl (University of Graz), who took

on the part of the local organizer. Last but not least we would like to thank our sponsors for their very important financial support.

We especially welcome conference delegates who are attending EMOOCs for the first time and hope you will enjoy it. We kindly ask all our EMOOCs "regulars" to extend a warm welcome to newcomers and students, who are now becoming a valuable part of the constantly expanding MOOC-community.

Warm greetings and welcome to Graz,

Michal Kopp, University of Graz, Austria
Martin Ebner, Graz University of Technology, Austria
Conference Chairs

Learning in MOOCs: A Comparison Study

Colin MILLIGAN[1], Allison LITTLEJOHN[2] & Nina HOOD[3]

[1] Caledonian Academy, Glasgow Caledonian University, UK, colin.milligan@gcu.ac.uk

[2] Institue for Educational Technology, The Open University, UK, allison.littlejohn@open.ac.uk

[3] Faculty of Education, University of Auckland, New Zealand, n.hood@auckland.ac.nz

Abstract

Massive Open Online Courses (MOOCs) have emerged as a significant environment for online learning, yet little is known about how people actually learn in a MOOC. The study brings together qualitative data from parallel studies in two different MOOCs, comparing learning strategies of people who self-report low and high levels of Self-Regulated Learning (SRL). This comparative study identifies commonalities and differences in learning patterns between these two learner groups and across the two courses. The study draws comparisons in goal-setting, self efficacy, and the selection of learning and task strategies. The study concludes that differences in the learning strategies of learners in each of the MOOCs may be influenced by different course design.

Keywords

Self-regulated learning, SRL, self efficacy, help-seeking, task strategies

1 Introduction

A recent study of the instructional design quality of 75 Massive Open Online Courses (MOOCs) concluded that MOOCs from major providers are generally of low instructional quality (MARGARYAN, BIANCO & LITTLEJOHN, 2015). These MOOCs are typically designed around the presentation of content resources to large numbers of learners. Learners have few programmed opportunities to engage in dialogue and receive feedback from instructors. This instructional design demands that learners self-regulate their learning, proactively seeking feedback from others and self-evaluating their progress to complement the learning content. Yet, MOOCs attract diverse groups of learners, many of whom may lack the ability to self-regulate, or choose not to regulate their own learning (MILLIGAN, LITTLEJOHN & MARGARYAN, 2013). This presents a design challenge to MOOC providers: to create MOOC environments that encourage and assist learners to self-regulate their learning. MOOCs are still novel, and we know very little about how individuals learn in MOOCs. Research in this domain is vital in developing our understanding of how to design MOOC environments that encourage active agency in learning. In this paper we compare the findings of two parallel studies of self-regulated learning (SRL) in MOOCs aimed at professionals (data scientists and those conducting clinical trials), exploring the commonalities and differences that emerge from this analysis. Each study used the same qualitative and quantitative instruments to explore individual self-regulation of learning (ZIMMERMAN, 2000). The paper begins with a short review of current research on MOOCs. This review is followed by a description of the method and context of the two courses under study, and the instruments used. The results are then presented and discussed. The paper concludes with a summary of the main findings and implications, alongside a reflection on the limitations of the study and prospects for future research.

2 Literature Review

While initial MOOC research was often qualitative, quantitative studies have become dominant with the emergence of large scale MOOC platforms that permit the generation and analysis 'clickstream' data (VELETSIANOS, COLLIER & SCHNEIDER, 2015). Attempts to interpret clickstream data include mining the data tracking how

learners access MOOC resources and classifying learners according to their patterns of interaction with content (KIZILCEC, PIECH & SCHNEIDER, 2013) or with other learners in online discussion forums (GILLANI & EYNON, 2014). These studies have demonstrated links between engagement and completion (where completion is used as measure of learning success). But while these quantitative studies of learner activity within MOOC platforms provide us with greater understanding of *what* learners do within MOOCs, our understanding of *why* MOOC participants learn as they do, and *how* they actually learn is less developed (VELETSIANOS COLLIER & SCHNEIDER, 2015, p571). Furthermore, unlike in traditional HE courses where learner expectations are largely standardised (for example successful completion of a course or degree programme as a marker of success), the diversity of learners in a MOOC results in a range of motivations for participation (KIZILCEC PIECH & SCHNEIDER, 2013) and potentially leads to different levels of engagement (BRESLOW, PRITCHARD, DEBOER, STUMP, HO & SEATON, 2013) which may not be focused on completion. To understand learning in MOOCs it is necessary to move beyond the artificial binary distinction between completers, and non-completers, to more fully investigate the particular motivations and drivers, including contextual, cognitive, and behavioural factors, that influence individual learners' behaviour and actions. GAŠEVIĆ, KOVANOVIĆ, JOKSIMOVIĆ & SIEMENS (2014, p. 168) call for studies that improve our understanding of 'motivation, metacognitive skills, learning strategies and attitudes' in MOOCs arguing that because levels of tutor support are lower than in traditional (formal) online courses, there is a need for greater emphasis on the individual learner's capacity to self-regulate their learning. Self-regulation is the 'self-generated thoughts, feelings and actions that are planned and cyclically adapted to the attainment of personal goals' through three phases: forethought, performance, and self-reflection (ZIMMERMAN, 2000, p. 14). Zimmerman identified a number of components (sub-processes) of self-regulation including goal-setting, self-efficacy, learning and task strategies, and help-seeking. Although originally conceptualised in formal (classroom) settings, SRL and its sub-processes have subsequently been studied extensively in online contexts (see BERNACKI, AGUILAR & BYRNES, 2011 for a comprehensive review) and SRL is increasingly being used to investigate learning in MOOCs.

ZIMMERMAN (2000) highlights goal-setting as a central component of SRL. By setting goals, the learner is able to monitor progress towards those goals, adjusting their learning as necessary. Setting goals and monitoring them is motivational as it provides evidence of progress to the learner. HAUG, WODZICKI, CRESS & MOSKALIUK (2014) explored the utility of badges in a MOOC focused on emerging educational technologies. The authors used self-report questionnaires and log files to explore patterns of participation, and found that learners who had set a goal to complete the course were more likely to sustain their participation (determined by measuring access to course content and active engagement with others about the course) than those who did not set a goal. Completion of the course provided an extrinsic motivation for these learners (RYAN & DECI, 2000). However, as highlighted above, MOOC learners may not be motivated by completion, so it is important to understand different types of motivation for studying in MOOCs. ZHENG, ROSSON, SHIH & CARROLL (2015) conducted interviews with learners who had undertaken a variety of MOOCs and identified four categories of MOOC learner motivation: fulfilling current needs, preparing for the future, satisfying curiosity, and connecting with people. Their findings suggest that completion is just one outcome of MOOC participation, with key motivations to study being intrinsic in nature, related to personal improvement. In a larger, survey based study, exploring motivations of MOOC learners based in the United Kingdom, Spain and Syria, seven different types of motivation were identified (WHITE, DAVIS, DICKENS, LEON & SANCHEZ-VERA, 2015), mirroring the categories identified by the Zheng study, and in addition identifying categories of motivation reflecting other extrinsic factors: the free and open nature of MOOCs, their convenience, and the prestige of courses run by high quality institutions. These studies help to describe the types of goals learners may be setting, but do not tell us about how different types of goals influence learning in MOOCs.

Self-efficacy, the personal belief about having the means to perform effectively in a given situation (BANDURA, 1986), represents another component of self-regulation. An individual's self-efficacy influences how they respond to setbacks in their learning, with highly self-efficacious individuals redoubling their efforts in an attempt to meet their goals when faced with a challenge, while those lacking self-efficacy may give up or become negative (ZIMMERMAN, 2000). In a study of learners registered for a MOOC on economics, POELLHUBER, ROY, BOUCHOUCHA & ANDERSON (2014) explored the relation between self-efficacy and persistence using clickstream data and scales for self-efficacy and self-regulation. Their study found a positive link

between self-efficacy and persistence, though the main predictor they identified was initial engagement. WANG & BAKER (2015) studied participants on a Coursera MOOC on big data in education to explore the link between motivation, self-efficacy and completion. They found that participants who self-reported higher levels of self-efficacy at the outset of the course were more likely to persist to the end, echoing findings from online learning research (WANG & NEWLIN, 2002).

Learners draw on a range of cognitive and metacognitive strategies (learning and task strategies) to support their learning, including taking notes, revising, supplementing core learning materials, exercising time management and undertaking ongoing planning and monitoring. Highly self-regulated learners draw on a wider range of strategies and recognise the applicability of different strategies to different situations (ZIMMERMAN, 2000). They are also able to effectively monitor their learning, changing strategies when they become ineffective. VELETSIANOS COLLIER & SCHNEIDER, (2015) explored the learning strategies of a small group of learners who had completed at least one MOOC, focusing on note-taking and content consumption. Their interviews uncovered a range of different note-taking strategies that facilitated these individuals' engagement with the course content. The range of note-taking strategies utilised illustrated how different approaches such as taking digital notes, using a dedicated notebook, or annotating printed slides, complemented different patterns of participation and engagement.

3 Context and Method

The study draws on data collected in studies of SRL in two separate MOOCs. Both MOOCs attracted participants who were professionals wishing to update or supplement their professional skills or to gain a certificate in the topic as evidence of their knowledge. The *Introduction to Data Science*' MOOC (IDS: https://www.coursera.org/course/datasci) from the University of Washington was an eight week course offered on the Coursera platform. The course introduced participants to the basic techniques of data science and was intended for people with intermediate-level programming experience and familiarity with databases. Alongside weekly readings, video lectures and short quizzes, the MOOC also included four programming assignments. 50,000 learners, from 197 countries enrolled in the MOOC. A full method and findings of this study are reported elsewhere (LITTLEJOHN, HOOD, MILLIGAN & MUSTAIN, forthcoming). The *Fundamentals of Clinical Trials* MOOC (FCT: https://www.edX.org/course/harvard-university/hsph-hms214x/fundamentals-clinical-trials/941) provided an introduction to the research designs, statistical approaches, and ethical considerations of clinical trials. The course was aimed at health professionals and those studying for a health professional role. The course used video lectures, multiple choice questions and weekly readings and participants were invited to contribute to two moderated case discussions if they wished to gain a completion certificate. The course attracted 22,000 registrants from 168 countries. Full details of the method and findings of this study are reported separately (MILLIGAN & LITTLEJOHN, forthcoming). In both studies the participants were drawn from a larger cohort of learners who responded to a message posted to the course environment in the first weeks of the course inviting them to fill in a slightly revised version of a previously validated survey instrument (FONTANA, MILLIGAN, LITTLEJOHN & MARGARYAN, 2014; http://dx.doi.org/10.6084/m9.figshare.866774). The instrument comprised 39 items (example: When I do not understand something, I ask others for help.), used a Likert-scale (ranging from 1: not at all true for me to 5: very true for me). The data collected was used to generate an SRL profile for each study participant comprising an overall SRL score, as well as scores for each of eight SRL sub-processes corresponding to factors identified following principal component analysis. The SRL profile provides an indication of the extent to which individuals are regulating their learning within the MOOC. Participants who completed the survey instrument, and who identified as professionals, were invited for interview to explore their learning within the MOOC. A semi-structured interview instrument (http://dx.doi.org/10.6084/m9.figshare.1300050), developed iteratively over a number of studies (MILLIGAN, LITTLEJOHN & MARGARYAN, 2013; LITTLEJOHN, MILLIGAN, FONTANA & MARGARYAN, forthcoming) was used to probe SRL sub-processes. Transcripts were analysed and narrative descriptions of learning in the MOOC were coded according to these sub-processes. For the *Introduction to Data Science* course, thirty-two Skype interviews were conducted. For the *Fundamentals of Clinical Trials* course, thirty-five Skype interviews were conducted. Qualitative data was integrated with quantitative data using a three step method. First interview transcripts were coded independently by two researchers. Second, each participant was assigned a rank corresponding to their score for each individual SRL sub-process as well as a rank for their overall SRL score, and assigned into high- and low-scoring groups for their overall and sub-process scores. Third, the coded transcripts were examined by two researchers (independently, then jointly, to reduce the risk of bias) to identify emergent patterns of learning in the low and high-scoring groups.

4 Results

For the analysis reported in this paper, the findings of the two parallel studies were compared and commonalities and differences identified. The summaries below focus on individual aspects of SRL, reflecting the initial coding of the interviews. Narrative accounts of learning in MOOCs focused on a sub-set of SRL sub-processes and in particular, three aspects of SRL stood out: *goal-setting*, *self-efficacy*, and *learning and task strategies*.

4.1 Goal-setting

High self-regulators in both studies set specific goals highlighting the benefits of their learning, and how it related to career or job requirements. These learners were adopting a 'mastery goal orientation', setting specific goals relating to the course content and how it related to their professional needs, and structuring their learning around the development of content knowledge and expertise (PINTRICH, 1999). In contrast, low self-regulators described their learning in more abstract terms, focusing on their love of learning, curiosity, or desire to broaden their knowledge. If they articulated specific goals, they were focused solely on extrinsic performance measures such as course completion or certification, in contrast to the targeted goals favoured by the high self-regulators. The range of goals set reflects the range of motivations (both intrinsic and extrinsic) identified by ZHENG, ROSSON, SHIH & CARROLL (2015) and by WHITE, DAVIS, DICKENS, LEON & SANCHEZ-VERA (2015). In the *Fundamentals of Clinical Trials* course (but not the *Introduction to Data Science* course), there is evidence of high self-regulators adopting performance goals (to complete the course or gain a certificate) in addition to learning focused goals. Two differences between the courses may account for this discrepancy. First, the FCT course was offered by Harvard Medical School, and many participants highlighted the prestige of Harvard in the goals they described, stating their desire to complete a Harvard course, or 'learn from the best'. This sentiment reflects one of the key motivations identified by WHITE, DAVIS, DICKENS, LEON & SANCHEZ-VERA (2015). Second, the FCT course had a more rigid structure that encouraged all participants, whether low- or high-self-regulators to become wholly focused on the course content and objectives. Perhaps because of this, high self-regulators on the FCT course were more likely to articulate goals that mirrored the course objectives than the IDS course participants.

4.2 Self-efficacy

Across both studies, there was evidence of high self-efficacy among most participants, with little difference between the low and high SRL groups. The lack of a clear-cut difference is perhaps unsurprising, as the participants in this study are highly-educated, experienced professionals and are, therefore, expected to be confident in their ability to extend their existing knowledge and expertise. Furthermore, the sampling approach used in these studies (recruiting participants active some weeks into the course) is likely to favour those whose self-efficacy helped them to persist with their learning. Self-efficacy, like many aspects of SRL, is highly context dependent, and one factor which seemed to influence self-efficacy across both studies was previous experience of MOOC learning. MOOCs still represent a novel way to learn and the format can present a challenge for even the most able learners if they have not encountered them before. Indeed, learning online in any form can challenge an individual's confidence. CHANG (2005) demonstrated how training in a range of self-regulatory strategies led to improved self-efficacy in an online context. MOOC designers may consider providing some initial orientation training to ensure that learners are familiar with the course environment and how they may interact effectively with it.

4.3 Learning and Task Strategies

Whereas high self-regulators in each course generally behaved in a similar fashion, this was not the case for learning and task strategies. In the *Fundamentals of Clinical Trials* MOOC, all high self-regulators used note-taking as a key strategy, with the majority of this same group maintaining the same approach to learning throughout the course. In contrast, the high self-regulators studying on the *Introduction to Data Science* Course displayed a wide variation in the learning strategies adopted, with this group being more flexible in their approach to learning, adapting their approach to suit different elements of the course. Once again, the differences appear linked to the different course structures adopted. For the FCT course, almost every week followed the same format, with video lectures, course readings and closely linked self-assessment quizzes inviting a standard learning approach of watching, reading, and answering, and a simple note-taking approach was sufficient. In contrast, the IDS course made extensive use of project work, where learners were invited to complete an exercise in data manipulation. These in depth tasks encouraged learners to focus their learning on those aspects which were of most relevance to them and to use a broader range of strategies to meet the demands of the course.

5 Conclusion

The analysis presented here helps us to recognize learning exhibited by MOOC learners across the two study contexts. Regardless, of context, high self-regulators will focus their effort on learning: extending their knowledge and expertise to benefit their current or future roles. This is the case regardless of whether they were intending to complete the course, or study more strategically. In contrast, low-self regulators focus primarily on performance, aiming to complete the course, with less (conscious) regard for what they want to learn. At least among the professionals studying here, there was a high level of confidence in their ability to learn, though this was sometimes diminished if the individual was an inexperienced MOOC learner. But context is also important. The rigid structure of the *Fundamentals of Clinical Trials* course encouraged learners to fall into line, all progressing through the course in a similar fashion. In contrast, the more in-depth tasks that formed the core of the *Introduction to Data Science* Course encouraged learners to focus their learning on those aspects which were of most relevance to them.

While this study has begun to address a key limitation of single context qualitative studies, this analysis is not without its limitations. Only two courses were studied, and many more contexts would need to be examined before clear patterns can be recognized. Even so, qualitative analysis on its own is unable to provide a reliable measure of the similarities and differences of MOOC learners. Integrating qualitative analyses such as the ones reported here with clickstream data such as forum use, content access, and final mark would allow more robust conclusions to be drawn with rich descriptions of learning illuminating the quantitative analysis. Nevertheless, the power of this analysis in highlighting commonalities and differences has provided insight into potential areas for future exploration and signals the dual importance of learner characteristics and context in MOOC learning. Course and platform designers may use the instruments developed in this study and the findings presented here to assist them in designing courses that support inexperienced learners, whilst motivating more able ones (LITTLEJOHN & MILLIGAN, 2015). For example, course designs that encourage learners to adopt a more active role in their learning by requiring them to utilise their own expertise or integrate learning into their work contexts may be particularly appropriate for professional learners who typically have focused learning requirements.

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Exploring learning objectives at scale through concept mapping of MOOC learner discussions

Silvia Elena GALLAGHER & Timothy SAVAGE

Trinity College Dublin, The Univeristy of Dublin, College Green, Dublin 2, Ireland, {sgallag1, tsavage}@tcd.ie

Abstract

Evaluating whether MOOC learners are aligning with learning objectives is often difficult to understand at scale. This paper explores whether concept mapping through text mining software can help MOOC providers assess whether learners are meeting the learning objectives of the MOOC. 67,557 learner comments from the Trinity College/Futurelearn ‘Irish Lives’ History MOOC were analysed using Leximancer software, and concept maps based on data extracted were created. These maps were then aligned with pre-defined learning objectives to determine whether this software could be used to better understand learner behavior in relation to MOOC learner objectives. This research, through observation of the learning process, contributes a new methodology for understanding learning objectives in MOOCs at scale.

Keywords

Massive Online Open Courses, MOOCs, Learning Objectives, Leximancer, Text Mining, Concept Mapping

1 Introduction

The growth in the popularity and perceived successes of Massive Online Open Courses (MOOCs) has driven more educational institutions and organizations to use this form of large scale knowledge dissemination and teaching (SINCLAIR, BOYATT, ROCKS & JOY, 2015). However, even with this large growth, questions remain as to how best MOOCs and their learners can be measured or evaluated (HEW & CHEUNG, 2014). Research suggests that MOOC practitioners and researchers should consider a variety of indicators of success in order to assess MOOC performance (KLOBAS, 2014). However, at scale, thematic analysis of qualitative data for evaluating MOOCs has been less common.

A potential method of evaluating MOOCs, is to examine whether participants are aligning with the initial MOOC learning objectives. This would help identify whether participants have learned what MOOC practitioners had set out for them to learn. Investigating alignment of learner comments to learning objectives at scale is a process that has not been previously undertaken. This research explores whether this can be achieved through the use of text mining and concept mapping, and whether it is a useful methodology for MOOC providers.

1.1 The Importance of Learning Objectives in MOOCs

Developing a MOOC involves an iterative process of designing the MOOC narrative. This design is often centered on learning objectives; a pedagogical tool commonly used by MOOC developers across many providers (e.g. Coursera, Futurelearn, EdX). These are one or more key questions or statements describing what the academic intends the learner to achieve. Learning objectives are important tools in order to focus the course content, allow the learners to understand the motivations behind the MOOC, and aid the MOOC developers in designing a coherent, linear and engaging course. They are often aligned with learning outcomes, which can be used to measure MOOC success or failure.

In MOOCs, learning objectives are frequently displayed to the learner at the beginning of each week of the course. Formal learning objectives involve three components; a

measurable verb, the condition by which the desired performance should occur, and the criteria of acceptable performance. These objectives should be specific, measurable and related to intended outcomes (MAGER, 1997). For example, a learning objective in the MOOC under investigation was to "evaluate the various economic realities across the period 1912-1923 and consider the extent to which economic factors shaped the course of events and people's participation in them".

Previous research into whether students have met MOOC learning objectives have analyzed differences in pre and post course survey results (ROOT KUSTRITZ, 2014), post course surveys only (MANTURUK, 2014), proposed qualitative analysis of interviews (SHAFAAT, MARBOUTI, & RODGERS, 2014) and explored reflexive essays describing progression towards learning objectives (COMER, CLARK, & CANELAS, 2014). However, there has been an absence of research into how or whether learners have met the objectives of the MOOC through the lens of their MOOC discussions. Rather than directly asking the learners about whether they met the learning objectives, this research questions whether the content of their discussions can be mined and aligned with previously determined learning objectives.

This proposed technique allows for a much larger analysis of learner contributions than surveys and reflection essays where response rates may be low. It also investigates whether learner discussions are deviating or aligning with the learning objectives which can be useful in MOOC evaluation both during and post implementation.

1.2 Text Mining in MOOCs

Comments provided by learners on MOOC discussion forums are an important driver of MOOC research (GILLANI & EYNON, 2014), and are useful for understanding user motivation, behavior and socialization (BAXTER & HAYCOCK, 2014). MOOC learners use discussion forums and sections in MOOCs for interacting with other learners, academics and moderators, and their comments can include reflection, help-seeking, emotional disclosure, personal narratives, and clarification of learning resources (GOLDBERG et al., 2015; HUANG, DASGUPTA, GHOSH, MANNING, & SANDERS, 2014; KOUTROPOULOS et al., 2012).

Text mining software for exploring MOOC learner comments has been previously used for evaluating learner emotions (LENOY, MUNOZ-MERINO, RUIPEREZ-VALIENTE, PARDO & DELGADO KLOOS, 2015), success factors (MATÉ, DE GREGORIO, CÁMARA, & TRUJILLO, 2014), student satisfaction and retention (ADAMOPOULOS, 2013), and opinions towards course tools (WEN, YANG, & ROSE, 2014), amongst others. Many of these studies used sentiment analysis for understanding learner perception towards particular aspects of a course. For example, TUCKER el al (2014) explored student performance and learning outcomes using text mining of discussion posts, and correlated quizzes and homework assignments with student sentiment. However, no previous research has attempted to explore whether the mining the content of discussion comments can be used to inform whether learners are aligning with previously defined learning outcomes used in MOOC pedagogical design.

1.3 The 'Irish Lives' MOOC

'Irish Lives in War and Revolution' was a six week MOOC developed by the Department of History and the Department of Online Education of Trinity College Dublin in collaboration with MOOC provider Futurelearn. This MOOC was developed in 2014, with its first iteration held in September 2014. It had 18,264 registered users, with 4,857 posting at least one comment on the MOOC. The main subject matter of the MOOC was the Irish revolutionary period between 1912 and 1923, and its overall intended learning objective was to present a wide range of personal experiences from this time period, rather than a fixed chronological narrative of historical facts and events.

The learning content of the MOOC was framed by the development of weekly learning objectives and themes. For each week of the course, a different theme was selected (e.g. fighting lives, social lives, economic lives, political lives, and private lives) and learning objectives were crafted in light of these major themes. In addition to these weekly themes, the overarching learning objective of the course was to explore perspectives of war and revolution in terms of ordinary lives.

Given the relatively less defined nature of the learning objectives designed, the evaluation of this MOOC was potentially more difficult than, perhaps, a more fact based MOOC. The MOOC team were curious whether the learners, in their discussions, had successfully aligned with learning objectives provided. However, with over 60,000 comments, it was difficult to determine this. It was decided to employ text mining software to investigate whether aligning discussion comments with research objectives was possible, and whether it could help evaluate the MOOC using the voices of the learning community.

2 Research Aim

This research is investigating whether concept mapping of MOOC learner discussion comments using text mining software can be a useful method of understanding whether learners are aligning with pre-defined learning objectives. This could aid MOOC evaluation both during and post implementation.

3 Methodology

Learner comments from the 'Irish Lives' MOOC were extracted and separated into six files based on the six weekly modules of the course. These comments were located within each of the weekly module sub-sections, known as 'steps'. Rather than being explicit 'discussion forums' as is the case in some MOOCs, Futurelearn use these 'steps' to allow learners to comment directly within the resources provided, or in response to fixed discussion questions. Each of these files were then uploaded onto the Leximancer software and concept maps were created for each week of comments. These concept maps were then compared with the learning objectives of that week. This comparison was a reflective process by two academics involved in the development and implementation of the MOOC, to determine whether the themes extracted by the software were aligning with the learning objectives. This analysis was carried out retrospectively, however, this process could have been done during the implementation of the MOOC. Results from the analysis of the first week are presented due to size considerations.

The first week explored the chronology of the Irish History period from 1912 to 1923. Videos, articles, further reading, discussion points, and surveys were used to encapsulate the research objectives. The broad learning objective was to understand the lives of ordinary individuals during the time of War and Revolution, consider key turning points during this time, and present a different viewpoint of history than the usual 'key characters'. Detailed learning objectives included:

a. Outline key events and developments in the history of Ireland in the period of war and revolution
b. Undertake a basic analysis and evaluation of the selected primary sources
c. Present, in online discussion, their views on the key challenges of this period

3.1 Leximancer

Leximancer is a validated text mining software for "transforming lexical co-occurrence information from natural language into semantic patterns in an unsupervised manner" (SMITH & HUMPHREYS, 2006, p. 262). It is used to analyse text based documents and display an overview of the extracted information in well-defined concept maps. The system is modelled on content analysis, and performs its analysis in a relatively rapid and unsupervised manner (SMITH, 2003). These concept maps denote the main concepts within a segement of text and interrelationships between them. It has been used in a wide variety of disciplines including health research, marketing, business, psychology, computer science and education (SCOPUS, 2015). Within the MOOC space, it has been used to investigate MOOC-themed blogs (CHEN, 2014), and stakeholder perspectives (YOUSEF, CHATTI, WOSNITZA, & SCHROEDER, 2015), however, it has not been used for analyzing MOOC learner discussion comments, nor for investigating learner objectives in this way.

4 Results

The concept maps generated by Leximancer for all comments within Week 1 'Chronology of Events' are presented in figure 1. The larger circles represent themes within the MOOC step comments, whereas the dots within represent smaller concepts. Larger and brighter circles denote more importance, and lines between dots indicate strong semantic links. The closer distance between concepts, the stronger they are linked. The first map uses all comments from Week 1 with no manual adjustment, whereas the second removed the word 'Ireland'. This was because of the implied importance of Ireland as the major overarching concept across the MOOC, and questions were posed as to the strength of its influence across other concepts. The top 50% of concepts are visible on both maps, and no additional manual adjustment of the software was conducted in order to maintain the open and exploratory nature of this research.

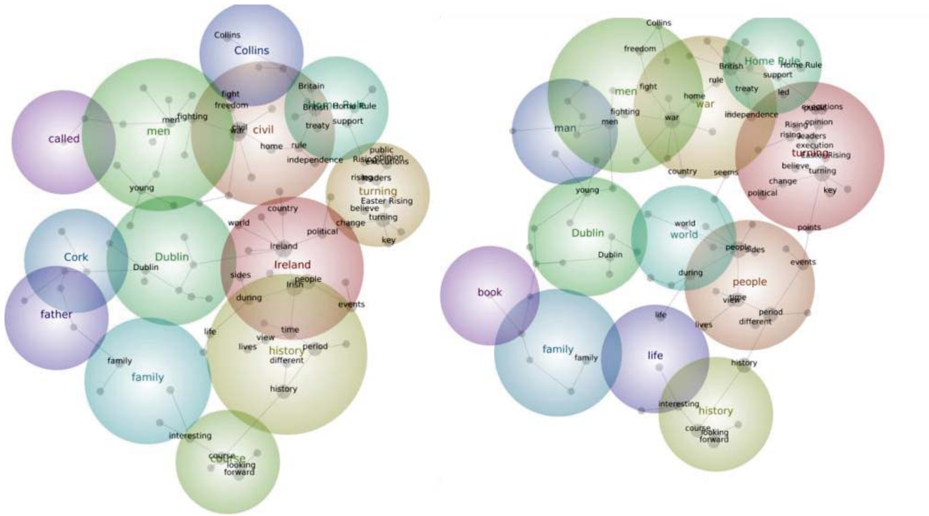

Figure 1: Concept maps generated by Leximancer of all Week 1 learner comments

Table 1 presents how the overarching learning objectives, and those specific to week 1, were aligned with concepts and sub-concepts the emerged from the Leximancer concept maps.

Table 1: Aligning the learning objectives with emerging concepts

Learning Objectives	Related concepts, sub-themes and interrelated concepts emerging from Leximancer analysis
Understand the lives of normal individuals during the time of War and Revolution	Family, father, life, people, maner, life, people, man
Consider key turning points during this time	Turning, Easter Rising, change, political, execution, Home Rule, war, men, British, independence
Present a different viewpoint of history than the usual 'key characters'	History, different, people, lives, time
1a Outline key events and developments in the history of Ireland in the period of war and revolution	Collins, Cork, Home Rule, Easter Rising, Dublin, war, civil war
1b Undertake a basic analysis and evaluation of the selected primary sources	Collins, Cork, Home Rule, Easter Rising, Dublin, war, civil war, question, world,
1c Present, in online discussion, their views on the key challenges of this period	Turning, Easter Rising, change, political, execution, Home Rule, war, men, British, independence, Collins, Cork, Easter Rising, Dublin, war, civil war, question, world, freedom, fight, treaty, support, British rule.

Exploring both concept maps, it is clear that elements of the overarching learning objective of understanding history from the point of view of ordinary people are arising from the analysis. The concepts, 'family', 'people' and 'men', and the sub-concepts 'people', 'lives' are immediately emerging.

The MOOC also strived to give a different viewpoint of this period of history (i.e. from the viewpoint of the ordinary person). This appears to be emerging with the sub-concept 'different' emerging from the 'history' concept. Within the second map (i.e. with 'Ireland' removed), the concepts 'people', 'life', 'family', and 'men' emerged which further strengthens this finding. Moving to specific learning objectives, the concepts 'Collins', 'Home Rule', 'Cork', 'civil war', and 'Dublin' all emerged which aligned well with learning objectives (a) and (c) (i.e. outlining key events in Irish History, and evaluating primary sources).

The concept 'turning' arose out of a directed discussion question "What represents the key turning point of this period", and sub-themes from this ('public opinion', 'leaders', 'Easter Rising', 'executions') also align well with learning objective (b) (i.e. engage with conflicting evaluations of events in Irish History).

Another interesting aspect that emerged was the cluster of concepts 'Men', 'War', 'Home Rule' and 'Turning'. The distance between the 'Home Rule' and 'Turning' concepts in the first map show that many learners felt that these themes were interrelated. In the second concept map, this is seen even more clearly, with 'Home Rule' and 'War' interrelating with 'Turning'. This demonstrates that the learners were engaging with the materials provided in order to understand the implications of key events in Irish history in terms of discussion points provided.

Examining both concept maps at a macro level, they give knowledge of the most popular concepts emerging from the discussions. Not only can this help align learning objectives but can lend support to future iterations of the MOOC. It is clear that the discussion question based on the 'turning point' is a very popular discussion driver, suggesting that this question should be retained within the MOOC for future iterations.

5 Discussion and Conclusion

This research investigated whether Leximancer software could be used as a tool to explore learner comment alignment with learning objectives in a large scale MOOC. The results show that the visualizations created with Leximancer are a useful way of presenting conceptual analyses of MOOC discussion comments at scale. In effect, concept mapping helps MOOC practitioners align the narrative of the MOOC with the journey of the learner, and determine whether the MOOC has been successful from the interactions of the learners rather than by assessment or activity.

In MOOCs where there are questions as to whether the learners are engaging well with the content, these maps could be useful to outline areas of difficulty. In addition, the analysis can also bring out additional concepts not previously considered in the learning design. These concepts help further understand what the learners are discussing, and can form discussion points to be driven by moderators during implementation. When the MOOC has been completed, these additional concepts should also be considered for future iterations of the MOOC.

Another benefit to using concept mapping in this way, is to present information about the MOOC to non-technical stakeholders. A key problem for many MOOC administrators is being able to explain learner behavior in a simple manner to individuals who may not have a background in statistics or sentiment analysis. Concept maps are a visually appealing way of presenting learner behavior which can be understood by a wide range of stakeholders, both technical and non-technical alike. It can also be a useful way of bridging the gap between academics and MOOC technical staff, and helping academics who are designing the course understand how learners are engaging with their material. Future studies should evaluate the usefulness of these concept maps from the perspective of MOOC academics and non-technical stakeholders.

Although these concept maps are an interesting visual tool for exploring MOOC learning objectives, it should be used in conjunction with other methods of learner analytics (e.g. quantitative and qualitative methods). Future research will examine additional MOOCs, in particular those with less successful completion rates, to determine whether these concept maps could help inform the reasons behind unsuccessful MOOCs. In addition, a rubric to determine to what extent comments are sufficiently aligned to objectives should also be investigated.

One question that should be addressed is to whether there is a circular nature to the concept maps. Given that the learning objectives are guiding learner discussions, it could be argued that the concept maps would obviously uncover themes from the learning objectives. It is important that in using the concept maps for analysis, that the sub-concepts are explored rather than just the primary concepts. It should also be noted that

formalizing learning objectives at the design stage of a MOOC is key to successful use of this technique.

An obvious limitation of this analysis is the absence of students who did not post comments on the MOOC. It is suggested that future research explores whether a minimum percentage of social learners (i.e. those who posted at least one comment) should be determined as being optimum for using this technique. In addition, quantitative measures such as assessment results and post-course surveys should be used in conjunction with the concept mapping to ensure a more holistic approach to evaluating MOOCs.

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An Experiment in Automated Proctoring

Thomas STAUBITZ, Ralf TEUSNER, Jan RENZ & Christoph MEINEL

Hasso Plattner Institute,
{thomas.staubitz, ralf.teusner, jan.renz, christoph.meinel}@hpi.de

Abstract

Credibility is a central feature for every certified training. The same applies for MOOCs. Individual supervision of participants in study centers reaches its limits when having thousands of students. Thus online proctoring as a means to handle the amount of participants in MOOCs seems to be a suitable way to increase certificate valuation. We compare various flavors of online proctoring and the current practices of current MOOC platforms. Furthermore, we present the results of several user surveys, dealing with the importance of the certificates to our users. Finally, we inform about an experiment with a rather new flavor of online proctoring, which instead of relying on human eyes is using an automated comparison by means of a mathematical model of the face, to identify a participant.

Keywords

Assessment, Identity, Exams, Proctoring, Online

1 Introduction

When completing a MOOC, students take several things with them. In best cases, they made some new contacts, acquired new knowledge and qualified for a certificate issued by the course instructors to prove their newly developed skills. Currently, MOOCs are shifting from the experimenting phase towards enterprise usage for additional on the job trainings. Recent addition of showcase functionalities in professional networks such as LinkedIn or Xing, further outlines the necessity for reliability and trust in virtual certificates. Most often, this trust issue is addressed by several measures known from bank notes in order to counter forgery. Since the certificates are usually printed by the participants, watermarks and logos are the only viable ways to prevent digital changes towards the scores. One step further, and luckily also de-facto standard today, is the approach to embed a link or QR-code in the document, which allows third parties to validate whether the certificate was indeed issued by the respective MOOC platform and whether the results and scores are correct. The validity of the document is however void, if the assessment itself was flawed. Every platform is unable to determine whether an exam was solved by the intended participant or probably by a skilled relative. The connection between the person solving an exam and the issued certificate therefore has to be validated. Despite the identity of the registered participant can not be guaranteed to 100%, the following approach helps to fortify the trust: The participant willing to be "proctored", signs up for an enhanced version of the respective assessment. She registers with the proctoring platform and takes some portrait photos (usually 2-5) to validate against via her webcam and thereby ensures that all technical requirements are met. Afterwards, she starts the assessment just like normal. The webcam is active during this time and shows her the captured scene. The whole stream or only parts of it (for example one photo each minute) is persisted and processed for anomalies. In order to close the chain of trust, a photo taken during the assignment is also embedded into the final certificate. Managing this identity problem is not a core business of an (academic) MOOC platform, leaving the field open for third party service providers. Nonetheless, the platform operators vouch for the quality of this check with their current reputation. At openHPI, we therefore tested such a system in order to ensure a baseline quality before further offering this feature to the public.

2 Valuation of MOOC Certificates

2.1 User Surveys

We started our research one and a half years ago in 2013. At that time, we asked the users of our platform how important certificates are for them and how they use their certificates in a job application process. A total of 774 of our users participated in this survey. A third of the participants stated that they are only marginally interested in the certificates. About a quarter of the participants opted for optional, very few for obligatory proctored exams. Another result of the survey was that only few users would be willing to pay for a more trusted certificate. 45.3% of the participants would add their certificates to their job application papers, another 17.5% would even add a confirmation of participation. 10.59% would only add a more trusted certificate to their application papers. One and a half years later, in 2015, we asked the questions again in a condensed form. Still, the majority of users is either not interested in a more trusted certificate at all or would not accept the privacy intrusion of a proctoring solution. Only very few would pay more than 50 Euros for such a certificate form (see also Figure 3–Right). In several meetings with different companies, however, proper identification of the users that are taking the exams were specified as a requirement, e.g. for using our platform for in-house trainings. Furthermore, this would be a self-posed requirement for us to offer ECTS points for a MOOC. At this point, we also need to state that the majority of our user base are not students but professionals with some experience in their job. ECTS points are no longer that relevant for them. So the survey results probably are biased to a certain extent. The question is not necessarily if our current user base is interested in certificates with an added value, but if we can expand our current user base by offering such certificates.

2.2 Anti-forgery measures

The first step to improve the quality of our certificates was to provide a mechanism that allowed employers to check whether a user had forged the document. An URL and a

QR code were added to the certificate[1], which allows the employer to make sure that e.g. the user's results have not been forged.

This, naturally, is not a sufficient measure to guarantee that the person who is stated as the participant on the certificate is actually the person who took the course and especially the exams.

Figure 1: openHPI certificate validation page

3 Proctoring vs. Identity Check

3.1 Definition of Terms

Whereas identity-control only attempts to make sure that the participant who took the exam is the one that is stated on the certificate, proctoring goes a step further in attempting to make sure that the participant does not cheat during the exam by using forbidden devices such as books, the internet or the help of other persons. In this context, we also need to speak about open vs. closed book exams. In an experiment, Gharib, Phillips and Mathew found out that results generally are better in open book exams while anxiety is significantly lower. Good students performed good in both types, bad students did not. The most significant finding of their study is, however, that the retention rate was the same for both exam types (GHARIB, PHILLIPS & MATHEW, 2012). Identity-controlled exams correspond to open book exams while proctored exams, depending on the predefined settings, correspond to closed book exams. We decided that open book exams are sufficient for our use case. In cases where learning by heart is still considered to be key, restrictive time constraints during exams have been proven to be a sufficient solution during our In-Memory Database (IMDB) courses. (TEUSNER et al., 2015)

[1] Back in March 2014 when we rolled out the new version of our platform

3.2 Current Solutions and Best Practices

Naturally, openHPI is not alone with this problem, so we examined how other MOOC providers tackle it. Coursera, Udacity, and edX have been selected, as they are the major players in the MOOC market. Iversity and mooin have been selected as they are fellow platforms on the German market. We have not included imoox as to our knowledge it currently does not offer some sort of identity check.

3.2.1 Tracks

What all of the platforms have in common is that certificates with different kinds of validity are offered for paying customers next to the basic free tracks. Iversity offers an *ECTS Track* and a *Certificate Track*. Coursera offers a *Signature Track*, edX a *Verified Track*. The identity check is similar on all platforms. Users register with a photo of themselves and a photo of their ID-card. Certificates in these tracks are enhanced with a verification URL similar to our solution. Only participants who have opted for one of the non-free tracks are allowed to access a final proctored exam. For online proctoring all of the platforms cooperate with third party providers. EdX and Iversity employ SoftwareSecure, Coursera and Udacity employ ProctorU (IVERSITY, 2015; COURSERA, 2015; PROCTORU, 2015; EDX, 2015; UDACITY, 2015).

3.2.2 Online proctoring solutions

ProctorU, a company that has evolved from an academic background runs a couple of online assessment centers. Course participants have to register for a certain date when they will take their exam a couple of days upfront. A real person will then watch what the participant is doing while she takes the assessment. The course providers can specify upfront which devices are allowed, e.g. certain books and some hand-written notes but no internet[2]. SoftwareSecure's solution differs from ProctorU as the participants are recorded during the exam and several people evaluate these recordings afterwards[3]. Naturally, the list of these providers is not exhaustive. There are others, such as Kryterion[4], or iSQI[5], where iSQI takes the role of a re-seller, bundling SoftwareSecure's proctoring solution with a quiz system[6]. SMOWL, a Spanish company, offers an identity check rather than a full-fledged proctoring. A user registers with SMOWL by taking three pictures. During the exams, at a predefined time interval plus a random time component, a picture is taken. These pictures are compared to the pictures that have been taken during the registration process. This is done by a machine using biometric verification technologies (LABAYEN et al., 2014).

Recently, ANECA[7] has approved two online master's degree programs by Universidad Rey Juan Carlos (URJC). These programs are no longer required to include a final offline exam that has to be attended by the students in person. Instead, a broader selection of learning activities and assignments throughout the course's runtime is monitored by SMOWL (SMOWL, 2015).

3.2.3 Offline exams

Offline exams are an alternative to online proctoring solutions. However, they do not scale easily. mooin currently offers one course where the final exam has to be physically attended (MOOIN, 2015). Udacity cooperates with Pearson VUE to offer offline exams in testing centers all over the world (UDACITY, 2012; PEARSON, 2015).

[2] Telephone Conference with ProctorU. July 22, 2014

[3] Telephone Conference with SoftwareSecure. July 17, 2014

[4] http://www.kryteriononline.com/

[5] https://www.isqi.org/

[6] Meeting with iSQI. July 22, 2014

[7] ANECA is the official entity, which certifies the university degrees in Spain, and a member of the European Association for Quality Assurance in Higher Education (ENQA).

At openHPI we have also conducted a (failed) offline exam experiment. Three out of ~10,000 course participants registered for an offline exam on our campus in Potsdam, two of them did not show up.

4 First Experiments with SMOWL

4.1 Why SMOWL?

After several in-depth calls with some of the previously mentioned proctoring providers, we decided to go for SMOWL. One of our reasons was the price tag. We had decided early on, that, if we offer proctored courses, we want all assignments in these courses to be proctored, not only the final exam. That accounts for a maximum of 8 hours proctoring per course and student. According to our surveys, only very few students are willing to pay more than 50€. SMOWL was the only provider that offered a solution in this price range with the trade off of only supporting open book exams. Furthermore, SMOWL employs HTML 5 video technology, which fits better in our technology landscape than the solutions of the other providers. Finally, even though ProctorU and SoftwareSecure support the SafeHarbor[8] framework for data protection, they're still located in the US, which freaks out many of our users in terms of privacy issues.

Table 1: Comparison of proctoring providers' key features

	Technology	Platform Support
ProctorU	Java	Windows, Mac
SoftwareSecure	Special Browser/Flash	Windows, Mac
SMOWL	HTML 5/Flash fall-back	Windows, Mac, Linux

[8] http://www.export.gov/safeharbor/

4.2 Test Setup

Up to now we ran two tests (alpha and beta), a third one is currently being set up. In this section, we will describe the settings of the completed tests. The alpha test was run on our staging platform with internal users only. Members of the openHPI team, colleagues from other projects of the chair, students, and a member of the openSAP team, volunteered as users. Overall we had about 20 participants in this first test. The following beta test was public. During the *Web Technologies 2015* course on openHPI we conducted a survey to ask who would be willing to test our new identity check feature. Out of about 10,000 course participants, 1826 answered the survey. 186 out of these were interested in testing our new feature. For those participants who volunteered to be proctored, we enabled the proctoring feature in one of the quizzes. Finally, 49 learners participated in the beta test.

Figure 2: Integration of the SMOWL Proctoring Solution within the openHPI quiz system. Left – Adjusting the camera before the quiz is started. Right – Proctoring during the quiz.

4.3 Evaluation

Both tests were accompanied by surveys. For the alpha test we only ran a post test survey, basically asking for usability issues with the integration. For the beta test we started with a pre-test survey, asking the users particularly about their attitude towards

Figure 3: Left – Privacy and missing webcams are the main reasons why users did not want to participate in the test. Right – Request for more valid certificates.

being proctored during an online assignment. An essential amount of participants, had strong objections against being filmed. The major concern was privacy. A surprisingly high amount of participants was unable to upgrade to the proctored track due to the fact that they do not have a camera available, particularly those that are participating at their workplace (see Figure 3–Left). The results of the post survey question are shown in Figure 3–Right. As already discussed in Section 2 the request for "more valid" certificates has not increased amongst our users during the last two years. We had a more detailed discussion with some users that revealed their exact motives for being concerned about their privacy. One big issue was the connection of their image to their name. We have taken this into account by identifying the users towards SMOWL with a cryptographic hash value of their user_id, which disables SMOWL from identifying them. Next to the surveys, we analyzed the results that we received from SMOWL by comparing them to our information about the cheating attempts. For the alpha test we had well-defined plans for each participant's cheating attempts. For the beta test we asked the users to come up with ideas of their own and report them to us. The simplest way to trick the system is to trick the camera with a photo of the "candidate to be certified" (CTBC). Technically more ambitious participants set up a remote desktop session or simply used two monitors and keyboards. The CTBC sits in front of the camera, while someone else is answering the questions. Another variation of this theme is to have a helper in the same room but out of sight of the camera. To prevent these forms of cheating, it would be required to install additional software—such as special browsers that lock the user in a certain window or tab—or hardware—such as a 360º panorama camera. In theory, it would be possible to integrate such tools with SMOWL.

SMOWL actually does not film the users, photos are taken in a previously defined time interval. There is also no audio surveillance. SMOWL uses HTML5 video as the default technology and also offers a Flash fallback version for devices that do not support HTML5. The HTML5 version gives the user the illusion of being filmed, while the Flash version shows exactly when the photo is going to be taken[9]. The most important finding here is that the automated part of their analysis works rather good. In both tests, the cheating attempts of our users had been detected. The most interesting case was one where we have a detailed description from the user how he cheated holding a photograph of himself in front of the camera[10]. In the report that we had received from SMOWL, the cheating attempt was not listed as such. When they investigated this issue, it turned out that the algorithm had actually detected the cheating attempt. In such cases they have a human controller taking a second look on the data. The controller rejected the cheating attempt and therefore caused the miss. Due to this finding, SMOWL has adjusted this process to prevent such errors[11].

The resulting data does not always give a clear distinction between cheating attempts and normal human behavior. SMOWL allows a variety of settings, which can be specified either as an absolute amount of pictures or as a percentage (see Figure 6 left.) Next to the severe issues, such as *incorrect user* or *cheating attempt* less severe, fuzzier issues are *nobody in front of screen, wrong lighting*, or *other tab*. *Black images* or *webcam discarded* were mostly reported for Linux users, who in turn reported technical problems[12]. Each of these criteria can be activated and a threshold can be set.

A good compromise needs to be found here between too strict and too loose settings.

Several smaller flaws in SMOWL's web interface have been detected during the tests and have been resolved immediately.

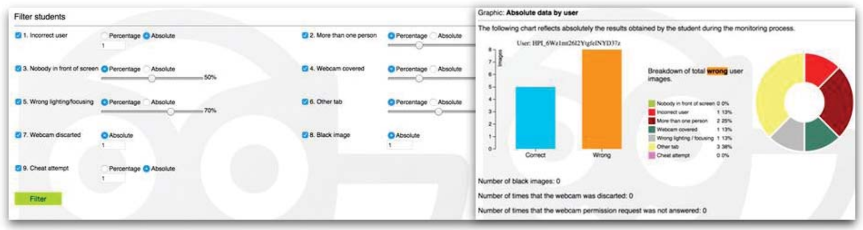

Figure 6: Left – SMOWL settings. Right – SMOWL results page (User)

5 Future Work

We are currently working on a better integration of the identity check with our platform. Particularly in terms of privacy concerns, we have to improve our information policy significantly. A third test is scheduled with, hopefully, significantly more participants.

[9] There is no deeper reason for this. The Flash version is just older than the HTML 5 version. The Flash version is not under active development any longer and its use as a fallback will not be necessary anymore in the near future.

[10] Pieper-Woehrle, R. Private Communication. July 22, 2015

[11] Fraile, M. Private Communication. August 7, 2015

[12] It is currently evaluated if this is a real issue or if it can be solved with different browser settings.

6 Conclusion

Even if more trusted certificates are not a major concern of our current user group, this will become an issue to make the courses more attractive for, currently, underrepresented target groups, such as e.g. students requesting ECTS points. Full-fledged human proctoring is expensive and not very well accepted amongst our users. SMOWL offers an alternative, using biometric face recognition, which has made a good impression during our tests. Naturally, it cannot provide 100% security, but at least it significantly raises the bar for cheaters.

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Measuring completion and dropout in MOOCs: A learner-centered model

Leslie HUIN[1], Yann BERGHEAUD[1], Pierre André CARON[2], Alexandra CODINA[1] & Eric DISSON[1]

[1] **University Jean Moulin Lyon 3, France**

[2] **Univ. Lille, France**

Abstract

In MOOCs, there is much discussion about persistence and completion. However, there is yet no consensus and this makes it difficult to analyze the success of this kind of system. At the University Jean Moulin, we needed a framework in order to objectively determine the relevance of our MOOCs from the learner's point of view. We therefore propose a learner-centered model to define the mechanisms of commitment and a dynamic classification of participants. We are thus able to finely analyze the progression of success and dropout indicators in our MOOCs and understand learners' behaviors to improve the learning experience. We do not pretend to have responded fully and definitively to all the issues under this phenomenon. However, we hope that the result of this work (in progress) is a consistent set of tools for a global understanding of dropout and completion in MOOCs, and can thus serve as basis for research or practical framework.

Keywords

MOOC, Completion, Persistence, Drop-out, Attrition, Commitment, Intention, Behavior, Learning Analytics

1 Introduction

Measuring the efficiency of a learning instrument is essential in order to revise and improve its quality. Two quantitative indicators are generally used: the rate of completion and the rate of dropouts.

In some reports showing the feedback related to the learners' experience, we see a paradox between the massive enthusiasm regarding MOOCs and the numbers reflecting the rate of success, which are reported relatively low, showing that less of 3% of the students would achieve the final exam (DANIEL, 2012). A study made in 2013 suggests that the average number of registered to a MOOC is 33000 students, with an average of only 7.5% of them completing the course (KOLOWICH, 2013).

These low rates nourish debates and legitimately raise some questions regarding the credibility of the MOOCs. However, many agree to say that studying the rate of completion and dropout in MOOCs requires a deeper reasoning (Section 2). Also, at the University Jean Moulin (Lyon – France), we wanted to raise this question, primarily not with a research purpose, but more with a pragmatic interest which would let us objectively analyse the relevance and the success of our Massive Open Online Courses. Our focus has not been put on an academic perspective, but rather on the learner's point of view. By defining the strong relation between intention, commitment and behavior during a MOOC (Section 3), we have proposed a dynamic model of classification of different types of students (Section 4), as well as a set of indicators for defining completion and dropout regarding this particular learning instrument and learning environment (Section 5). Within the limits of the data offered to us, we have tried to apply this model on the progress of one of our own courses (Section 6).

2 Intention, commitment and behavior

2.1 A different process of selection and commitment

We find the notions of completion and dropout in traditional ways of teaching, as well as in the context of distance and online training. However, in these very contexts, universities are taking measures in order to prevent potential failing, like:

- the selection at the beginning which allows to limit the number of enrolment based on the skills required to take the course, in relation to its content or to its form;
- the registration fees being often a factor of external motivation;
- a diploma given at the end as a valorisation factor regarding the provided efforts.

Those elements which are promoting motivation (DECI & RYAN, 2002) are not inherent to MOOCs. There is no selection *a priori* and no consequence to drop out or to fail. Thus, MOOCs have *a priori* less factors of commitment and are based on a real auto-determination (DANIEL, 2012), and the selection based on the participant's capacity is done once the course has started (SIEMENS, 2013).

In the context of MOOCs, it is the learners themselves who define their objectives and what they expect of the MOOC. Some could wish to get the final certificate, or to participate only in the exchanges through a certain community of interest, while some others could be more interested by the acquisition of knowledge regarding the whole course or only some aspects of it. MOOCs reveal other learning experiences as completely valid and rewarding for the learner as the ones conceived by the teachers. Thus, students can drop out from the institution's point of view, and can be at the same time fully satisfied of the experience as well as achieved their own and personal objectives. Thus, a lot of researchers now agree to relativize those indicators, or even to challenge their relevance (HAGGARD, 2013). Downes explains that the rates of failure are misleading metric and that a more refined definition of the classification of learners is necessary (DOWNES, 2011).

2.2 A proposition of commitment process

In the context of MOOCs, participants must autonomously understand and integrate their learning process, without always finding a formalized support structure. We thought this process according to three key concepts: intention, commitment and behavior (figure 1). This process is part of the "Integrative Model of Motivation" (FENOUILLET, 2012), itself inspired by the theoretical framework of Self-Efficacy (BANDURA, 1997), Reasoned Action (FISHBEIN & AJZEN, 1975) and self-determination (DECI & RYAN, 2002).

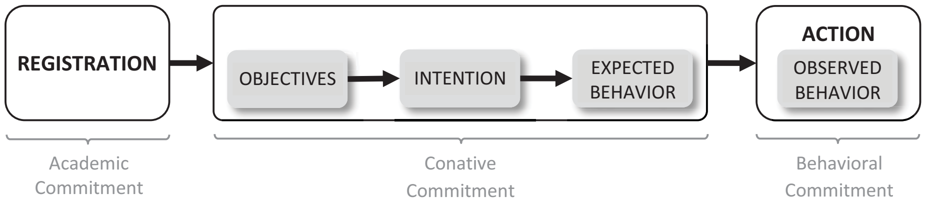

Figure 1: Intention, commitment and behavior

2.2.1 Intention

The intention of the learner toward the MOOC must be taken into account. We define intention as the will of the learner to achieve the learning objectives (FISHBEIN & AJZEN, 1975). This includes the selection (or negotiation) of its objectives, whether explicitly proposed by the designer or emerging from the perception of the course content by the learner. We define two categories of intent:

- **Conceptualized intentions** which are provided by the instructional design in which the learner can engage,
- **Custom intentions** emerging from the appropriation of the content by the learner.

2.2.2 Commitment

An autonomous learner is a person who has the ability to take over its own learning (its definition, management, evaluation and realization) (RYAN & DECI, 2002). In MOOCs, demonstration of this autonomy requires the commitment of the individual. We define three kinds of commitment: academic, conative and behavioral.

Academic commitment: when a person wishes to participate in a MOOC session, he must proceed to a registration. The major platforms currently require this step before giving access to the course content. Registration is one form of interest in the course. Registration for a MOOC follows the same logic than one to a traditional university course. However, the procedure is much faster and there is no selection. This first action can then be described as *academic* commitment, referring to the academic process.

Conative commitment: It is important that participants negotiate themselves the extent and nature of their participation and completion based on their intention and objectives. It is a self-directed learning (DECI & RYAN, 2002). This deliberate and voluntary negotiation reflects a commitment that we call *conative*. A single participant then becomes a learner for which a certain behavior is expected according to its intention.

Behavioral commitment: The final kind of commitment is the *behavioral* commitment, when the learner engages himself in a set of actions to achieve its objectives. Here we come to self-determination but also to intrinsic abilities of the learner. Instead of being carried out before the start of courses in *traditional* education, it is by the time of this behavioral commitment that is performed the selection of students on the basis of presumed ability to follow the course regarding its content (Knowledge prerequisite) or in relation to its form (ability to follow a course autonomously, online...) (BANDURA, 1997).

4 A dynamic classification

One of our goals to understand completion and dropout in MOOCs is to distinguish different subpopulations of individuals in terms of intention and behavior. Several relevant studies based on analytical statistics or feedbacks have already been exposed (COFFRIN et al. 2014; KIZILCEC et al., 2013; HILL, 2013; CLOW & DOUG, 2013). By aggregating those various analyses and by adding the concept of intention, we propose a taxonomy to identify different profiles. We also assume that this classification must show a dynamic dimension of the individuals' change of state. This will put forward the commitment process in order to be more accurate in our understanding. Thus, we formalized our classification as a state-transition diagram (from the Unified Modeling Language method – UML) (Figure 2).

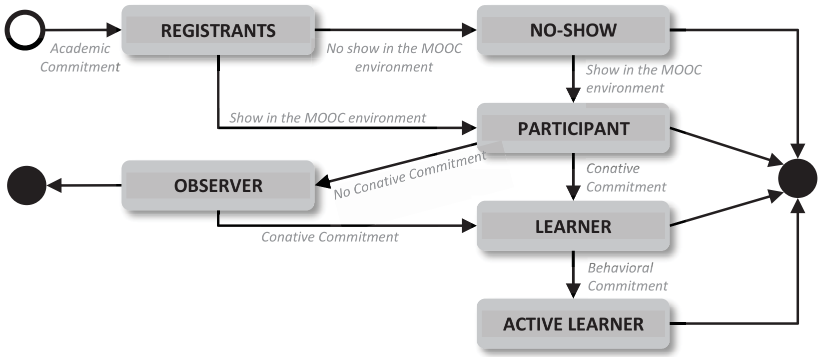

Figure 2: Dynamic Classification

4.1 The Initial categories

Registrants: they are all persons who have made the act of registration. This act shows a first form of interest toward the MOOC.

No-shows: Among the registered, a number will not even go through the door of the MOOC environment. We call this category the no-shows. This is a first step to move from quantitative to qualitative massification.

Participants: Registrants who perform an action in the MOOC environment will be qualified as participants.

4.2 The pre-committed profiles

Learners: Learners are participants who expressed a learning plan through an intention, whether conceptualized or custom.

Active learners: they are unique users having completed a committing action, meaning a learner for whom we have observed an active behavior in the learning environment. We are here on a behavioral commitment with a qualitative dimension. For example, the random navigation in the MOOC is not an active behavior but an exploratory one.

Observers: An observer is a participant who explicitly says having no intention and therefore no learning objective but who still wants to perform some actions.

4.3 The committed profiles

Committed profiles correspond to consistent patterns of behavior observed in active learners. It is then possible to compare the expected behaviors required by an intention with the observed behavior in the active profile.

5 Measuring completion: rates and numbers

The dropout and completion are complex phenomena in MOOCs. Thus, we do not propose a single indicator but a set of metrics to globally and appropriately apprehend the MOOCs analysis and enhance each learning experience (Figure 3).

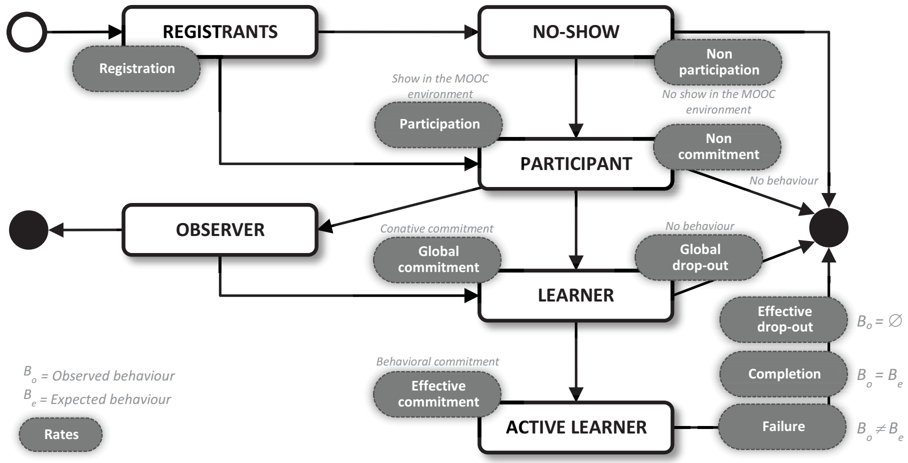

Figure 3: The various rates in the classification

Here, we believe in two strong assumptions:

- there is no failure without any attempt to succeed,
- there is no dropout while there is still an active behavior.

5.1 Initial rates

The participation rate: The participation rate is defined by the number of participants compared to the number of registrants.

The commitment rates: they allow to differ the participation from the commitment and offer another perspective regarding the success of the MOOC. We propose two rates to express the commitment:

- The *global commitment rate* based on the number of participants engaged in an intention (ie learners)
- The *effective commitment rate* based on the number of learners engaged in an active behavior (*i.e.*: active learners).

5.2 Completion and failure rates

The completion rate is generally defined by all the students who have achieved the objectives attesting the success of learning, and which can be deducted the failure rate. The intention of the learner must be at the heart of the evaluation. To actually define whether the MOOC has a positive impact, it is necessary to parallel behavior of the learner with his intention. The learner's behavior can be analysed using data recorded by the learning environment. However, the intention must be explicitly expressed by the participant.

An individual in a state of completion in a MOOC is a learner for which the Observed Behavior B_O is consistent with the Expected Behavior B_E. Thus, it is possible to calculate the success rate on the basis of learners engaged in a behavior, that is to say, active learners. On the contrary, failure is determined by the inadequacy of the learner's behavior with the behavior expected to achieve the objectives.

This can be translated into these following two logical implications:

If Expected Behavior $\subseteq$ Observed Behavior $\Rightarrow$ Completion

If Expected Behavior $\not\subset$ Observed Behavior $\Rightarrow$ Failure

Calculated like that, it gives a good understanding of the learners' success, and by derivation of the MOOC itself. It can be evaluated anytime during the course to observe progression or also regarding a particular track if the MOOC propose different ones.

5.3 Dropout rates

The dropout of a participant will be established when no active behavior has been detected on a given period. To be relevant, it must be defined multiple dropout rates generally corresponding to the opposite of the initial rates. Therefore, we introduce the rate of non-participation and the rate of non-commitment. We also distinguish:

Global dropout rate: this rate is calculated on the basis of learners, that is to say, the participants having expressed an intention. This is the percentage of learners who do not engage (or no more engage) any active behavior.

Effective dropout rate: this rate is calculated on the basis of active learners, that is to say learners engaged in a behavior. This is the percentage of active learners who do not engage (or no more engage) any active behavior.

5.4 The numbers matter as much as the rates

Lukes also raises an interesting point: the magnitude (LUKEŠ, 2012). Although a high percentage of participants drop out, it will always have a greater impact than a traditional university course. Should a teacher and his institution be satisfied if they can certify 1,000 students even if it is only a small part of all the registrations? We think so. The numbers are therefore as important as the rates of learners who complete de course.

6 Application to the MOOC IBPM

The course "Introduction to Business Process Mapping (IBPM)" was the first MOOC experiment at the University Jean Moulin (Lyon – France). It was an opportunity to apply and test a part of the proposed classification model. Relevant dashboards were built for driving the progression. We also used these indicators to analyse the course as a whole.

The course offers 3 tracks, corresponding to three choices of intention for the learner:

1- the *"open track"* where the learner can follow the learning path he wishes;
2- the *"knowledge track"* where the learner aims to achieve a level 1 certification and is committed to complete a sequence of 4 MCQ with a minimum score of 60%;
3- the *"skills track"* where the learner aims to achieve a level 2 certification and is committed to complete a sequence of 4 MCQ and achieve a group project.

The first track corresponds to all types of custom intentions. The next two concern conceptualized intentions (defined by teachers with a clearly identified expected behaviour).

We met some limitations in our experiment. Indeed, during the 2015 iteration, the hosting platform of the course[1] did not offer access to many analytical data. Thus, some data are estimations and not statistical evaluations. For the 2016 iteration, we will be able to cross more information and thus to elaborate quantitatively and qualitatively more relevant results. Here are the results of the analysis for the entire course and especially for the *"knowledge track"*.

There were 7436 *registered* (academic engagement). There is a 50% estimated *participation rate*. This is an estimation based on the activity observed in week 0.

There were 2442 *learners* engaged in the *"knowledge track"*, which means people who have explicitly expressed the intention to commit (conative engagement). This corresponds to 1/3 of the registered and 2/3 of the participants.

1350 learners had an *active behaviour*, by making at least one mandatory MCQ. Therefore, we had at the beginning an *effective commitment rate* of 55%.

Table 1 shows the change in *dropout rates* over the various activities. At the end of the MOOC, 1042 people completed the 4 MCQ. 1001 people obtained the expected minimum score for the certificate that makes a *completion rate* of 96%.

Using these figures, we can especially conclude:

1- The conative commitment is not enough. It is the behavioural commitment which is actually a predictor of persistence.
2- The dropout rate evolves less as the MCQ are performed. Once engaged in the first MCQ, the chances to complete the course are very strong.
3- The failure rate is very low (4%). Participants who are fully committed in the 4 MCQ succeed at 96%.

[1] French Platform – FUN https://www.france-universite-numerique-mooc.fr/

Table 1: Drop-out rates through time (t)

Behavior	Drop-in		Drop-out		Δ
	Nb	%	Nb	%	(t vs t-1)
Commitment (t0)	2442	-	-	-	-
MCQ 1 (t1)	1350	55%	1092	45%	1092
MCQ 2 (t2)	1150	47%	1292	53%	200
MCQ 3 (t3)	1065	44%	1377	56%	85
MCQ 4 (t4)	1042	43%	1400	57%	23

In addition, we analysed that 75% of active learners' dropout concerns learners who didn't have the good results to project the award of the certificate. Dropout may therefore be explained by the fact that the goals were no longer achievable.

7 Conclusion

We have presented in this paper a work of exploration and reasoning. We aim of proposing a framework including definitions and models to understand, interpret and appropriately measure the completion and dropout in MOOCs. Note that it is also interesting to refine this assessment using user-centric data, including aspects of satisfaction. We do not pretend to have fully and definitively answered all the issues related to this phenomenon. However, we hope that the result of this work (in-progress) suggests a consistent set of tools for a global understanding of dropout and completion in MOOCs, and can thus serve as a basis for research or practical framework. The ultimate goal would be to use these results to improve instructional design and propose a better learning experience by individualizing massification.

We hope to have contributed to the current and future research and participated in the growth of MOOCs, which, if they do not always constitute an innovative educational concept, appear as a practice full of interesting perspectives. This constitutes our first attempt in the educational research field so we are open to any inputs, feedback and even partnerships.

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eMOOCs for Personalised Online Learning: A Diversity Perspective

Tanja JADIN & Martina GAISCH

University of Applied Sciences Upper Austria,
School of Informatics, Communications & Media, Hagenberg,
{tanja.jadin, martina.gaisch}@fh-hagenberg.at

Abstract

Since the introduction of MOOCs, most scholarly debate has focused on xMOOCs, cMOOCs, and more recently, also on eMOOCs where personalised learning takes centre stage. It is argued that a micro level approach to culture is needed that incorporates diversity aspects that not only include demographic aspects but, more importantly, also takes account of cognitive factors. By adopting a holistic diversity lens, it is sought to benefit from culturally diverse participants and include their otherness as a resource for learning. For these purposes, an innovative didactical design is required, one that foregrounds personalised, student-centred and collaborative learning where the role of the facilitators is clearly defined. In line with previous research in this field, this paper seeks to further elaborate on a didactical concept of enhanced MOOCs (eMOOCs), especially in the light of diversity and trialogical learning aspects.

Keywords

eMOOC, diversity, trialogical learning, collaborative learning, personalised learning

1 Introduction

This paper seeks to elaborate on the eMOOC concept brought forward by JADIN & GAISCH (2014; 2015), especially in view of a diversity concept that is not only used as a construct where affirmative action and anti-discriminatory measures are highlighted, but in view of a reconstruction of this complex term that takes positive and appreciative handling of diversity into account. In light of these challenges, it is attempted to show how a reconceptualisation of established didactical frames can be beneficial and why the idea of trialogical learning may be a promising avenue to pursue. In this paper, it is argued that in view of these substantial transformations, a fresh approach towards didactical designs of MOOCs needs to be considered. Such a stance, then, requires a broader and more contextualised view of the MOOCversity and of all the factors that shape current online learning scenarios.

2 Underlying Rationale

As previously outlined, there are a number of reasons that speaks in favour of a reconceptualisation of MOOCs and their didactic design as well as the need to engage in more personalised learning. Such a shift places greater emphasis on quality rather than quantity and foregrounds intensified interaction with the facilitator that need to go well "beyond group boundaries, not only in terms of societal cultures but also with regard to professions, class or gender" (GAISCH, 2014, p. 50).

One of the most prominent features that justify such a shift can be found in diversity research (KLAMMER & GANSEUER, 2013; PAUSER, 2011) where the implementation of demographic diversity has become a socio-political dictate in the (Western) world of higher education.

2.1 Demographic Diversity

In most higher education institutions, it is common knowledge that the so-called big 6 (age, cultural or ethnic origins, socio-economic status, gender, ability and sexual orientation (CARBERY & CROSS, 2003, p. 104) need to be taken into account when it comes to diversity management. LODEN & ROSENER (1991, p. 18) referred to these core or primary dimensions along the lines of innate differences or differences that have an essential impact on a person's socialisation.

When taking a cultural perspective, it becomes obvious that a macro approach will not satisfy the needs of lingua-culturally diverse individuals that have differing learning experiences and expectations, educational and organisational backgrounds and professional expertise. Hence, it is argued that the path to be followed is a micro approach to culture – one in which social actors create cultures on the basis of their emic cultural understanding (see GAISCH & JADIN, 2015, p. 124).

2.2 Cognitive Diversity

Cognitive diversity embraces differences in perceptual processes and their interpretations, information processing, problem-solving strategies and predictive models. Empirical evidence has shown that demographic diversity has the potential to reduce social cohesion while at the same time increasing the probability of socio-emotional conflict (DE DREU & VAN VIANEN, 2001; JEHN et al., 1999) while cognitive diversity may result in more informed decisions and a higher level of teamwork effectivity (e.g., BRODBECK et al., 2002).

When drawing on these resources, heterogeneous participant groups were found to have both enlarged problem solving skills and the competency to find more creative and more innovative solutions (VAN KNIPPENBERG & SCHIPPERS, 2007; BELL et al., 2011). In view of these findings, there is little doubt that a didactical design that aims at incorporating as many participant voices as possible is not only desirable, but a necessary step, especially when considering Bologna aims such as life-long learning and global citizenship. Further, the concept of cognitive diversity strengthens the role of the MOOC facilitators who not only need to be aware of diversity in the web, but pro-actively seek to profit from cognitive differences to ultimately come to more informed decisions and better solutions.

2.3 Trialogical Learning

Also learning differences and preferences of online participants play a crucial role when designing e-learning scenarios. This incorporates previous knowledge bases and expertise reversal effects which means that instructional design in multimedia learning for experts can be detrimental when designed for novices (see KALYUGA, AYRES, CHANDLER & SWELLER, 2003). SCHULMEISTER (2004) argues in favour of open-learning situations with strong elements of problem-oriented and inquiry-based learning, and learning with cognitive tools.

Trialogical learning stresses collaborative knowledge building with a so-called shared artifact or shared object. PAAVOLA & HAKKARAINEN (2005) argue that learning can be divided into three metaphors, namely knowledge acquisition, knowledge participation and knowledge creation. The acquisition metaphor rooted in cognitive psychology and constructivism highlights individually constructed knowledge. Knowledge acquisition centers propositional learning and conceptual knowledge structures while knowledge participation focuses on the "interactive process of participating in various cultural practices and shared learning activities that structure and shape cognitive activity in many ways, rather than something that happens inside individuals' minds" (PAAVOLA & HAKKARAINEN, 2005, p. 538). In addition, participation means knowledge construction in collaborative setting, negotiation of meaning and enculturation in communities. As a consequence of ever-increasing networks, the third metaphor emphasizes innovative knowledge communities. Following this argumentative line, knowledge acquisition can be seen as a monological view of human cognition while knowledge participation can be regarded as a dialogical perspective that stresses interaction with other people, cultures and the surrounding environment. The knowledge creation metaphor is assigned to the trialogical view of learning including the collaborative development of mediating artifact and shared objects (PAAVOLA & HAKKARAINEN, 2005).

Arguably, these metaphors are not clearly distinctive. PAAVOLA & HAKKARAINEN (2009, p. 83) argue in line of CSCL research that although meaning making and dialogues play an important role for collaborative learning, it should be supplemented with "approaches emphasizing joint work with artefacts and practices". The main idea of trialogical learning is the collaborative development of concrete objects in form of

ideas, concepts, knowledge artefacts or practices which go well beyond simple participation aspects. Thus, the object has a central position in collaborative learning and is developed through several stages to ensure innovation and novelty with the aim to create something new (PAAVOLA & HAKKARAINEN, 2009).

For pedagogical approaches and the usage of technology under trialogical perspectives, six design principles were developed (PAAVOLA, LAKKALA, MUUKKONEN, KOSONEN & KARLGREN, 2011). While the first is intended to look at the organisation of activities around a shared object, the second seeks to support integration of personal and collective agency and work through developing shared objects. The third design principle stresses development and creativity in working on shared objects through transformations and reflection, and number four aims at fostering long-term processes of knowledge advancement with shared objects (artefacts and practices). While the fifth design principle seeks to promote cross-fertilisation of various knowledge practices and artefacts across communities and institutions, number six places particular focus on flexible tools for developing artefacts and practices (see PAAVOLA et al., 2011).

3 Review of Instructional Design Approaches

An extensive desktop research[1] on enhanced personalised and collaborative learning was undertaken to outline the principles of instructional design approaches. These approaches includes didactical approaches for online learning and learning considering individual differences – all in line with the constructivist learning paradigm.

Taking as a base understanding that constructivist learning environments are student-centered and collaborative, KARAGIORGI & SYMEOU (2005) propose to offer authentic tasks to the learners, supported by teacher scaffolding, facilitation of reflective thinking and the capacity of taking multiple perspectives. In addition, such learning

[1] Since an in-depth elaboration would be beyond the scope of the present paper, it is intended to present the synthesis of the desktop research and the role of the facilitator in an upcoming contribution.

environments were found to include "tools to enhance communication [...], modelling or problem solving by experts in a context domain and mentoring relationships to guide learning" (KARAGIORGI & SYMEOU, 2005, p. 19). This is also in line with the approach adopted by Johnson & Aragon (2002) since they regard contextual learning as a way of using appropriate case studies with the engagement of external partners, providing content in multiple forms, peer review, feedback and reflection.

Further design principles for MOOCs were outlined by GUARDIA, MAINA & SANGRA (2013) who placed particular focus on fostering a set of competences (competence-based design approach). Also "learner empowerment" is considered a goal for MOOC design where participants are directed towards learning in a self-directed and personalized way based on their individual goals. Such an approach is accompanied by a learning plan and clear orientation (third principle), in form of a study plan, detailed description of tasks and sub-tasks and estimated times to accomplish the assignment, followed by elaborated criteria that go beyond the offer of multiple choice tests after video lectures (GUÀRDIA, MAINA & SANGRÀ, 2013). Their fourth design principle is about collaborative learning, i.e. providing netiquettes for participation and discussion, tools like a discussion forum and tasks with the need for collaboration. In addition to this principle, social networking should be included with exchange and social interaction in mind. Peer assistance (6^{th} principle) and assessment and peer feedback (9^{th} principle) are intended to foster the dialogue aspect of learning and co-creation and co-construction of knowledge. By doing so, helpful guidance is required on how to give feedback and criteria for assessment. In this regard, it is evident to think about quality criteria for knowledge creation and generation (7^{th} principle) and to distinguish between different learning activities (e.g. brainstorming vs. final integrating activities). Different interest groups (8^{th} principle) based "on interests, culture, geography, language, or some other attribute" should also be developed. Each member of a group should be assigned a specific role to support team work and create a social learning environment for exchange. As a conclusion, media-technology-enhanced learning (10^{th} principle) should be encouraged through a variety of media and tools but also through guidance to and through these tools.

Drawing on all those principles, the following section seeks to provide a potential learning and teaching scenario for an enhanced MOOC.

4 Instructional Design for eMOOCs

The instructional design brought forward in this contribution shall allow for a more diversified online learning scenario with eMOOC and consists of eight specifically defined phases. It needs to be stated here that our view of an enhanced MOOC is not a restrictive one and can hence incorporate components of both xMOOC and/or cMOOC design principles. For a combination of all elements, see GAISCH & JADIN (2015).

In the following, a short sketch is provided of how such an eMOOC design may look like (see figure 1). The overlapping cycles symbolize the connection to the other stages and also the interrelation to the collaborative development of the shared object, e.g. in the collaboration phases and in the peer review phases the shared object is most foregrounded.

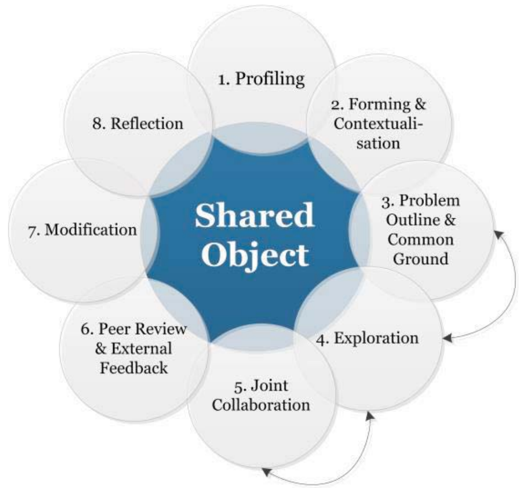

Figure 1: Didactical Framework for an eMOOC (authors' own illustration)

As can be seen in figure 1, the unit of analysis or -in in terms of trialogical learning- the shared object is placed in the centre of interest.

The eMOOC cycle – as it is conceived by the authors – should start with the so-called **profiling** phase where individual (learning) preferences and previous knowledge bases are taken into account which then impact the composition of the potential teams. At this stage, learners complete a profile to get deeper understanding of their expected learning outcomes and learning goals but also to position themselves within the eMOOC as potential learning partners for specific team constellations.

This requires a software-based application designed to enable participants to generate tailor-made profiles, to voice individual learning goals, make learning plans (GUÀRDIA, MAINA & SANGRÀ, 2013) and to document and reflect on individual learning processes. This self-reflective entry enables learners to make choices based on their prior knowledge and misconceptions, engage with authentic tasks and support reflective processes (see principles by KARAGIORGI & SYMEOU, 2005; JOHNSON & ARAGON, 2002). It is expected that the completion of a learner's profile can greatly enhance both the learning outcome and the motivation level.

The second cycle that is introduced here is the so-called **forming and contextualization phase** in which the team formation is not just randomly made, but is based on the previous profiling phase where the participant's voice is particularly valuable to set up an online collaboration environment in which all learners can thrive. During contextualization, learners are called upon to get individually familiarised with the contents of a course based on their state of knowledge, level of expertise, and interests. For this reason, advanced organisers and structured overviews are incorporated as an integral part of an eMOOC (JONASSEN & GRABOWSKY, 1993; JOHNSON & ARAGON, 2003), so that learners may gain a quick overview of the contents of different instructive units and choose for themselves which sections they would like to examine in more detail. Such a contextualisation allows the participants of an eMOOC to relate the goals of instruction to their individual needs and engage in instructive units that help advance their knowledge base. At this stage, it is crucial to meet the learner's needs by offering differing learning paths and scaffolding. Hence, it becomes clear that eMOOC facilitators require sound knowledge of culturally sensitive learning strategies as well as collaborative tools (whiteboard, wiki, google docs, TeamViewer, skype, Google hangouts, etc.) that are all geared towards the collaboration on a shared object (e.g. PAAVOLA & HAKKARAINEN, 2009).

In the next phase the **problem is outlined** and presented to the learners. Since the definition of a problem can be manifold – it can be a task, a product, a shared artifact – it is vital to assess the relevance and scope of the assignment.

In a subsequent step, learners exchange institutional and personalised experiences, and best practices examples and outline their perception of the problem within their allocated group. During this phase, learners seek to find **common ground** while at the same time encourage individualised perspectives to unfold.

Based on the previous steps taken by the learners, the **exploration** phase is intended to first individually engage in the learning activities by drawing on cognitive tools and gain a broad overview of the presented problem. In this phase, the role of the facilitators is critical since they need to adapt their teaching strategies and scaffolding to the individually perceived needs of the participants. Such an approach is much in line with the recommendations provided by the instructional design principles where content exploration should be possible from a multitude of perspectives (KARAGIORGI & SYMEOU, 2005).

The next stage aims at meeting the requirements of all instructional design approaches which go hand in hand with the constructivism learning paradigm. In this phase – the so-called **joint collaboration** – learners are required to cooperate and engage in joint task completions. In doing so, the participants need to be accompanied by proficient online coaching, most preferably by culturally sensitive facilitators. In this second collaborative phase, learners are intended to work in primarily small groups of maximum 6 persons for the sake of convenience. This learner-centred instructional process foregrounds student empowerment and equal opportunity for success in which a shared object can take a number of forms, be it an idea, a concept or a prototype. By the end of this phase, group members should reach consensus regarding the developed prototype of a shared object which occurs under continuous reflections within the team and support of facilitator. In accordance with JOHNSON & ARAGON (2002), such virtual learning teams are geared towards the simulation of reality by using appropriate case studies and integrating collaborative projects with schools, businesses, or other organisations.

In the **peer review and external feedback** phase, learners from different groups present the artefacts to each other and, by doing so, are encouraged to engage in a reflective process about the prototype of the shared object which had been previously created through collaborative practices (GUÀRDIA, MAINA & SANGRÀ, 2013; JOHNSON & ARAGON, 2003). In respect of cognitive diversity it is also sought to draw on external stakeholders that shall contribute with their technical expertise to further refine the outcome. Both the reviews made by peers from other groups and the external feedback serve as a basis for further improvement. This phase is intended to engage participants in activities for higher order thinking and critical reflection.

In the **modification phase**, the review and suggestions for modifications provided by peers and facilitators is incorporated to further improve the shared object. The focus is placed on cooperative and collaborative learning activities which result in a jointly produced shared object. This cycle is closely observed and efficiently accompanied by the facilitator who also acts as mediator and provides support with regard to differing communication, response, processing, and social interaction styles. To the same extent as for cMOOCs, the artifacts are to be published and shared through diverse social media channels.

The last phase is defined as the **reflection** cycle where individual and collaborative reflection is encouraged to support individual paths of lifelong learning (KARAGIORGI & SYMEOU, 2005; JOHNSON & ARAGON, 2002). In line with the evaluation principle brought forward by KARAGIORGI & SYMEOU (2005) learners are required to reflect on their own learning expectations and learning goals (see profiling). As to collaborative reflection, it is made both in the in-group forum (where only the members of the group may reflect on, e.g., the developed shared object, etc.), and in the course forum (where all the eMOOC participants may reflect on the course, facilitation, expectations, etc.). At the end of the learning process, further work can be facilitated through social media activities (GUÀRDIA, MAINA & SANGRÀ, 2013). In doing so, participant's learning perspectives can be enhanced and one of the key goals of Bologna – lifelong learning – can be achieved on a more practical level.

5 Conclusion

This paper has argued that in view of numerous diversity aspects of online learners, a fresh instructional design is required, one that goes beyond traditional principles of

MOOC teaching. By considering individual characteristics, differing previous knowledge bases and design principles that are based on trialogical learning, it is sought to take account of both demographic and cognitive diversity aspects and hence reach online learners on a more personalised level.

For these purposes, an instructional design for an enhanced MOOC scenario was provided consisting of eight distinctive stages in which the facilitator and his/her capacity to embrace an interdisciplinary and multicultural learning group constitute the key ingredient for a successful and personalized learning environment. In a next step it is intended that the eight stages sketched as the underlying didactic framework on an eMOOC are going to be tested with a culturally sensitive facilitator.

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Driving Learner Engagement and Completion within MOOCs: A Case for Structured Learning Support

Syed Munib HADI & Rebecca RAWSON

University of Derby, {s.hadi, r.rawson1}@derby.ac.uk

Abstract

Massive Open Online Courses (MOOCs) are open to all, regardless of learners' age, educational level, experience, or demography. MOOCs allow enrolled learners a flexible learning environment in which they can study at their own pace without one to one support. Yet, this may result in many learners feeling unsupported and disengaged. Although peer support mechanisms have been tried in a MOOC context, this paper aims to consider whether replicating a degree of structured learning support as provided within conventional Higher Education courses can improve engagement and completion rates among MOOC learners. This paper will draw conclusions based on evidence from two MOOCs, as well as consider limitations and suggestions for further improvement.

Keywords

MOOC, Support, Pedagogies, C ompletion, Engagement

1 Introduction

Massive Open Online Courses (MOOCs) are known for being accessible and open to any learner worldwide for enrolment that is often free of charge, regardless of learners' age, previous experience, and level of education or demography. The 'massive' and 'open' characteristics of a MOOC allow an unlimited number of learners to take part in courses at their own pace, providing them with a huge amount of freedom over what to learn and when to learn. Yet, due to the variations in learners' levels of maturity and experience (GUÀRDIA, MAINA & SANGRÀ, 2013), MOOCs are often perceived as failing to maximise the potential of learners (BALI, 2014) which has been reflected in reported completion rates. MOOC engagement rates are also considered to be very low; on average, only 54 to 56 per cent of enrolled learners actually view the course and between 3 and 7 per cent of enrolled learners and around 5 to 10 per cent of active learners go on to complete the course (GILLANI & EYNON, 2014; HO, REICH, NESTERKO, SEATON, MULLANEY, WALDO & CHUANG, 2014; JORDAN, 2014). The low engagement and high dropout rates have been attributed to many factors including lack of time, decreasing levels of motivation, feelings of isolation, insufficient background knowledge and, sometimes, hidden costs (KHALIL & EBNER, 2014).

What is interesting is that the reasons for course dropouts are attributed to the learner as opposed to the content or design of the course. Furthermore, it leads one to question why there is such a heavy focus on completion and dropout rates within MOOCs. BALI (2014) has highlighted that the key focus should be on meaningful learning taking place. If MOOCs are focused on learning, rather than on completion statistics, then they provide the opportunity to enrich both learner and teaching experience (BALI, 2014).

In order to enrich learner experience and provide meaningful learning, researchers have suggested empowering learners through collaborative activities and ensuring that teachers are present within course design (GUÀRDIA, MAINA & SANGRÀ, 2013). Collaborative discussions where contributions are awarded and awareness is raised strengthen the learning process by providing richer perspectives for reflective observation (GRÜNEWALD, MEINEL, TOTSCHING & WILLEMS, 2013).

As well as providing forums for collaborative discussions and ensuring teachers are present, another way to encourage meaningful learning is through the use of structured support. As generic person to person support is not possible given the key traits of a MOOC, the MOOCs referred to in this paper aim to consider whether providing structured support to learners within a MOOC can facilitate an enriched and meaningful learning experience for all.

2 Research Aims

This paper aims to consider whether providing structured support to learners within a MOOC can facilitate an enriched and meaningful learning experience and whether the learning that takes place is in sync with the order of support provided. One of the key aims is to see if providing structured support also increases the engagement and completion rates. This will be based on quantitative data such as engagement and completion rates and qualitative data such as anonymised feedback from learner feedback surveys from two MOOCs launched by the University of Derby, hosted on the Canvas platform.

A total of 2353 learners enrolled on to the first MOOC which was in the subject area of digital literacy. For the second MOOC, which was on dementia, a total of 3,070 learners enrolled. According to survey responses, both courses reached a global audience.

Both MOOCs contained six units each but were open to learners for seven weeks. This allowed for the completion of one unit per week, plus an extra week to allow for learners to complete any outstanding tasks if necessary. Each unit utilised a sequential week by week support structure, which is outlined in the following section.

3 MOOC Support Structure

The courses ran in the subject areas of digital literacy and dementia, and utilised week-by-week structured support with the aim of enhancing the learning process by providing a guided learning experience in addition to the ability of self-paced study.

The structured support encompassed the following:

- Every Monday, learners received an announcement from the lead academic within their MOOC, which introduced what would be covered in the unit for that week, and what learners would be required to do in order to complete the unit. The announcement included a link to the unit to allow for easy access.
- On the homepage for each course, the unit for the corresponding week of the MOOC was highlighted to allow learners to see what stage the MOOC was at. This allowed learners to quickly navigate the course and access the current unit for which structured support was provided. (Refer to Figure 1).

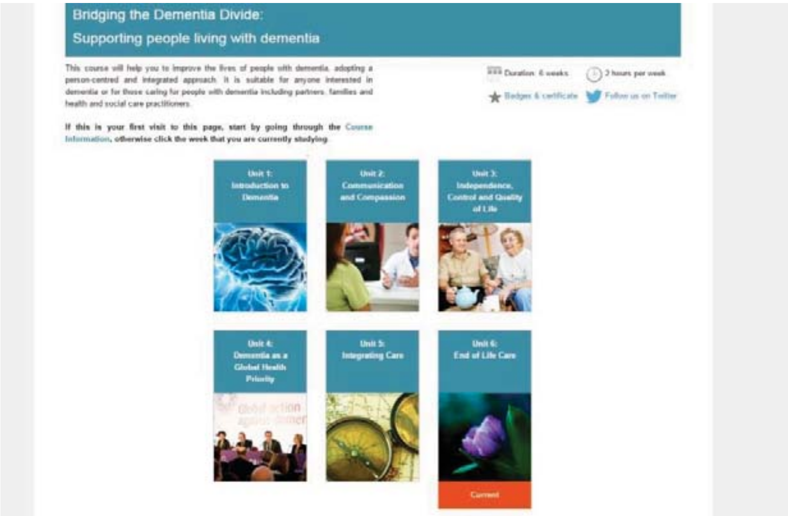

Figure 1: The course homepage for the dementia MOOC on Canvas, with unit 6 highlighted as the current unit.

- Each unit featured a similar structure and contained a number of content pages and a minimum of one activity (discussion forum, reflection post and a scored quiz) which learners were required to view and complete in order to complete the unit and earn the unit's digital badge. The lead academic for each course

was present within the discussion forums in order to answer any questions from learners, reinforce key learning points, and indicate where to find further resources.

- On successful completion of each unit, learners were awarded a digital badge recognising the skills that had been learned within that particular unit. Both MOOCs utilised this award system on a unit by unit basis in order to promote the focus on meaningful learning and allow learners to complete the sections of the course that interests them, rather than focusing on course completion and providing a singular award at the end of the course.
- In addition to the Monday announcement, a course announcement was sent every Friday which aimed to wrap up the learning for each unit. The purpose of the Friday announcements was to remind learners to check that they had completed all the required activities for the unit in order to earn and download the badge. The Friday announcement also invited learners to attend a live online webinar, delivered by the lead academic, which aimed to wind up the week's activities. This was known as the 'Friday wind up'.
- All units featured the Friday wind up. The Friday wind up was a live streaming of the lead academic for the MOOC concluding the topic for that week and answering questions that learners may have had. The wind up brought the current unit to an end and prepared learners for the unit that would follow in the next week. For those learners who weren't able to view the live video, a recording was placed on the page for later viewing.
- In addition to the weekly support structure, both MOOCs featured a help discussion forum where they could post any queries or issues that they had with the course. The help forum was monitored by the lead academic, course leaders and course facilitators daily to ensure that issues were resolved.
- As well as the help forum, learners were provided with an email address which had been set up specifically for each MOOC to serve as a support mechanism. This directed all emails to the project teams for each MOOC; incoming emails were filtered to allow for the right person to respond. This was to ensure efficient responses to learners to avoid decreasing levels of motivation.

- Both courses had a well-defined course orientation section that familiarised learners with the learning environment. This also highlighted how learners can monitor their progress.

4 Results and Findings

4.1 Unit completion in order of structured support

The sequential unit by unit support had a clear impact on when in the course learners completed each unit. The units were designed to run in a consecutive order, each lasting a week commencing on Monday and concluding on the Friday. Figures 2 and 3 show the number of learners that completed the units in each week of the course.

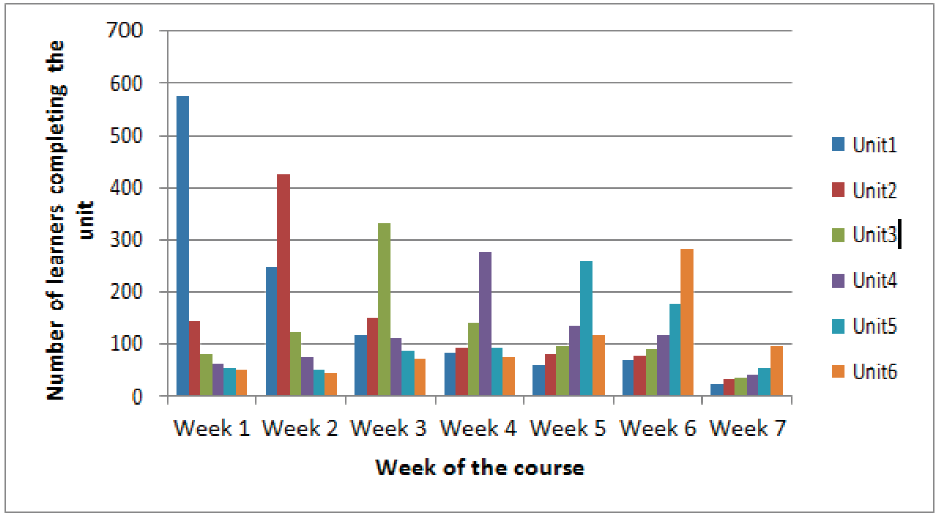

Figure 2: Frequency of unit completions per week for the MOOC on dementia.

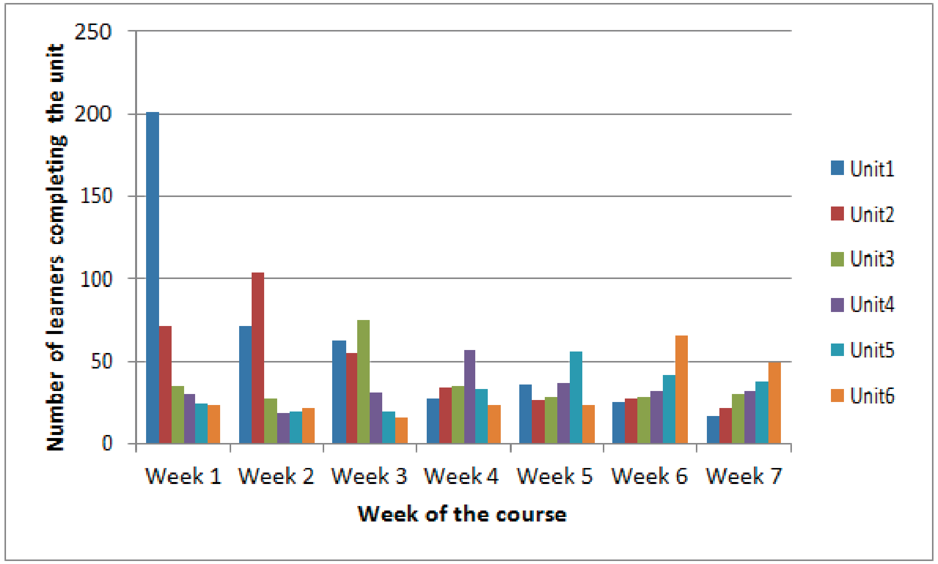

Figure 3: Frequency of unit completions per week for the MOOC on digital literacy.

It's important to note that all units were unlocked at all stages of the course, giving learners the opportunity to study as many or as few units, in whatever order that they wished. Yet, Figures 2 and 3 show that the highest number of units completed per week were those for which there was support provided. This suggests that having a well-designed support structure encourages learners to engage with the course alongside their fellow learners, thus resulting in an enriched and meaningful learning experience taking place. Although, from the figures we can see a clear drop off of learners, there is still a large group who remained motivated and engaged with the learning alongside the course support until the end. Even with the dropout we can see clearly that the unit for which the support is provided each week has the highest completion rate in that week.

There were also on average twice as many posts within discussion forums in the supported unit than any of the others for both dementia (2.22 times as many) and digital literacy (2.02 times as many).

4.2 Structured support impact on encouraging engagement and increasing completion rates

The course support, such as the help forum and navigational home page within the course, not only had a positive impact on the number of learners that completed the units, but also impacted on the number of enrolled learners who engaged with, and went on to complete, the course. Our first indication of this is based on the number of active learners within both courses. Active learners are calculated based on the number of enrolled learners who are active, i.e. viewing at least one page of the course.

Table 1: Number of enrolled and active learners within the two MOOCs, in comparison with reported averages for edX and Coursera

	Digital Literacy	Dementia	edX (Ho et al., 2014)	Coursera (Gillani & Eynon, 2014)
Enrolled learners	2353	3070	841,687	87,000
Active learners	1407	2077	469,702	47,000
% of active learners	59.80%	67.65%	55.80%	54%

Table 1 shows that the percentage of enrolled learners who were active at some point within the course is higher than averages reported for MOOCs hosted by edX and Coursera (GILLANI & EYNON, 2014; HO et al., 2014), an early indication of the positive impact gained from the course support. As well as active learners, we propose that another type of learner to consider is the 'engaged learner'. By this we mean the number of learners who contributed to the course, through taking part in a minimum of one discussion forum.

Table 2: The number of learners who have posted in at least one discussion forum.

	Digital Literacy	Dementia	edX (Ho et al., 2014)	Coursera (Gillani & Eynon, 2014)
Posted in discussions	522	1284	66,844	4337
% of enrolled learners	20.45%	41.82%	7.94%	5%
% of active learners	37.10%	61.82%	14.23%	9%

Table 2 shows that more than twice as many learners were engaged with our MOOCs than learners on the edX MOOCs and Coursera MOOCs as reported by GILLANI & EYNON (2014) and HO and colleagues (2014). This demonstrates that our use of structured support, which aimed to boost meaningful learning within a modular approach, encouraged learner engagement. As expected, using structured support replicating that of higher education also impacted the completion rates. Completion rates are calculated based on the number of enrolled learners and active learners who complete all six units within the course. Completion rates for both MOOCs were higher than reported averages for both enrolled learners and active learners.

Table 3: Course completion rates for enrolled and active learners within the two MOOCs, in comparison with previously reported averages

	Digital Literacy	Dementia	edX (Ho et al., 2014)	Coursera (Gillani & Eynon, 2014)
Completion rate (Enrolled)	9.35%	24.01%	5%	3%
Completion rate (Active)	15.64%	35.48%	8%	5%

As presented, the number of learners who are active and engaged within the course, and completing the course, is higher than the averages that have been previously reported for edX, Coursera, MITx and Udacity MOOCs (GILLANI &EYNON, 2014; HO et al., 2014; JORDAN, 2014). Thus, our argument is that the provision of consistent and well-structured support provided to learners throughout the course plays a significant role in increasing completion, engagement and activity rates within a MOOC.

Course surveys have further captured support for this argument, with learners stating the following:

"I'm always interested in learning, and the way this was structured made me motivated until the end."[1]

"The course was very well organised and all the units were very interesting."[2]

"It was a wonderful learning experience by digital me. Thanks to the wonderful instructors and I would like to salute how the course program was organised, i.e.; quizzes, study notes, discussions and reflections. It really helps one remember and recall well everything that was taught. Thanks again for the amazing course and learning opportunity."[3]

"I really am enjoying this MOOC. It has been very well guided and the learner journey well signposted with a great deal of encouragement. Like all MOOCs, there is the danger of disengaging – and this time I think much has been done to tackle that, with good navigation, clear statements of what has been achieved and most importantly, fantastic pedagogical direction."[4]

5 Conclusion

MOOCs are considered 'massive' and 'open' due to being able to enrol an unlimited number of learners of any age, experience and time zone. This can lead to learners feeling isolated and unsupported which can result in decreasing levels of motivation (KHALIL & EBNER, 2014). The findings from this paper suggest that utilising consistent and structured support within a MOOC results in increased levels of engagement and completion and also causes more meaningful and enriched levels of learning to occur.

The research, however, is not without its limitations. Qualitative and quantitative data suggest that the structured support was not the only reason behind the higher level of activity along with higher engagement and completion rates among University of Derby MOOCs. Some of the learning design aspects of our courses, in particular the awarding of digital badges for individual units of the course, in which learners were required to contribute to all course forums and complete reflective elements had an effect on learner motivation and hence the engagement level. Current research focuses on a correlation between learners and low completion rates and more research needs to

[1] Comment from a learner enrolled on the MOOC on the subject of dementia.

[2] Comment from a learner enrolled on the MOOC on the subject of digital literacy.

[3] Comment from a learner enrolled on the MOOC on the subject of digital literacy.

[4] Comment from a learner enrolled on the MOOC on the subject of digital literacy.

be held on whether the current learning design and lack of support is also a contributing factor in low completion rates.

Future MOOCs should consider providing a structured learning journey along with the self-paced learning element to cater for learning styles of a diverse range of learners. Provision of a structured learning journey within a MOOC along with the option to learn at one's own pace also limits learners' disengagement and allows the replication of a traditional learning experience.

Providing a massive online course with open enrolment on a global scale is never going to be without its challenges. While many will compare the success of MOOCs based on completion rates, it is important to ensure that the learner is always at the centre of the course. MOOCs are still popular among learners, and by providing a consistent and structured supported learning journey, we can encourage a meaningful and enriched learning experience for all.

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New model for measuring MOOCs completion rates

Syed Munib HADI & Phillip GAGEN

University of Derby, {s.hadi, p.gagen}@derby.ac.uk

Abstract

MOOCS (Massive Open Online Courses) differ from typical Higher Education courses as they are open to everyone over the age of 13 regardless of learners' age, educational level, motivation, experience or demography. MOOC are heavily criticised for their attrition rates of between 90-95 percent. Numerous studies have highlighted that large number of MOOCs learners who don't complete the whole course do in fact access substantial amount of content. This highlights the different motivations MOOCS learners have. The traditional MOOCs criteria for completion is not suited to measuring this micro learning within MOOC. The paper aims to propose a new methodology for measuring learner achievement that would take account of the overall completion rates plus the micro learning that takes place within MOOCs.

Keywords

MOOC, Learners, completion rates, attrition rates, micro learning, MOOCs success

1 Introduction

The initial optimism about MOOCs transforming higher education provision has now moved to a degree of skepticism of their effectiveness with a particular focus on their high attrition rates.

Typical rates for learners who have logged into the platform at least once and then go on to complete the course is between 5 to 10 percent of active learners (GILLANI & EYNON, 2014; JORDAN, 2014; HO, REICH, NESTERKO, SEATON, MULLANEY, WALDO & CHUANG, 2014).

A typical HE learner is over 18 years old, already possess formal college based qualifications and is willing to dedicate a number of years of study to achieve a University qualification. As typically HE qualifications are fee paying courses which are recognised by employers, there is extra motivation for learners to complete these courses. The completion rate for the course in this context does makes sense as the course is restricted to a set audience who have a degree of commonality in terms of motivation and educational level deemed suited to study such a course. The admissions process in place also vets out learners who do not meet an eligibility criteria.

In terms of MOOCs, a learner can be 13 years old (or higher), with no formal qualifications and may have varied level of motivation for completing the course as well. Most MOOCs learners are also mostly interested in accessing part of the course to make themselves familiar with a topic. MOOCs are also predominantly free of charge and open to all which again limits the motivation. The traditional method of attrition rate to measure success does not take into account these learners and their varied levels of motivations.

To better understand the diversity of a typical MOOC learner. Let us look at the motivational factors, age group and educational level of the University of Derby's "Bridging the Dementia Divide: Supporting People Living with Dementia" MOOC.

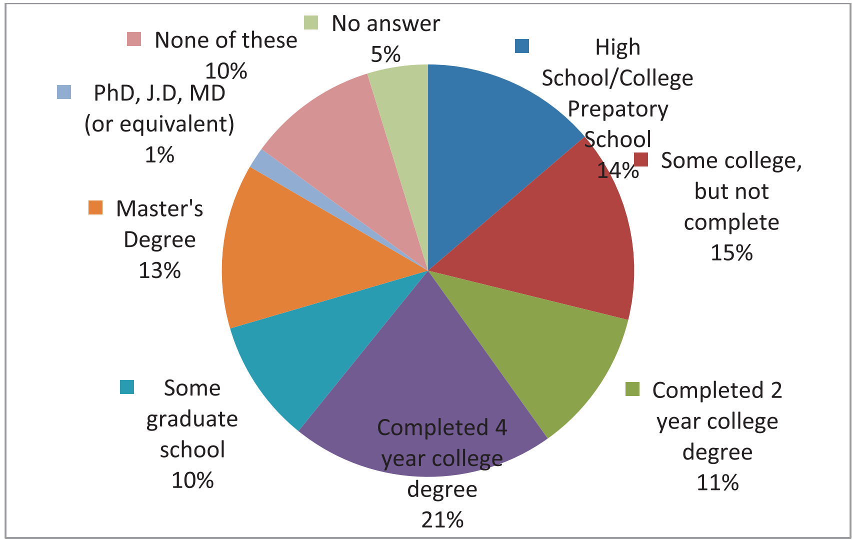

Figure 1: Welcome Survey Responses for Level of Education

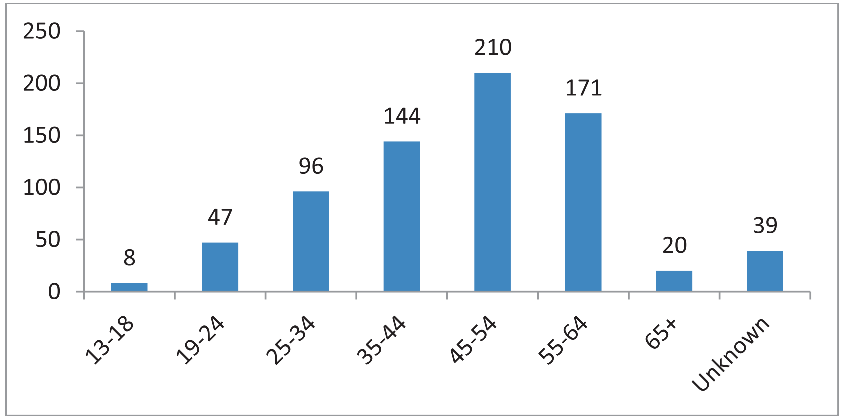

Figure 2: Welcome Survey Responses for Age (years)

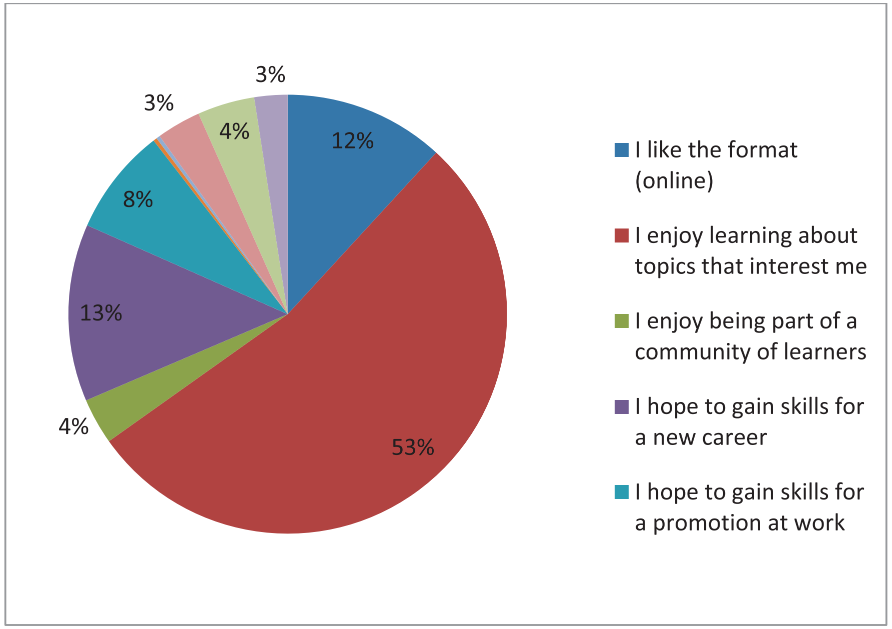

Figure 3: Welcome Survey Responses for Reasons for Taking the Course

Figures 1, 2 and 3 showcase that the typical MOOC learner is significantly different to a typical HE learner. This raises the questions that why are we applying traditional HE metrics to measure MOOCs?

As DEVLIN (2013) points out "[A]pplying the traditional metrics of higher education to MOOCs is entirely misleading. MOOCs are a very different kind of educational package, and they need different metrics – metrics we do not yet know how to construct."

Katy JORDON (2014) also concludes that "it is inappropriate to compare completion rates of MOOCs to those in traditional bricks-and mortar institution-based courses."

T. DARADOUMINS, R. BASSI, F. XHAFA & S. CABALLE (2013) also point out that "dropout statistics might not be representing the only reality of MOOC learners."

Previous case studies have highlighted that large number of non-completers do in fact access substantial amount of course content and that Course completion rates are misleading and counterproductive indicators of the impact and potential of open online courses (HO et al., 2014).

BALI (2014) has highlighted that the key focus for measuring MOOCs impact should be on meaningful learning taking place rather than completion rates.

The paper aims to propose a new model for measuring MOOCs impact that takes into account the meaningful learning taking place as well as the overall completion rates. The model proposed is based on the findings of the two MOOCS developed and delivered by the Academic Innovation Hub, at the University of Derby in 2015.

The MOOCS were titled "Digital.Me: Managing your Digital Self" (henceforth referred to in the short form Digital.Me) and "Bridging the Dementia Divide: Supporting People Living with Dementia" (henceforth referred to as Dementia).

Both MOOCs followed a modular approach to course design as recommended by LACKNER et al. (2015).

Both MOOC consisted of six units- each of which had its own clearly defined learning outcomes and assessment strategy and successful completion of the unit was rewarded with the award of a digital badge. This allowed the MOOC team to measure the micro learning that would otherwise not be captured through overall course completion rates.

The clearly defined learning outcomes associated with each digital badge also brought credibility and measurable learning outcomes.

2 Model for measuring MOOCs learning

The new model proposes two key metrics in addition to the typical overall MOOCs completion rate.

2.1 Percentage of Units Completed

The first metric as part of the proposed model is the percentage of units completed relative to the total number of units that can be completed by learners.

Overall course completion is achieved by a learner by successfully completing all units of the course. This allows the particular metric to measure the overall success of the course by not only counting the overall course completion but also take into account micro segmented learning patterns of the diverse group of learners within a MOOC.

There were six units within each MOOC, we have simply multiplied, the number of enrolled and active learners by six to determine the maximum number of units that can be completed by learners.

Total no of units that can be completed by learners = *No of Learners × No of units in a MOOC*

We then divided the number of units completed in each MOOC by the aforementioned figures to measure the MOOCs success rate (as proposed by our model) for enrolled and active learners. Enrolled Learner (EL) are learners who have signed up to the MOOCs while Active Learners (AL) are calculated based on the number of enrolled learners who are active, i.e. viewing at least one page of the course.

% of units completed units completed = *Total Number of Units Completed ÷ Total no of units that can be completed by learners × 100*

Table 1: MOOCs success rate (as proposed by our units completed metric) for enrolled (EL) and active learners (AL)

Courses	No of units	Total no of units that can be awarded to EL	Total no of units that can be awarded to AL	Total no of units awarded	% of units completed by EL	% of units completed by AL
Dementia	6	18420	124262	5429	29.47%	43.56%
Digital.Me	6	14118	8442	1731	12.26%	20.50%

2.2 Percentage of Learners achieving meaningful learning

The other key metric that we proposed as part of the new model is the percentage of who complete at least one unit. This would highlight the percentage of learners on a MOOC who have achieved some meaningful learning from the MOOC.

Table 2: The percentage of Enrolled (EL) and Active learners (AL) with a minimum of one completed unit

Courses	EL	AL	No of Learners with at least one completed unit	% of EL with at least one complet-ed unit	% of AL with at least one completed unit
Dementia	3070	2077	1201	39.12%	57.82%
Digital.Me	2353	1407	452	19.21%	32.13%

2.3 Standard completion rates for the MOOCs

Table 3: The completion rate for enrolled and active learners for both of the MOOCs

	Digi-tal.Me	Demen-tia	edX aver-age (Ho et al., 2014)	Coursera aver-age (Gillani & Eynon, 2014)	Various plat-forms average (Jordan, 2014)
Completion rate (Enrolled)	9.35%	24.01%	5%	3%	6.5%
Completion rate (Active)	15.64%	35.48%	8%	5%	10%

Although numerous studies (HO et al., 2014; DEVLIN, 2013) state that course completion rates are misleading and counterproductive indicators of the impact and potential of open online courses, the paper agrees with Katy JORDON (2014) that percentage of active learning in a course should not be the sole measurement and the overall completion rates should not be ignored entirely.

3 Advantages of the proposed model?

Both the MOOCs delivered by University of Derby reported significantly higher overall completion rate than those reported by GILLANI & EYNON (2014), JORDAN (2014), HO, REICH, NESTERKO, SEATON, MULLANEY, WALDO & CHUANG (2014). What is significant though is that the overall standard completion rate for the two MOOCs is still lower than the figures reported by the new proposed percentage of completed units metric.

This is because the new model also measures the meaningful learning Bali (2014) and substantial learning (HO et al., 2014) that is not recorded by the standard completion rate model.

The model recommends that instead of focus on overall completion rates MOOCs should focus on measuring meaning learning as suggested by BALI (2014).

Katy JORDON (2014) also points out that "defining completion as a percentage of active learners in courses is interesting and warrants further work".

The proposed model is a better set of metrics for measuring the MOOCs success as it not only takes into account overall completion rates but also the meaningful (micro) learning that takes places within a MOOC. It is very difficult to measure the impact and effectiveness of MOOC through a single metric as MOOCs similar to it diverse learners has a much wider impact that requires multiple metrics but as the predominant focus among the wider public has been on completion rates, the new model has proposed new metrics within that narrow constraints of course completion. The proposed model is devised keeping in mind of the recommendation of the previous research work about the need for newer metrics and models for measuring MOOCs success.

4 Conclusions

MOOCs delivery models and pedagogical styles are rapidly changing and the metrics with which MOOCs would be measured would evolve along with those views. The proposed model is trying to measure the MOOCs within the narrow constraints of completion rates with new suggested metrics.

Further work needs to be done to explore further metrics for measuring MOOCs impact not only in the narrow constraints of completion rates but on their social impact and also on their impact on opening up access to higher education for the masses. This would allow MOOCs to be measured against one of the primary objectives of MOOCs movement of social impact through Open Education.

Lack of access to data from MOOCs platforms and the varied definitions of learners and completion that are used to define completion rates makes it impossible to measure effectiveness of courses against each other. Adaptation of standard models and metrics is fundamental to overcoming this.

The paper recommends that MOOCs course design need to follow modular approach LACKNER et al. (2015) to make it appealing to a diverse range of learners with different motivational levels and interests. This would allow MOOCs to offer micro learning opportunities that can be measured as well.

The individual units of the course should also have clearly defined learning outcomes to provide credibility and meaningful learning. The study finds it hard to justify defining meaningful or substantial learning with just access of MOOCs pages as advocated in previous studies as clear learning outcomes cannot be systematically associated with random access of pages within MOOC. The time spent on viewing pages is also not a good measure of meaningful learning as it is open to manipulation based on how internet browsers calculate time spent on webpages.

Implementation of the proposed model for measuring MOOC success and meaningful learning within MOOC is dependent on implementing a modular approach to MOOC learning design with clear learning outcomes associated with each unit within the MOOC as well as the overall course.

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Enhancing MOOC Videos: Design and Production Strategies

Alexandre GUEDES DA SILVA[1], Ana MOURA SANTOS[2], Fernando ALBUQUERQUE COSTA[3] & Joana VIANA[3]

[1] **University Lusíada of Lisbon, FCHS, alixpt@gmail.pt**

[2] **Instituto Superior Técnico, Universidade de Lisboa, ana.moura.santos@tecnico.ulisboa.pt**

[3] **Instituto da Educação, Universidade de Lisboa, {fc, jviana}@ie.ulisboa.pt**

Abstract

Since its inception in 2008, MOOCs have been including videos as a primary mean to improve the learning experiences. Since we are part of a team involved with the design and production of MOOCs aimed to address STEM curricula, we think that a deep analysis on this process, in particular of MOOC videos, became fundamental, both from an efficient pedagogical and communicational point of view, and of a cost-effective production techniques point of view. Based on the cinemetrics analysis, we then recommend the following characteristics for the MOOC videos: short (6–10 min. long), dynamic (ASL ranging 6–30 sec.), personalised (by each instructor) and focused (one topic at a time).

Keywords

Elearning, MOOC, digital learning contents, video design and production, cinemetrics analysis, Average Shot Length (ASL)

1 Introduction

The beginning of the twenty-first century brought the emergence of new paradigms in education sciences, which allow more flexibility and are more aligned with recent teaching practices (ANDERSON, 2004; MARSH & WILLIS, 2006; McAULEY, STEWART, SIEMENS & CORMIER, 2010; SELWYN, 2011). This new paradigm integrates new technologies, e-learning contents and social networking. A good example of the increase for the efficiency in the use of ICT for learning through learning tools is the growing success of social *software* within personal learning environments (Personal Learning Environment's[1] – *PLE's*), of Open Educational Resources, and from 2008 on of Massive Open Online Courses (MOOCs) that come to shape, all of them questioning new forms of learning using Internet (TURKER & ZINGEL, 2008). Universities and other academic institutions are offering each year more online courses, which together with the generalized use of web and intranet platforms for academic management, have the consequence of increasing the funding that goes to personnel staff and technological resources dedicated to the development of IT platforms (FORMIGA, 2013).

A deep analysis on the process of designing and producing these courses, in particular of MOOC videos, became fundamental to achieve cost-effective production contents that are simultaneously significant from both pedagogical and communicational point of views. For instance, we think that the negative effect of possible discrepancy between enrolment and completion noticed (and may be overly publicized) in the first runs of MOOCs (see e.g. news from 2013–2014[2]) can be overcome with good practices and with carefully designed videos (GUO, KIM & RUBIN, 2014; KIM, GUO, SEATON, MITROS, GAJOS & MILLER, 2014). Recently, as part of a team involved with the design and production of MOOCs aimed to address Science, Technology, Engineering and Mathematics (STEM) curricula, inside Universidade de Lisboa (University of Lisbon, http://www.ulisboa.pt/en/), we formulate guidelines of good practices with this goal in mind, and conclude the following general principles:

- Online courses, prepared to be open to potential students/participants and massive that must include a schedule for orientation through the different proposed weekly activities and have communication channels;
- The online course must have a short duration: run at most 7-8 weeks, if possible 4-5 weeks;
- Traditional expository and/or tutorial classes shall be substituted by a sequence of short video modules typically 10 minutes long, complemented with learning activities by online self-assessment and evaluation quizzes;
- Each course includes a discussion forum, where students can put their questions and get feedback by fellow students or tutors (dedicated staff members).

Besides, we recognize the fact that video is a key pillar of the digital literacy, we also came to a conclusion that it can bring tangible benefits to the online learning experience when well designed and produced (MOURA SANTOS, COSTA, VIANA & GUEDES SILVA, 2015). In the present paper, we are going to present some results of our cinemetrics analysis, done in full detail for 46 videos from 31 MOOCs, and propose the design and production of short, dynamic, focused and technically strong videos that enhance the learning experience of a MOOC. Finally, although what we present here constitutes an overview of recent design practices and different style approaches to MOOC videos, our final goal is to apply our conclusions to our own practice of video design and production.

2 Methodology

Although the cinema, and by extension the video are languages to communicate using sounds and images with almost universal understanding, they have structural rules, syntax and context, to which we can access and understand through a process of deconstruction. In order to enable the present study of the different languages used in MOOC videos, we have firstly chosen to build a classification grid that allow us to identify categories and measure, as objectively and rigorously as possible, the several compo-

[1] http://edutechwiki.unige.ch/en/Personal_research_and_teaching_environment

[2] https://www.insidehighered.com/news/2013/03/08/researchers-explore-who-taking-moocs-and-why-so-many-drop-out; http://www.wsj.com/articles/SB10001424052702303759604579093400834738972.

nents of film/video language. To begin with, what one sees on the screen, or display of a screen, is the narrative content of the film/video, which is simple called narrative and can be subdivided into two distinct major areas (STADLER & McWILLIAM, 2009): stage-in (*mise-en-scene*, in French), the set of all components that are placed on the stage to be seen and heard by the viewer; shot-in (*mise-en-shot*, in French), which encompasses all aspects of technical and photographic style used for translating a stage-in into a movie/video (macro) and plan sequences/shots (micro).

Table 1: Video classification grid

Areas	Categories	Indicators
Stage-in (Mise-en-Scene)	**Focus of interest (FOI)**	Teacher
		Teacher+blackboard/ presentation
		Blackboard/presentation
		Other
		Headings/credits
		Cutaway
Shot-in (Mise-en-Shot)	**Framing (F)**	Centered
		Non-centered
		Obliquous
	Field Size (FS)	Close-up
		Medium shot
		Full Shot
		Long shot
	Depth of the Field (DOF)	Low
		High
	Camera Movements (CM)	Static
		Zooming
		Translation/Rotation
Recording and Pos-production aspects	**Recording Location (RL)**	Studio
		Lecture rooms
		University campus
		Other places
	Video Sources (VS)	Original footage
		Chroma Key
		Archive images (photo and video)
		Computer graphic images

In the process of analyzing MOOC videos, we identified focus of interest (FOI) as the most significant aspect of the stage-in phase. FOI refers to the selected element at the center of the action in each shot, and in the context of producing videos in STEM fields, we chose the following indicators: teacher shot (Fig. 1), teacher and presentation or blackboard shot (Fig. 2), presentation or blackboard shot (Fig. 3), other inserted focus of interest; computer graphics images and/or credits (Fig. 4) and cutaways; i.e. photographs or videos from archives (Fig. 5).

Figure 1: Teacher close-up

Figure 2: Teacher and presentation shot

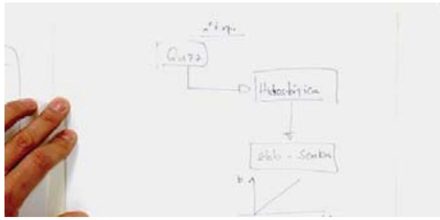

Figure 3: Presentation shot

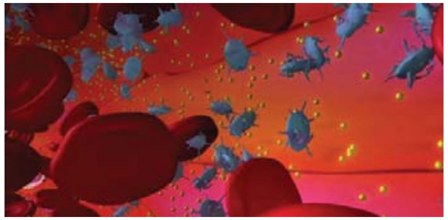

Figure 4: Computer animated shot

Figure 5: Data bank images (stills or video)

Regarding the shot-in, the categories we considered most relevant in the MOOCs context are: framing (F), field size (FS), depth of field (DOF) and camera movements (CM), which includes translational and rotational movements of the camera.

To complete the video analysis we also considered two complementary categories related to the video production and post-production: recording location (RL), i.e. the place where the elements of the shot-in are captured, an video source of the footage (VS) used in assembling the videos.

To sort out RL we identified four types of locations: recording studio (with real or virtual sets), lecture rooms (classrooms and laboratories), other locations on campus and eventually other places, real or virtual. Regarding VS, we considered the original footage for a given MOOC, archive images, computer graphics images produced specifically, and the action of replacing the latter two in scenarios using Chroma Key.

Finally, to perform the study of all described video categories, we have relied on the principles of cinemetrics analysis (http://www.cinemetrics.lv/), which includes as a major classification principle the average duration of each shot for a given movie, called Average Shot Length (ASL). This statistical filmic analysis is traditionally used to compare different ASLs for the same movie director and then build a graph of its own evolution and artistic choices over time. But, it also allows study the movie editing and directing styles based on the average rates of the cuts over several decades of film production (TSIVIAN, 2011; SALT, 2011).

In our case, each video was first decomposed by frames/scenes contents into shots and their durations measured. After this first step, we then classified the shot contents according to the different categories and indicators described in the above classification grid. This approach, unlike others statistical studies based on Youtube Analytics (DIWANJI, SIMON, MARKI, KORKUT & DORNBERGER, 2014) and video analytics (KIM, GUO, SEATON, MITROS, DUDES & MILLER, 2014), allows us, staying at pre-production phase, to have a technical/ artistic reading of each individual video and establish statistics data on the video language used in the considered MOOCs.

We present here several results of the detailed analysis of 31 MOOC videos selected from 4 platforms (Coursera, edX, MiríadaX, Open2Study), in 4 languages (Chinese, Spanish, French and English), from 9 countries (Australia, Belgium, China, Colombia, Spain, United States, India, Mexico and Switzerland). The videos were selected from four distinct classes, classified according to the purposes they serve and roll played in MOOCs: teasers, introductory videos, videos of theoretical/expository content, and tutorial/laboratory videos. In the next section, we describe in more detail the results for the teasers, which includes the cinemetrics analysis of 26 teaser videos from courses in STEM areas (Chemistry, Mathematics, Physics and Computer Science), followed by a brief description of the stage-in for 20 videos of the other classes of MOOC videos.

3 Results

After doing a thorough analysis for all 26 teasers, grouping the results for each of the thematic areas, we will discuss them for the three selected indicators: stage-in, shot-in and complementary aspects of production and post-production. Thereafter, as a general picture, we can conclude that on average the teaser videos are 120 seconds long and consist of 26 shots with an average duration of 5 seconds. To complement these results, we also give the stage-in analysis for 20 MOOC videos from the same STEM topics, and classified as introductory videos, videos of theoretical/expository content and tutorial/laboratory videos.

3.1 Stage-in: Focus of Interest (FOI)

Table 2: FOI cinemetrics analysis for the MOOC teasers

Video Class	Areas	General Results				Stage-in (Mise-en-Scene) Focus of Interest (FOI)											
		Sample		Shots		Teacher		Teacher +blackboard/ presentation		Blackboard/ presentation		Other		Headings/ credits		*Cutaway*	
		Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration
Teaser	STEM	26	120s	26,0	5s	6,3	10s	3,0	5s	3,7	5s	4,0	8s	2,8	4s	14,2	3s
	Chemistry	6	148s	26,0	6s	5,5	17s	0,0	0s	2,0	2s	1,0	14s	3,8	5s	14,4	3s
	Matematics	6	121s	24,0	5s	6,7	9s	2,0	4s	2,3	7s	8,0	3s	2,6	4s	12,0	3s
	Physics	8	105s	26,0	4s	5,6	6s	0,0	0s	8,0	6s	0,0	0s	2,4	4s	16,1	3s
	Computer Science	6	112s	27,8	4s	7,8	8s	4,0	5s	1,0	7s	3,0	6s	2,4	5s	13,8	2s

Table 3: F and FS cinemetrics analysis for the MOOC teasers

Video Class	Areas	General Results				Shot-in (Mise-en-Shot) Framing (F)						Field Size (FS)							
		Sample		Shots		Centered		Non-centered		Obliquous		Close-up		Medium shot		Full shot		Long shot	
		Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration
Teaser	STEM	26	120s	26,0	5s	9,2	6s	10,7	5s	6,7	3s	6,9	5s	9,8	6s	7,4	5s	3,5	3s
	Chemistry	6	148s	26,0	6s	9,3	9s	7,3	6s	5,4	5s	5,8	5s	7,3	12s	7,2	4s	2,8	3s
	Matematics	6	121s	24,0	5s	4,8	7s	14,3	5s	7,3	4s	10,0	6s	12,8	3s	6,0	7s	2,0	4s
	Physics	8	105s	26,0	4s	12,6	5s	10,0	4s	5,4	3s	6,4	3s	8,8	5s	8,9	4s	3,8	3s
	Computer Science	6	112s	27,8	4s	9,0	4s	11,3	5s	9,0	3s	5,5	6s	10,8	4s	7,2	4s	5,2	2s

The results of the cinemetrics analysis for the focus of interest (FOI) are given in Table 2. A simple image of the teacher is the focus of interest in 96.2% of the cases. When this happens, the teacher appears on average 6.3 times for approximately 10 seconds[3] each time. The teacher only appears next to the blackboard or the presentations in 11.5% of cases. When this occurs, it happens on average 3 times during the teaser in 5s for each shot. The use of the board or the presentations is present in 38.5% of the teasers, with an average of 3.7 times and 5s lengths. Other focuses of interest, for example, graphics or images intended to divert the attention from previous focus, occur 26.9% of the time, within circa of 4 shots with an average duration of 8s. Headings or credits appear in 88.5% of cases, only 2.8 times for teaser and with an average duration of 4s. Finally, the cutaways are used in 76.9% of cases, about 14.2 times and with a mean duration of 3s each shot. The segmentation results of these promotional videos (teasers) by subject area are quite variable and are mostly due to the way in which they are designed and carried out. For example, the Chemistry and Physics videos barely make use of the teacher+blackboard/presentation and the other indicator of FOI. For these videos the cutaways are dominant. On the other hand, the blackboard/presentations are hardly used, reaching only 50% of the cases in Mathematics and Physics.

[3] From now on, we are going to abbreviate seconds by the letter s.

Table 4: DOF and CM cinemetrics analysis for the MOOC teasers

Video Class	Areas	General Results				Shot-in (Mise-en-Shot)									
						Depth of the Field (DOF)				Camera Movements (CM)					
		Sample		Shots		Low		High		Static		Zooming		Translation/ Rotation	
		Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration
Teaser	STEM	26	120s	26,0	5s	10,0	4s	16,7	6s	19,2	5s	2,5	4s	6,3	4s
	Chemistry	6	148s	26,0	6s	11,2	5s	11,8	9s	17,2	8s	3,0	4s	5,0	5s
	Matematics	6	121s	24,0	5s	7,0	3s	19,3	5s	14,7	6s	3,6	6s	12,7	3s
	Physics	8	105s	26,0	4s	9,6	3s	17,8	4s	21,5	4s	1,8	3s	4,3	3s
	Computer Science	6	112s	27,8	4s	12,2	4s	17,7	4s	22,7	4s	1,8	4s	4,0	4s

Table 5: RL and VS cinemetrics analysis for the MOOC teasers

Video Class	Areas	General Results				Recording and Pos-production aspects															
						Recording Location (RL)								Video Sources (VS)							
		Sample		Shots		Studio		Lecture rooms		University campus		Other places		Original footage		Chroma Key		Archive images		Computer graphic images	
		Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration
Teaser	STEM	26	120s	26,0	5s	6,8	7s	7,6	3s	9,4	8s	12,0	4s	12,6	7s	4,2	10s	9,3	3s	5,0	5s
	Chemistry	6	148s	26,0	6s	7,0	6s	11,0	3s	4,8	20s	10,5	4s	7,5	13s	0,0	0s	10,2	3s	3,5	4s
	Matematics	6	121s	24,0	5s	6,3	8s	4,5	2s	20,0	5s	9,3	4s	17,4	5s	5,5	8s	4,0	3s	5,7	4s
	Physics	8	105s	26,0	4s	5,3	8s	8,8	3s	4,4	4s	15,3	4s	14,5	4s	3,5	12s	8,5	3s	5,9	5s
	Computer Science	6	112s	27,8	4s	9,3	5s	5,7	5s	10,0	4s	12,0	3s	10,3	5s	8,0	8s	14,8	3s	4,8	4s

3.2 Shot-in: Framing (F), Field Size (FS), Depth of Field (DOF) and Camera Movements (CM)

The results of the cinemetrics analysis for the shot-in aspects are presented in Table 3 for framing and field size, and in Table 4 for depth of field and camera movements.

3.2.1 Framing (F) and Field Size (FS)

For F the averages of centered (9.2 shots/video[4]) and non-centered (10.7s/v) shots are equivalent both in number and in duration (from 5 to 6s). However, when we look closer, we notice that the number of centered shots is 2.5 times higher for Physics than for Mathematics and that the average duration of this type of shots for Chemistry is more than double than for Computer Science. Similar signs of variability exist for the non-centered shots, with Mathematics MOOC videos doubling Chemistry in number of this kind of shots (14.3s/v in average versus 7.3s/v). The oblique shots are less common and when applied they tend to have a smaller duration (3s in average) and a less frequency (6.7 shots in average).

For FS the mid shot prevails (9.8s/v, almost 40% of all shots) despite being closely followed by the full shot (7.4s/v) and the close-up (6.9s/v). Also, for these three cases we have an average duration ranging from 5 to 6s. The long shots shows a similar pattern as the oblique, they are less common and when applied they tend to have smaller duration (3s in average) and a less frequency (3.5 shots in average). Detailing the results, we notice that the number of close-ups is almost 2 times higher for Mathematics than for Computer Science videos, and that the mean duration of this type of shots for Physics is half of the length for Mathematics and Computer Science videos. As for the medium shot, the biggest difference arises between Chemistry and Mathematics MOOC videos. For Mathematics we found smaller (3s) but more frequent (12.8s/v) mid-shots, while for Chemistry we found the opposite results (12s) and (7.3 s/v), respectively.

3.2.2 Depth of Field (DOF) and Camera Movements (CM)

The use of a high depth of field is more frequent (16.7%) and happens on slightly longer periods (6s). However, when we look closer we notice that the use of high DOF is 63% higher for Mathematics than for Chemistry and that the average duration of this type of shots for Chemistry is more than double than for Physics and Computer Science. Similar signs of variability exist for the low DOF, with Computer Science videos doubling Mathematics in number of this kind of shots (12.2s/v in average versus 7s/v).

Camera movements are not very common in these videos, in fact the majority of the images are captured within a fixed plan (73%). Sometimes, the apparent motion is actually obtained using the Ken Burns technique, particularly with photos/pictures from archives or computer graphics. Translational or rotational movement is 3 times

[4] We are going to use s/v as the short abbreviation for shots per video.

more used in Mathematics than in Computer Science or Physics, and 2.5 times more than zooming for the STEM videos.

3.3 Recording and Post-production aspects

The results of the cinemetrics analysis for the recording location and post-production aspects are given in Table 5 for both categories.

3.3.1 Recording Location (RL) and Video Sources (VS)

The other places category prevails (12s/v, more than 46% of all) despite being closely followed by the university campus (36%) and the classroom and / or laboratory (29%). The university campus shots have an average duration of 8s, which is the double of the other two classes. The studio shots show a similar duration as the campus (7s) but are less frequent, only 6.8 s/v. In detail, we notice that the number of university campus shots is almost 4 times higher for Mathematics than for Chemistry and Physics and double of Computer Science. On the other hand, the average duration of this type of shots is 4 to 5 times higher in Chemistry (20s), if compared with the remaining areas.

Analysing the video sources is clear that the use of original image, captured on purpose for the teaser, prevails when compared to other types (48%), particularly with Chroma Key technique that has been used only in 1/6 of the videos (16%) although being relatively long shots (about 10s). Archive images are another relevant source for the construction of the teasers (36%) but they tend to be very short (3s) inserts normally used to connect sequences of shots. Computer graphic images are used with moderation (19%) with an average duration of 5s for each shot. As in the previous categories it is visible a large scatter in the results for the different STEM areas.

3.4 Stage-in: FOI for the other classes of MOOC Videos

We have also realised the cinemetrics analysis for the FOI for each of the areas and for the remaining three classesof videos: introductory, theoretical/expository and tutorial/laboratorial videos. For that purpose we used a comprehensive set of 20 videos from

6 different STEM courses. The MOOC introductory videos duration are 11.5 minutes[5] (691s) long and consist of 19.8 shots/video with an average of 67s. For expository videos the average duration is 13mn and 21s (801s), being composed of 20.3 s/v with a mean duration of 49s. Finally, the tutorial videos have an average duration of 8mn and 23s (503s) and consist of 11.2 s/v with an average duration of 50s. Regarding the most relevant indicators for each of the three classes, we reach the following results for introductory videos:

- The teacher appears in 80% of videos with 2.2 s/v, with a mean duration of 2mn and 45s;
- The blackboard/presentation also occurs in 80% of videos with 8.4 s/v, with an average duration of 4mn and 30s.
- In the case of theoretical/expository videos we have the following results:
- Teacher+blackboard/presentation occurs in 90% of videos, with 9.8s/v and an average duration of 41s;
- The blackboard/presentation also occurs in 90% of videos, with 6.8s/v and an average duration of 62s.
- Finally, for the tutorial and laboratory videos:
- The teacher occurs in 60% of videos, with 2s/v and an average duration of 57s;
- The blackboard/presentation in 80% of the videos, with 5.4s/v and an average duration of 6mn and 9s (369s).

[5] We are going to abbreviate minutes by the letters mn.

Table 6: FOI cinemetrics analysis for the MOOC introductory, theoretical/ expository and tutorial/laboratory videos

Video Class	Areas	General Results				Stage-in (Mise-en-Scene) Focus of Interest (FOI)											
		Sample		Shots		Teacher		Teacher +blackboard/ presentation		Blackboard/ presentation		Other		Headings/ credits		*Cutaway*	
		Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration	Quantity	Duration
Introductory videos	STEM	5	691s	19,8	67s	2,2	165s	7,6	23s	8,4	270s	0,0	0s	1,0	5s	0,6	7s
	Chemistry	1	547s	3,0	182s	1,0	537s	0,0	0s	0,0	0s	0,0	0s	2,0	5s	0,0	0s
	Matematics	2	690s	33,5	21s	1,5	48s	18,5	29s	11,0	7s	0,0	0s	1,5	5s	1,0	6s
	Physics	1	490s	16,0	31s	7,0	27s	0,0	0s	8,0	37s	0,0	0s	0,0	0s	1,0	8s
	Computer Science	1	1039s	13,0	80s	0,0	0s	1,0	12s	12,0	1027s	0,0	0s	0,0	0s	0,0	0s
Theoretical/ practical videos	STEM	10	801s	20,3	49s	1,8	68s	9,8	41s	7,6	56s	0,0	0s	1,8	4s	0,6	4s
	Chemistry	2	725s	20,5	35s	0,0	0s	12,0	51s	6,5	16s	0,0	0s	2,0	5s	0,0	0s
	Matematics	5	806s	24,8	32s	1,4	74s	14,2	26s	8,0	51s	0,0	0s	2,8	4s	1,0	3s
	Physics	1	767s	22,0	35s	11,0	40s	0,0	0s	10,0	32s	0,0	0s	0,0	0s	1,0	8s
	Computer Science	2	884s	8,0	111s	0,0	0s	1,5	68s	6,5	120s	0,0	0s	0,0	0s	0,0	0s
Tutorial/ laboratorial videos	STEM	5	503s	11,2	50s	2,8	57s	5,2	294s	6,5	369s	0,0	0s	3,0	14s	1,0	8s
	Chemistry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Matematics	3	560s	8,7	65s	2,0	78s	7,0	386s	5,5	594s	0,0	0s	3,0	14s	0,0	0s
	Physics	1	490s	16,0	31s	7,0	27s	0,0	0s	8,0	37s	0,0	0s	0,0	0s	1,0	8s
	Computer Science	1	348s	14,0	25s	1,0	25s	5,0	20s	8,0	28s	0,0	0s	0,0	0s	0,0	0s

4 Conclusions

From the main results of the analysed MOOC videos, we highlight the following aspects: the mean duration is 6mn and 12s, the average shot length (ASL) is 26s, in average the videos have 22.5 shots. This indicators are particularly useful to set limits to the STEM video design variables in a pre-production phase of a MOOC. As recommendations we highlight the following principles: short and dynamic videos with a particular emphasis on personalized and focused contents. The teasers should have a maximum duration of 2 to 3mn, while the introductory and expository videos should average the 9 to 11mn and tutorial videos should not exceed the 7mn. All considered four classes of video should use at least 3 different FOI with a dynamic shot sequence in order to attract student's attention. Particular care should be taken in the development of teasers, because of their promotional nature, we advise the use of a low ASL of around 6s. The future development will be the use of web metrics and video analytics along with cinemetrics.

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A research agenda for exploring MOOCs and change in higher education using Socio-Technical Interaction Networks

Steve WHITE & Su WHITE

University of Southampton, Web and Internet Science,
S.T.White@soton.ac.uk, saw@ecs.soton.ac.uk

Abstract

In recent years, exaggerated claims about the impact of MOOCs on education systems have appeared in various media. But how can claims about the effects of MOOCs in higher education be effectively investigated? Simplistic, technologically determinist concerns with 'impact' mask the complexity of processes, infrastructure and interactions involved in the creation and use of MOOCs. It is challenging, therefore, to investigate the relationship between technology and change in higher education. This paper proposes a novel way of researching MOOCs as socio-technical systems. It is argued that the analytic strategy of Socio-Technical Interaction Networks (STIN) can highlight the social and technical forces intertwined in the construction and practical use of MOOCs in particular HE contexts.

Keywords

MOOCs, Socio-Technical Interaction Networks, STIN, Web Science, Social Informatics, educators, learning designers

1 Introduction

MOOCs have arisen in a complex and dynamic context of increasing demand for higher education, competition between providers, Web connectivity and evolving views of knowledge and digital literacy (CONOLE, 2013). From a Web Science perspective, this complex social, political, and technological context hints at multiple and mutually shaping connections between technologies and social actors (HALFORD, POPE & CARR, 2010). Indeed, Siemens describes MOOCs as manifestations of the efforts of contemporary universities to understand and redefine their role in the era of the Internet. In this sense, MOOCs are a "middle ground" for education "between the highly organised and structured classroom environment and the chaotic open web of fragmented information" (SIEMENS, 2013, p. 6).

MOOCs particularly interest Web Scientists, as they embody conflicting interests across social institutions of government, education, media and business (CARR, POPE & HALFORD, 2010). Indeed, like the Web, a MOOC is "not an independent thing, it is a socio-technical phenomenon, brought together … by people, historical contexts, antecedents, (sub-) cultural norms, and expectations". This perspective emphasises the contingency of Web (and MOOC) characteristics, such as openness. Openness is "not an inevitable property of the user experience" (CARR et al., 2010) – something recently highlighted in WILES's (2015) critique of MOOC provider restrictions on reuse and remixing of resources. This paper argues that because MOOCs are co-constructed by social and technological forces, an interdisciplinary perspective is required to more fully understand them.

The direct focus of this study is on change at an organizational level, rather than with learners, learning and the learning environment. The paper draws on aspects of critical studies in education, which aim "to develop social scientific accounts of the often compromised and constrained realities of educational technology use 'on the ground'" (SELWYN, 2010, p. 65). This is done by studying educational phenomena in their broader social context beyond "the individual learner and their immediate learning environment" (2010, p. 68) in order to provide a fuller understanding of the use of educational technology and its consequences.

The paper proposes the analytic strategy of Socio-Technical Interaction Networks (STIN) as a useful way to study MOOCs, particularly regarding the co-construction of MOOCs and the practices of educators, learning designers and disciplinary groups in higher education. This connection between MOOCs and educator practices in HE is recognised as under-researched (LIYANAGUNAWARDENA et al., 2013; NAJAFI et al., 2015).

2 Problematising the 'impact' of MOOCs

For complex socio-technical phenomena like MOOCs, conducting empirical research into changing practices and influences on technological developments can be challenging. MOOCs have been widely discussed and debated as a potential 'change agent' in HE (YUAN & POWELL, 2013; BULFIN, PANGRAZIO & SELWYN, 2014). Speculation about the possible impact of MOOCs on education has ranged from expectations of greater openness and access, predictions of changes in university teaching and business models, or warnings about threats to the nature of academia (BOVEN, 2013).

However, this narrative of inevitable technological progress, of tools and their impact on passive 'users' is criticised as a form of technological determinism (BULFIN et al, 2014) which fails to consider the influence of social context. Previous studies have shown that individual and organisational change in education occurs at levels which are "beyond the provision of technology" alone (SALMON, 2005, p. 202), and that claims about the applications of learning technologies can differ widely from the reality of their use (SELWYN, 2007). As a result, it is argued that simplistic, causal explanations of technological impact on educational practice should be treated with caution, and new more socially nuanced approaches should be considered in the study of educational technology (OLIVER, 2011).

3 Disciplinarity, technology and changing practices

Creating and running MOOCs requires substantial input from subject specialists within their disciplines (NAJAFI et al., 2015). As a result, beliefs, values and norms which characterise particular disciplines may be influential in the design and implementation of MOOCs. This idea of disciplinarity was introduced in Becher's work on ‘academic tribes and territories’, which claimed that differences in epistemological beliefs and particular discourses shaped academic disciplines (1989). Conversely, the affordances or limitations of technologies may shape the practices of educators within particular disciplines (OLIVER, 2012), and the pedagogies they adopt (ANDERSON & DRON, 2011).

Indeed, recent work on digital scholarship links particular disciplines, the epistemologies of their subjects and engagement with particular technologies (PEARCE, WELLER, SCANLON, & KINSLEY, 2012). Oliver also shows how technologies may be intensively used in ‘core’ disciplinary work (as tools in research, for example), or treated as more “peripheral” tools for simple teaching functions (OLIVER, 2012, p. 231). However, this distinction becomes less clear in the case of MOOCs considering their potential for use as data collection instruments for particular disciplines, learning analytics tools, and as learning and teaching platforms (BAYNE & ROSS, 2014).

Returning to Becher’s earlier work, TROWLER has questioned essentialist views of disciplinarity (in which academic practices are solely determined by internal characteristics of the discipline), arguing that external forces influence academic practices in addition to disciplinary norms and routines. Such forces include the “evaluative state”, commercial pressures to compete, and perceptions of students as consumers (2012). Many of these contextual factors are related to the drivers of development identified in research on MOOCs (YUAN & POWELL, 2013). If technological ‘impact’ and disciplinary characteristics cannot fully account for the mutual shaping of MOOCs and academic practices in HE, a more comprehensive view of socio-technical change is required.

4 Socio-technical interaction networks

The STIN approach is part of the broader interdisciplinary field of Social Informatics which explores the relationship of information and communication technologies to social and organisational change (KLING, ROSENBAUM & SAWYER, 2005:54). The STIN strategy applies network theory in contexts where new technologies have been introduced, viewing these technologies “as nodes that interact with actors, groups, and resources” (SANFILLIPPO & FICHMAN, 2013, p. 12). Networks are conceived at the metaphorical level rather than as formal graphs (WALKER & CREANOR, 2009), but serve to represent the complex interrelationships involved in human use of technologies within organisations. Using network theories in this way allows researchers to recognise the complex, overlapping relations between people (whether technologically mediated or not) and between people and systems. Thus, STIN can be used to understand “socio-technical systems in a way that privileges neither the technical nor the social” (MEYER, 2006). One outcome of the approach may be to reveal how the introduction of new technologies can produce unforeseen consequences, with effects “far removed from the original intentions” (WALKER & CREANOR, 2009). In common with a Web Science perspective, the STIN strategy recognises that unpredictable effects of technology use can be the result of a process of co-constitution in which technical and social factors may be “highly intertwined” (KLING, MCKIM & KING, 2003, p. 54).

STIN rests on assumptions about the inseparability of the technological and the social, and the importance of “sustainability and routine operations” (KLING et al., 2003, p.56-7) both in terms of understanding and designing technical systems. In their study of scholarly communication forums, KLING, MCKIM & KING define a STIN as:

> “*A network that includes people (including organisations), equipment, data, diverse resources (money, skill, status), documents and messages, legal arrangements, enforcement mechanisms, and resource flows*” (2003, p.48).

This definition reflects the flexibility of the framework, and its concern with studying networks of practices, processes and artefacts in their context of use.

STIN builds on related perspectives of the Social Construction of Technology (SCOT) (PINCH & BIJKER, 1984) and Actor-Network Theory (ANT) (LATOUR, 1987), but focuses on "patterns and routines of use" of technology, rather than "adoption and innovation" (MEYER, 2006, p.38).

The STIN framework can be applied to a range of contexts, provided they entail relationships of people and technological artefacts which process information in some way. STIN researchers have explored complex technical and social interaction patterns within digital libraries, open source software development projects, and even practices of digital photography in marine biology (for a review of studies, see SHACHAF & ROSENBAUM, 2009). More recent studies have looked at socio-technical Web phenomena in work on networked learning (WALKER & CREATOR, 2009) and research directions in online social reference sites (SHACHAF & ROSENBAUM, 2009). This shows the flexibility of the approach, and indicates broad possibilities for the application of STIN to various aspects of MOOCs.

A series of "heuristics", outlined as steps, have been proposed which aim to identify the key social and technical elements, and architectural design features of socio-technical systems (KLING et al., 2003,p.57):

- Identify a relevant population of system interactions
- Identify core interactor groups
- Identify incentives
- Identify excluded actors and undesired actions
- Identify existing communication forums
- Identify system architectural choice points
- Identify resource flows
- Map architectural choice points to socio-technical characteristics

These steps are designed to "map some of the key relationships between people and people, between people and technologies, between technologies and their infrastructures, and between technologies that constitute e-forums in use" (KLING et al., 2003, p. 49).

Questions have been raised about STIN's theoretical under-development, the demands it places on researchers (MEYER, 2006) and the challenges of representing changes in STINs over time (WALKER & CREANOR, 2009). However, provided researchers

address these practical and methodological concerns, the STIN strategy may have potential to contribute to knowledge about MOOCs in use and inform future designs.

5 A STIN research agenda for MOOCs

Having looked in detail at the STIN strategy, it is now possible to consider how it can be applied to the study of MOOCs. The usefulness of the STIN strategy for education is highlighted by MEYER (2006, p. 41) as it takes a nuanced view of technology, rather than seeing it as "a simple phenomenon". Further, STIN's normative concern with the sustainability of technologies (lacking in SCOT and ANT) is of practical relevance to educators and learning designers affected by MOOCs, and to the wider debate about the future and role of MOOCs in higher education (MARSHALL, 2013).

The idea of STINs is useful as it adequately captures the systematic (in the case of xMOOCs) or networked (cMOOCs) arrangement of people, artefacts and processes of which MOOCs themselves are characterised. STIN analyses can, however, also interrogate wider organisational structures, social interactions, and resource flows involved in the creation and implementation of MOOCs within universities more generally. This adds an interesting dimension to possible research, as analysis of HE institutions involved with MOOCs can include both those who find technologies important and those who are less involved in, excluded by or even resistant to such technologies (KLING et al., 2003). This section will focus on the possibilities for research concerning ideas of openness, disciplinarity, pedagogy and roles of educators and learning designers in relation to MOOCs. For each area of research, some possible questions are proposed, followed by some elaboration of their relevance for MOOCs and HE.

5.1 Openness

- How has engagement with MOOCs influenced practices and attitudes related to openness in HE institutions?
- What influences the degree of openness in particular MOOCs/institutions?

A Web Science perspective foregrounds openness as both a feature of Web architecture and a factor in its widespread adoption and use across society. However, the nature of openness is variable in MOOCs, as noted in Wiley's of critique the influence of MOOCs in the open education infrastructure. In some cases, the potential for reuse and remixing of educational resources in certain MOOC platforms is severely limited (WILEY, 2015). STIN analyses would allow the investigation of the social and technical factors promoting or limiting openness in the routine use of MOOCs, and among wider, overlapping networks of people and systems within universities. Such research might be useful to inform future design choices and to explore whether involvement with MOOCs influences attitudes and practices toward openness in higher education more generally.

5.2 MOOCs, technology and scholarship

- Who are the key actors involved in designing and implementing MOOCs in different disciplinary areas?
- To what extent are MOOCs used as 'core' or 'peripheral' tools in different disciplines?
- To what extent are disciplines influenced by different incentives or disincentives to engage with MOOCs? Are any disciplines under-represented?

In order to understand the complex, dynamic relationship between changes in academic practices and the introduction and proliferation of MOOCs, a nuanced approach to the subject is required. A STIN approach could investigate how MOOCs and different 'academic tribes and territories' co-construct one another, and how wider contextual forces work to shape the discourse and practices of those involved with or resistant to MOOCs. STIN research could also explore how different disciplines are adopting (or resisting) MOOCs as 'core' or 'peripheral' tools (OLIVER, 2012) in their research and teaching, and what influence such practices have on their disciplinary activities and uses of other technologies.

5.3 MOOCs and pedagogy

- What are the motivations or barriers to involvement with MOOCs from the educators' perspective? To what extent does this differ across different disciplines or institutions?

Research shows that MOOC designs and the pedagogical models which underpin them are not uniform and can be influenced by a range of factors, including the disciplinary differences mentioned above (BAYNE & ROSS, 2014). The networks of influences on MOOC designers and designs are complex. Indeed, researchers in educational technology have long argued that new technologies and pedagogies emerge which are "consistent with the worldview of the era in which they develop" (ANDERSON & DRON, 2011). As universities come under increasing external pressures and influences (TROWLER et al., 2012), researchers need the tools to identify and account for them. STIN analysis of the key roles and relationships between people, resources and infrastructure can help contextualise the diverse uses of technologies and pedagogies in actual use in HE, and inform planning and design for future technological and pedagogical developments.

5.4 MOOCs and learning designers

- How do learning designers manage competing pressures from other stakeholders in the MOOC design and implementation process?
- To what extent has involvement with MOOCs shaped learning designer practices in other forms of online or blended learning initiatives?

Learning designers are a relatively new academic 'tribe' whose role requires them to "cross the boundaries of disciplinary tribes, to share and develop learning and teaching through the use of technology" (OLIVER, 2012, p. 222). Such individuals may influence the form and content of MOOCs and other online and blended learning initiatives to a significant extent, so understanding their position in socio-technical technical interaction networks related to MOOCs is important. This is especially so in view of the relative paucity of research into the role of those who create and facilitate MOOCs (LIYAGUNAWARDENA et al., 2013). It would also be useful (and possible, through the STIN strategy) to consider whether working on MOOCs influences the way learning designers approach other online/blended learning projects. Indeed, the potential for encouraging openness and enabling social learning at scale has been identified as a key affordance of MOOCs even by critics (BATES, 2014; DRON & ANDERSON, 2014), so determining whether these concepts have influenced the practices of learning designers may be a valuable avenue of investigation.

6 Conclusion

This paper has argued from the perspective of Web Science that MOOCs are a complex socio-technical phenomenon, involved in a process of social and technical co-construction. As such, attempting to investigate their 'impact' on academic practices in higher education is problematic. The analytic strategy of STIN is thus proposed as way to account for the multiple social and technical networks of interactions which shape MOOCs and the practices of educators and learning designers engaged with them. Research is currently underway in this area, and preliminary findings will be reported in the literature.

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Towards Predicting Success in MOOCs: Programming Assignments

Kshitij SHARMA[1], Łukasz KIDZINSKI[1], Patrick JERMANN[2] & Pierre DILLENBOURG[1]

[1] Computer Human Interaction in Learning and Instruction

[2] Center for Digital Education, École Polytechnique Fédérale de Lausanne, {kshitij.sharma, lukasz.kidzinski, patrick.jermann, pierre.dillenbourg}@epfl.ch

Abstract

Students of programming languages in massive on-line open courses (MOOCs) solve programming assignments in order to internalize the concepts. Programming assignments also constitute the assessment procedure for such courses. Depending on their motivation and learning styles, students pursue different strategies. We identify which approach to attempt these assignments results in better performance. We predict students' success from their online behaviour; and identify different paths students chose in order to complete the MOOC. We also discuss how students resign from the course after having difficulties with assignments. Moreover, we also predict, when would a student give-up (or succeed) submitting solutions to a given assignment.

Keywords

MOOCs, Programming assignments, Predicting success, Student categorization

1 Introduction

According to the current trends in MOOCs, assessments play a key role in defining success. In the case of programming courses, assessments become even more important, as programming assignments are the prime ways to assess students' understanding about the content. In a preliminary analysis for 120,000 programming assessments, we observed that the main disengaging factor for the active students (who submit at least one assignment, SHARMA et al., 2015a) is failure in these programming assignments. Among all the active students, 27% fail the course, among which 74% left the course after failing in their last assignment submissions. This fact attracts a special concern for analysing the submission behaviour of the students.

In this contribution, we predict students' success (final score for each assignment) in programming assignments. Our goal is to predict the success of the MOOC students at an early stage of the course. This might enable the MOOC teachers to support the students who have (or are predicted to have) problems in getting the correct submission for a programming assignment.

We also present the prediction results for every other submission attempt. We predict for each submission two quantities: 1) whether there will be another submission; and 2) what will be the next attempt score? Based on these predictions the MOOC instructors can have multiple support design guidelines, that reach beyond the simple error messages from the "online judge".

The rest of the paper is organised as follows. The second section presents the related work. The third section explains the problem statement and the research questions. The fourth section introduces methods and different variables used in this contribution. The fifth section presents the results. Finally, the sixth section discusses the results and implications, and concludes the paper.

2 Related Work

The work on predicting the success in MOOC programming assignments is sparse. However, there have been numerous attempts to find the relationships between the

academic success, the success in programming assignments and the success in programming courses in normal classroom settings; with students' profiles (based on demographics, learning strategy and motivation). In this section, we provide a few examples on these findings.

Academic success and student characteristics: Students' personal characteristics, learning styles, and learning strategies were correlated with their academic success. Conscientiousness (CHAMORRO-PREMUZIC & FURNHAM, 2003; BUSATO et al., 2000), directed learning style (BUSATO et al., 1998; RICHARDSON, 1999), intellectual ability (BUSATO et al., 2000; MINNAERT & JANSSEN, 1999), achievement motivation (BUSATO et al., 1998), and strategic learning approach (CASSIDY & EACHUS, 2000) had positive correlations with students' success. On the other hand, neuroctism (CHAMORRO-PREMUZIC & FURNHAM, 2003), undirected learning style (BUSATO et al., 1998; BUSATO et al., 2000), and apathetic learning approach (CASSIDY & EACHUS, 2000) were shown to have detrimental effects on students' academic success.

Programming assignments/ Success in computer science education: Specifically, for university level programming courses, students' success was positively correlated with their maths background (WILSON, 2002; WILSON & SHROCK, 2001; BENNEDSEN & CARPERSEN, 2005; BYRNE & LYONS, 2001), comfort level (WILSON, 2002; WILSON & SHROCK, 2001), hard work (BENNEDSEN & CARPERSEN, 2005), and attribution to success/failure to luck (WILSON, 2002; WILSON & SHROCK, 2001); while students' attribution to success/failure to task difficulty (WILSON, 2002; WILSON & SHROCK, 2001; BENNEDSEN & CARPERSEN, 2005) and a non-converging learning style (BYRNE & LYONS, 2001) were negatively correlated with students' success in programming courses.

Experiences in MOOCs: There had been other attempts to measure/improve the learning experiences in MOOCs. For example, LI et al. (2015) showed that students' perceived content difficulty is reflected from their video navigation patterns. Building upon their results, SHARMA et al. (2015) showed that displaying teacher's gaze in a MOOC video results in a behaviour that corresponds to low perceived content difficulty.

However, these studies do not focus on a particular type of courses. Moreover, either these studies focus on the student attributes (learning style, strategy, demographics, motivation) or they focus on learning experience. In this contribution, we focus on the success in programming courses, and we analyse the assignment part of these courses. We propose to use the students' submission behaviour, which is also automatically logged in MOOC platforms, in order to predict success.

3 Problem Statement

A preliminary analysis shows that out of more than 120,000 students' assessments (from 5 programming MOOCs) 13% students failed. Moreover, 45% submit the assignments only once, 16% of these students could not score passing marks for the given assignment. In order to support these students, predicting their level of success at an early stage is necessary. Furthermore, to help the students who failed (or as predicted, will fail), we need to find out strategies that the passing students chose. Specifically, we investigate the following research questions:

Question 1: Can we predict success in programming assignments using students' submission behaviour only? As we said before, this is necessary to know if a student will succeed or not at an early stage to provide support.

Question 2: Can we predict whether a given submission would be the last submission for a student? In our preliminary analysis, we observed that 13% of the students fail after attempting to solve the assignments and its necessary to predict when the students give up.

Question 3: What are the different paths to succeed in programming MOOCs? This is necessary to know how students succeed in programming assignments to provide support to the student who face problems.

Question 4: How is the dropout related to the failure in programming assignments? If there is a relation between students failing in a given assignment and them dropping out, we can take a few measures to encourage the re-engagement.

4 Methods and materials

4.1 Course descriptions

We used five programming courses, to test our methods for predicting success and engagement in programming assignments. For maintaining the ANONYMITY, we will give only generic information in this version. Complete details will appear in the final version of the paper.

The five courses were the first courses for their respective paradigms (procedural, object-oriented, functional). Here are the common details about the courses:

1. All the courses were 7 weeks long, in terms of instruction.
2. All the courses, except Scala that had Java as a prerequisite, had no prerequisites.
3. All the courses, except Scala that had five graded programming assignments, had four graded programming assignments, scores from which would contribute to the final grade and achievement level of the students.

4.2 Variables

First score: the score that the student gets after the first attempt to the given programming assignment. **Time difference between two successive submissions:** the time difference between the two successive attempts to the same programming assignment. **Improvement in score:** the difference in the score between the two successive attempts to the same programming assignment. **Change in the program:** the difference in the submitted programs, between the two successive attempts to the same programming assignment. This is the sum of the number of lines added and number of lines removed. **Number of attempts:** the total number of attempts done by a student for a given programming assignment. We observed that 95% students attempt to solve a given programming assignment up to 10 times. Hence, we limit our analysis to those students who attempt up to 10 times to solve a given assignment.

Dependent Variables - Final score: the score that the students get for each assignment. We normalised the score, dividing it by the maximum attainable score for each assignment. **Next score:** the score that the students get after each submission. We will test our methods to predict the score for the next submission attempt. We normalised the score, dividing it by the maximum attainable score for each assignment. **Last Attempt:** We distinguished between the attempts for the same assignment for each of the students, whether it was succeeded by another submission attempt (last attempt) or not (not a last attempt).

4.3 Methods

In this contribution, we propose two prediction methods. The two methods differ by one factor: the first method, uses the complete data from each assignment submission; while, the second method, uses the predicted output from the previous attempt as an input to predict the success in the current attempt.

All-in-one prediction: This method (as shown in the Figure 1, left pane) uses the data from each attempt in order to predict the success. This is an iterative method, where every iteration uses the data available from all the previous attempts.

Staircase prediction: This method is hierarchical and uses the data from each attempt in order to predict success. The input to each level "i" is the data from the "ith" attempt and the predicted values from the "(i-1)th" level. In the case of a continuous independent variable, the predicted values are the output value of the classifier; while, in the case of a categorical independent variable, the predicted value is the probability of being classified in one of the categories.

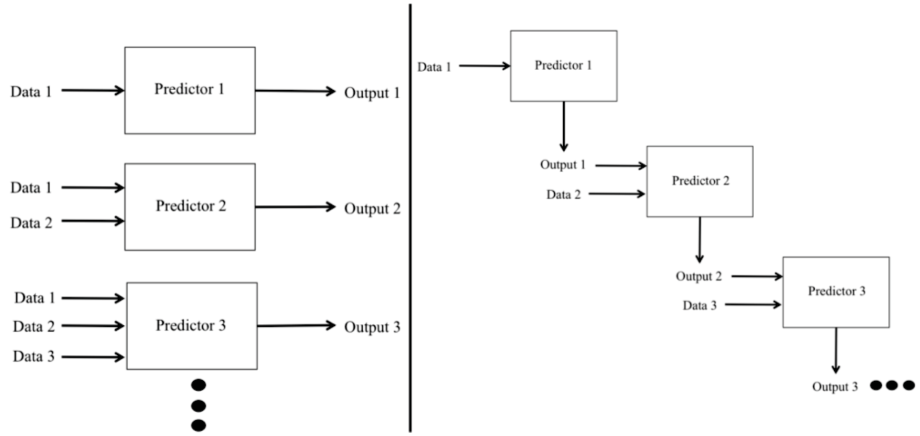

Figure 1: The two prediction methods: left- all-in-on, right- the staircase model

In both aforementioned methods, we used artificial neural networks and generalised additive models as the prediction algorithms.

5 Results

In this section, we present the prediction results. First, we give the prediction results for the final score, the next score, and whether the current attempt is the last attempt. Then, we will provide different strategies chosen by the students and its effect on their success. Finally, we present the relation between failing in a given assignment and dropout. For the prediction sections there were two steps: 1) we selected the best predictors, from the list of variables presented in Section 4.2, using a forward feature selection method; and 2) we used variables selected in the first step to predict the score (or, whether the current submission is the last submission) after each assignment submission for a given assignment.

5.1 Final score prediction

First, we present the prediction results for the score that the students are awarded after each assignment submission. Using the forward feature selection, we observed that the model with the "first score" and the "improvement in the score" had the best results. Next, we predict the final score after each attempt for a given assignment. Figure 2 shows the prediction quality after each attempt for all the assignments. We observed that after the third attempt for a given assignment, we achieve decent prediction accuracy.

5.2 Last attempt prediction

Next, we will present the prediction results for the fact whether the current submission is the last submission for a given assignment. Using the forward feature selection, we observed that the linear model with "first score", "improvement in the score" and "change in the program" had the best results. Next, we predict the current attempt to be the last attempt for every given submission. Figure 3 shows the progress of the prediction quality. We can see from Figure 3, that after the third attempt for a given assignment, we achieve decent prediction accuracy.

5.3 Next score prediction

Next, we will present the prediction results for the score for future (next) submission attempt for a given assignment. Using the forward feature selection, we observed that the linear model with "first score", "improvement in the score" and "number of previous attempts" had the best results. Next, we predict the current attempt to be the last attempt for every given submission. Figure 4 shows the progress of the prediction quality. We can see from Figure 4, that after the fourth attempt for a given assignment, we achieve decent prediction accuracy.

5.4 Different paths for success

We identified three different classes of students submitting programing assignments: 1) those who submitted only once; 2) those who submitted more than once but only a few times (submitted twice); and 3) those who submitted more than twice but up to 10 times. Following are the details about each of these classes:

Submitting once (one-timers): Among all the students' assessments; 45% of the students submitted only once, 16% of them failed; and rest of them passed.

Submitting twice (thinkers): Among all the students' assessments; 21% of the students submitted twice for a given assignment, 9% of them failed; and rest of them passed. We observed a significant difference between the two groups (failed and passed) on the time difference ($t(5008.33) = -9.85$, $p < .001$) and program change ($t(4488.637) = -8.29$, $p < .001$). This shows that among those students, who submitted only twice, the students who did small and quick changes had a higher score. One plausible explanation for this could be that for the first submission, the students got a very small error but the ones who failed could not understand the automatic message and made bigger changes (for which they needed more time) to their previous programs and failed to score the necessary marks.

More than 2 but up to 10 submissions (trial-and-error): Among all the students' assessments, 32.5% of the students submitted more than twice but up to 10 times for a given assignment; 11% of them failed; and rest of them passed. For the students in this class, we found a difference between the two groups (failed and passed) on program change ($t(4738.717) = -5.38$, $p < .001$). This shows that the students who introduced smaller changes than others had a higher score. This shows a typical "trial and error" strategy.

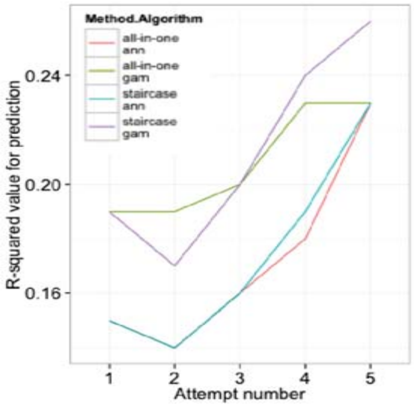

Figure 2:
Prediction results for final score

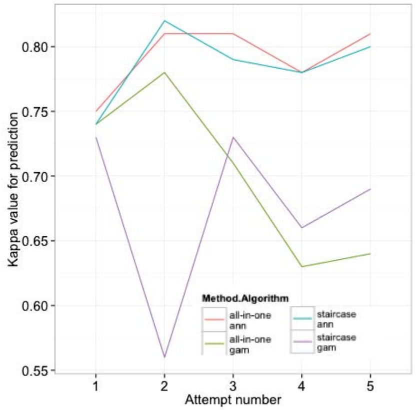

Figure 3:
Prediction results for last attempt

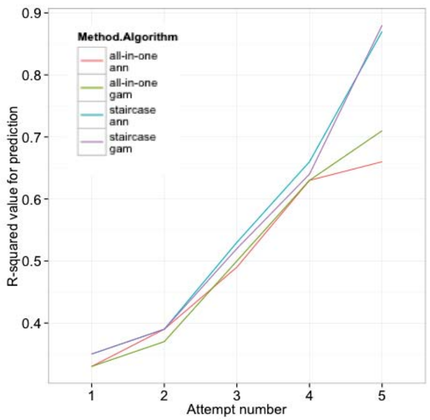

Figure 4:
Prediction results for next score

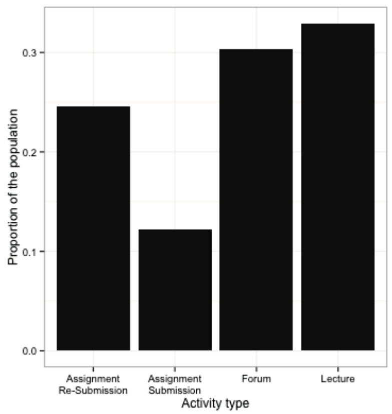

Figure 5:
Relation between failure and dropout

5.5 Effect on dropout

Next, we show the last activity of the students who failed in a given assignment (Figure 5). We observed that 36% of the students have their last activities as a submission to a programming assignment. We distinguished between the first submission (Assignment Submission, 12%) and submitting more than once (Assignment Re-submission, 24%). This shows that most of the "one-timers" quit the course after failing in one of the assignments. While most of the failed "thinkers" and "trial-and-error" students try to get help from the forums or the lectures and they re-submitted, but finally they quit the course.

6 Discussion and conclusions

We showed that, it is possible to detect students' success in programming assignments at a very early stage. This is a key process if one chooses to provide any kind of support to the students who are predicted not to perform well, for example, suggesting extra course material, giving detailed feedback on the submitted programs and pointing the students to correct forum posts.

The facts that we were able to predict the next score and the last attempt to an assignment might give detailed guidelines for designing a support system that is beyond the mere error messages from an online judge. For example, if a student is predicted to give up submitting any further and his next score will not give him a passing grade, one can examine her previous submissions in more details than a set of unit tests; and provide appropriate support in terms of more learning material or motivating her for another submission with specific hints based on her mistakes in the previous submissions.

Moreover, since we can also predict the final score for an assignment after only a few submission attempts, one can use these predictions to enable the feedback systems to the teachers. Usually there are 2-3 weeks between the open time and submission deadline for an assignment. If many students are predicted to get lower grade, during these weeks the teacher can provide additional material to the students and/or discuss the problem statement in detail at the forums.

We have also shown the relationship between the students failing in an assignment and dropping out of the course. Figure 5 shows that 36% of the failed students (who attempt at least once) had last actions as assignment submissions (or re-submissions). This shows that failing in an assignment can have detrimental impact on students' engagement levels. One could use the predictions, we proposed in this contribution, to design a support system (automatic or with the intervention from the teaching staff) to prevent the engagement levels from dropping.

Using the proposed variables, in this contribution, we were able to distinguish between the different paths, which the students chose in order to succeed in programming assignments. Most of these variables (all except the difference in the submitted program) are generalizable for the assessment in other type of courses as well.

Furthermore, we distinguished different approaches that the students chose to succeed in programming assignments. The three major strategies are: one-timers, thinkers and trial-and-error. We saw that one-timers have the most failure rate. This also reflects the relation between the disengagement and failure in one assignment. One can support these students by automatically analysing the program they submitted and providing more information about their mistakes than a simple error message from the online judge.

Finally, we observed that 32.5% students follow trial-and-error strategy to succeed in an assignment. These students might not learn the basic concepts even though they pass the course. For such students, one might suggest more learning material based on the predictions about their last attempt and their next score. If a student is predicted to have another attempts and not to achieve a passing score, the support system could suggest extra reading and re-watching a few lecture videos to help the student understand the programming concept and not to approach programming as a trial-and-error process.

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Supporting Diverse Learner Goals through Modular Design and Micro-Learning

Matthew LEACH, Syed Munib HADI & Adam BOSTOCK

University of Derby, Academic Innovation Hub, innovationhub@derby.ac.uk

Abstract

Much is made of the diversity for MOOCs learners – with their varied motivations and interests; yet MOOCs are often run and judged on the assumption that learners would progress through the course in its entirety, to completion. This paper presents the experience from two recently delivered MOOCs, where the aim was to support a broader set of learner goals by applying a modular design – where each part included well defined learning outcomes and assessment criteria, and where completion was rewarded with digital badges. Results show that a considerable level of micro-learning achievement would have been missed if only completion rates were considered. Large number of learners also followed the course in the pattern of the modular design.

Keywords

Modular MOOCs, digital badges, completion rates

1 Background

The Academic Innovation Hub, at the University of Derby, developed and delivered two MOOCs in 2015. The first titled "Digital.Me: Managing your Digital Self" (henceforth referred to in the short form Digital.Me) and the second titled "Bridging the Dementia Divide: Supporting People Living with Dementia" (henceforth referred to as Dementia).

MOOCs differ from traditional Higher Education courses primarily due to their open nature – with the courses officially available to anyone over the age of 13 under EU law (EUROPEAN COMMISSION, 2012). In order to support the widest possible range learners, while still facilitating an individualised and active approach (JASNANI, 2013), the decision was taken to make all content available from the start of the course. This would allow learners to adopt their own strategy, such as following the course synchronously with the provided support, complete at their own rate, join late and catch-up, or just access materials that they were interested in.

There is a growing consensus that completion of the whole course is not the best criteria for analysing MOOCs (HO et al., 2014; HAYES, 2015); but instead a more granular approach should be followed (LACKNER et al., 2015). Both MOOCs consisted of six units with a digital badge available for completing each one. Each unit was self-contained, with its own identified learning outcomes verified through a UK Higher Education validation process (ROBERTSHAW et al., 2015). The aim of using badges was give learners recognition for achieving the learning outcomes in each unit they chose to study.

2 Data Collection

Both MOOCs were delivered through the Canvas.Net platform. As with many web-based applications a vast amount of data is collected – ranging from high-level learner submissions of assessments and discussion posts, down to the lowest level of times and locations for individual mouse clicks.

Portions of this data are available through the web interface for those with the appropriate level of permission (e.g. teachers and support staff); such as grades attained in assessments. For this paper some of the lower-level data was obtained through the available API. Software was written to make repeated calls to the API, and then to collate and structure the data.

In some cases behavior was inferred from missing data – for example a learner with a blank value for their last login date was known to have never logged into the course.

Learners also completed three optional surveys during the course. The 'welcome survey' that collected intention and demographic data, and the midway survey that sought their opinions on the course, were both standard components in all Canvas.Net courses. In addition learners were asked to complete a course review survey at the end.

Learners could continue to enroll on the MOOCs up to one week before the end. This provided some challenges in terms of assessing retention and unit completions while the course was running – with learners both joining and leaving the courses daily. The results presented here are from an evaluation of the courses after they ended.

3 Results

3.1 Evidence of Different Learner Goals

A total of 735 learners completed the welcome survey for the dementia MOOC, with the majority (477) saying that they expected to fully engage with the course; which leaves 258 who from the outset did not intend to fully complete. However, it should be noted that these predictions were inaccurate since around 35% of both groups actually went on to complete.

Although unit 1 was considered the first on the course, 6.16% of learners on Dementia and 7.06% of learners on Digital.Me took the opportunity to start with a different unit. 2.08% of learners on Dementia and 2.65% on Digital.Me that completed at least one unit never completed Unit 1.

3.2 Completion of Units

Both courses experienced the large percentages of learners that enrol but never access the course that is reported elsewhere (ONAH et al., 2014) – 31.61% for Digital.Me and 26.29% for Dementia. For this reason the initial analysis was performed against active learners – those that logged in to the course at least once. In Digital.me 15.64% of active learners (9.35% of those enrolled) completed the course (all 6 units); and 35.48% (24.01%) completed the Dementia course.

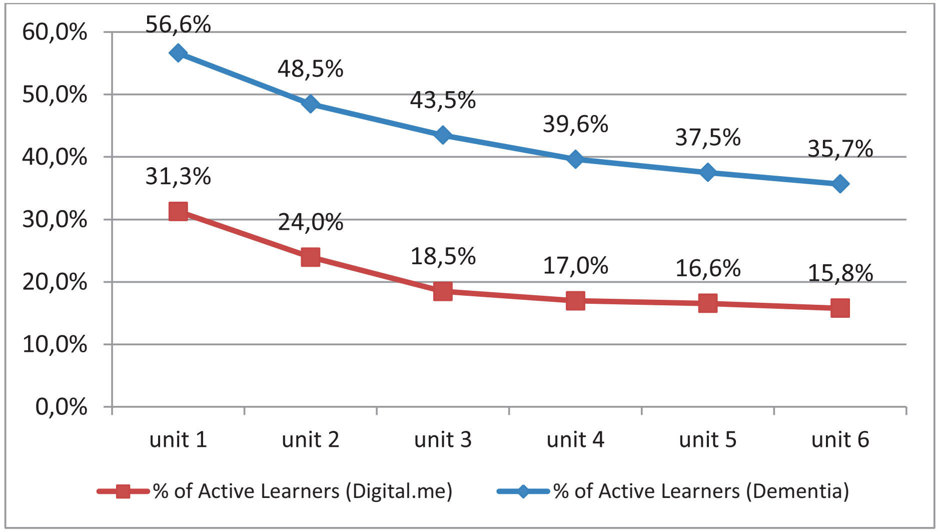

Figure 1: Learners completing units as a percentage of all active learners

The percentage of badges awarded, relative to the total number that could have been awarded to active learners, provides another metric for judging learner activity. For example in Dementia 2,077 learners were active, and so across all 6 units a maximum of 12,462 badges could have been awarded. For Digital.me 20.5% of badges were awarded to active learners; with 43.6% of badges awarded on Dementia.

The pattern through which learners completed units also provides interesting insights into their behaviour. Figure 2 shows this pattern of completion – with each learner represented by a single line that shows on what date they completed each unit.

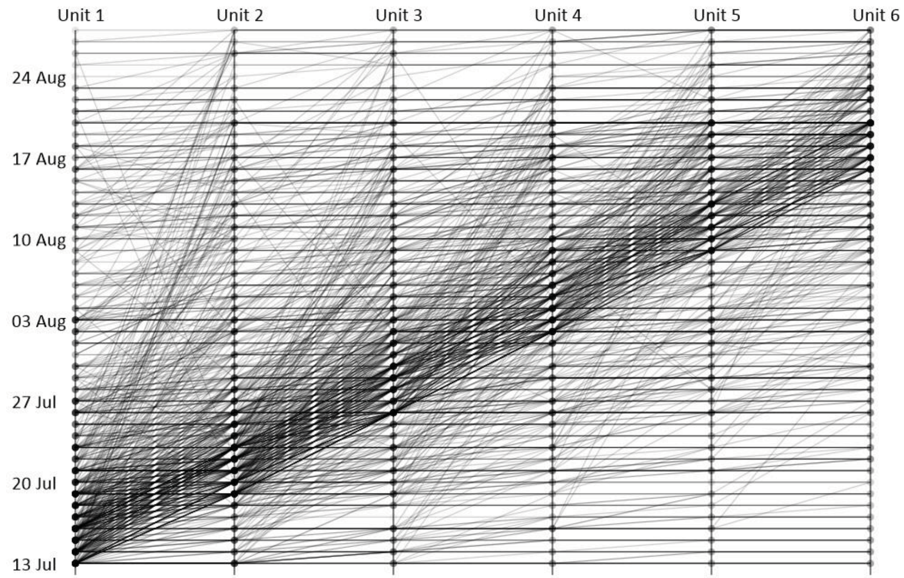

Figure 2: Pattern of unit completion for Dementia

There is a strong diagonal feature which represents a large portion of the learners following the weekly pace of the course – in line with the provided support. Horizontal lines indicate that two units were completed on the same date. In some cases a learner may only have completed two units on the same date, but in both Dementia and Digital.Me around 10% of learners completed the entire course in one day.

Also note that lines going diagonally downwards (higher on left than the right) represent units being completed out of sequence. This variation in order is better visualised in a state diagram, as recommended by COFFRIN et al. (2014) and shown in Figure 3 for Dementia.

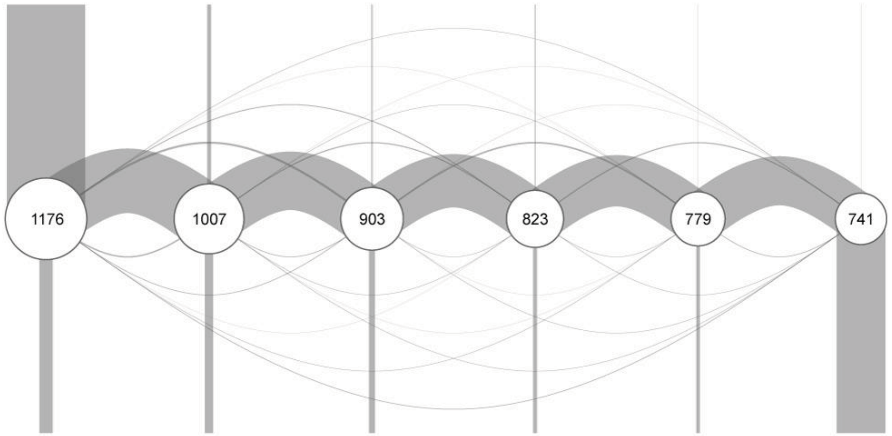

Figure 3: State diagram representing the order in which units were completed

Here each circle is a unit – with size denoting number of completions. A line entering from above indicates the number of learners that started with that unit, and the line below is the number of learners for which that was their last unit completed. Curved lines above represent learners choosing which unit to move onto next, while curved lines below represent back-tracking to complete and earlier unit. Again this demonstrates a core body of learners moving linearly through the course, but also some learners taking different approaches.

Although most learners completed the whole course in a much shorter time than the six scheduled weeks, this did not translate into spending less time on the course. Figure 4 compares the gap in days between the first and sixth units completed, against total time logged on Dementia. There is only a small positive correlation between these datasets of 0.12 (and 0.08 for Digital.Me), and we can see that completing all six units within 3 days compares well to spreading activity over 29 days.

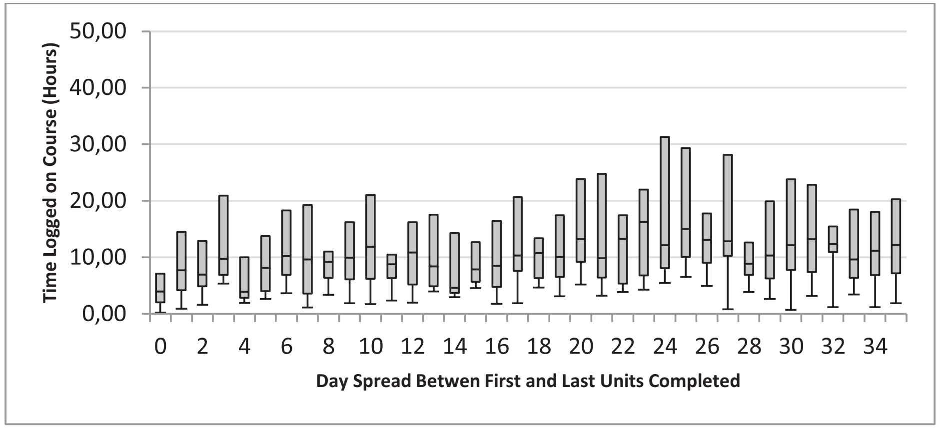

Figure 4: Distribution of time logged on course against gap in days (up to 35) between completing first and sixth units, for learners that completed the course Visualisations for Digital.Me follow a similar pattern to those shown for Dementia.

3.3 Modular Flow

In each week of the MOOCs more activity took place in the week that was currently being supported, than in any of the other weeks. Evidence for this comes from dates when units were completed, but also more reliably from the dates of posts in the discussions. There were on average twice as many posts in the supported unit than any of the others for both Dementia (2.22 times as many) and Digital.Me (2.02 times as many)

Although this represents a large number of learners that were synchronised with the current week (e.g. participating in Unit 2 during week 2), it should be noted that combined together more activity was taking place in unsupported units than supported ones. In dementia an average of 58.4% of overall posts were made in an unsupported week, and in Digital.Me the average was 65.8%.

4 Conclusions and Recommendations

By awarding badges for achievements on each unit, many more learners gained recognition of their achievements than if there had just been a completion certificate. In Digital.me 452 learners gained badges (compared to 209 being rewarded by the completion certificate); similarly in Dementia 1201 learners gained badges (compared with 527 certificates).

The higher percentage of learners who's only recognition came from badges, compared to those completing the whole course, proves that learning takes place in MOOCs that is not reflected in overall completion rates. This suggest that when measuring learning success or completion in MOOCs, this micro learning needs to be taken into account. However, designing modular MOOCs should not be just about providing recognition for individual segments of the course. Instead these modules should also have clear learning outcomes and assessment criteria to maintain academic integrity.

The second aim of the open, modular approach was to provide learners with more freedom in how they approached the course, and this is certainly evident in the data. The massive range of abilities, goals and behaviours make identifying any patterns almost impossible. There were no correlations between data sets such as amount of time logged, duration to complete the course, amount of contributions to discussions, and the quality of contributions. Learners joined at different times and completed different units, with the majority of activity taking place outside of the supported week. If the aim is to provide beneficial materials to as wide an audience as possible then a certain amount of chaos may have to be embraced.

5 Further Research

There is the potential to go further – using a purely modular structure without sequence or hierarchy, where learners are not just allowed but actively encouraged to choose their own order.

BALI (2014) and HO et. al (2014) suggest placing less emphasis on course completion and completion rates. Given this, an area for further research is the exploration of minimal criteria to "complete" a course, but with more engaging and challenging optional stretch activities. When scores do not contribute to the final grade then more accurate assessments of student progress might be discerned.

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Describing MOOC-based Hybrid initiatives: The H-MOOC Framework

Mar PÉREZ-SANAGUSTÍN[1], Isabel HILLIGER[1], Carlos ALARIO-HOYOS[2], Carlos DELGADO KLOOS[2] & Saif RAYYAN[3]

[1] Pontificia Universidad Católica de Chile, {mar.perez, ihilliger}ing.puc.cl

[2] Universidad Carlos III De Madrid, {calahoy, ckd}@it.uc3m.es

[3] Massachusetts Institute of Technology, srayyan@mit.edu

Abstract

Several studies have described different *hybrid* initiatives to integrate MOOCs into traditional higher education. Most of these studies have partially documented students' perception on hybrid initiatives, measuring course satisfaction among other metrics. Few researchers have reported institutional efforts implied in implementing hybrid initiatives and their benefits from a curriculum perspective. This paper presents H-MOOC, a framework that describes hybrid MOOC-based initiatives as a continuum of two factors: (1) institutional effort, and (2) curriculum alignment. H-MOOC facilitates the comparison of different hybrid MOOC-based initiatives by suggesting Key Performance Indicators to measure their impact at an institutional level. Different hybrid initiatives in the literature are analyzed to illustrate how H-MOOC works. An actual case study on a course on Calculus is presented as empirical evidence of its use.

Keywords

MOOCs, KPIs, Metrics, Higher Education, Hybrid pedagogies, Flipped Classroom, Blended learning

1 Introduction

Since the appearance of Massive Open Online Courses (MOOCs), several institutions have joined the MOOC wave. They have been creating a huge amount of courses that have become available as new types of Open Educational Resources (OERs). In order to benefit from these new OERs, Higher Education (HE) institutions started to explore and describe a set of *hybrid* initiatives to integrate MOOCs into their curriculum as internal innovations (ZHANG et al., 2013; DELGADO KLOOS et al., 2015). In this context, the concept of *hybrid* is understood as a broad term, including any learning initiative, strategy or model that integrates MOOCs and MOOC-related technologies into a traditional curriculum.

Most of these studies describe the impact of hybrid MOOC-based initiatives from students' perspective, analyzing their learning gains in comparison with more traditional approaches (JOSEPH & NATH, 2013). However, only few studies have analyzed institutional implications of hybrid initiatives. These initiatives can be classified into two groups: (1) those describing the initiatives implemented institutionally (ZHANG et al., 2013; DELGADO KLOOS et al., 2015, HO et al., 2015), and (2) those analyzing different metrics needed to measure their institutional impact in terms of costs and learning benefits (GRIFFITHS et al. 2014).

Over the last decade, metrics in hybrid initiatives have evolved from student course satisfaction to indicators of student support and effort (Firmin et al., 2014). Still, few metrics inform about institutional advantages and threats of integrating MOOCs into the academic curriculum (SOFFER & COHEN, 2015).

The variety of hybrid initiatives offered by universities is growing with the passage of time (ZHANG et al., 2013; DELGADO KLOOS et al., 2015). Thus, decision-makers need more information about what to expect of each hybrid strategy. For this purpose, the contribution of this paper is twofold: (1) H-MOOC, a framework for describing hybrid MOOC-based models and organizing their implementation, and (2) sets of Key Performance Indicators (KPIs) in order to measure both costs and benefits, allowing decision-makers to adjust expectations and optimize the use of resources.

1.1 MOOC-based Hybrid initiatives

ZHANG et al. (2013) identified 5 models to integrate MOOCs into HE curricula and organized them according to the relevancy for the institution. The list of models, organized from low to high relevancy, are the following: (1) **MOOC learner services**, providing university services to learners that participate in MOOCs but that are not enrolled in residential education (i.e. use of library); (2) **MOOCs as Open Resources**, using MOOC components as learning objects on residential courses; (3) **Flipped classrooms**, using MOOC content for residential students to study at home; (4) **Challenge course for MOOCs**, developing courses based on projects that residential students have to do as an assessment of their work on a MOOC; and (5) **Credit transfer from MOOCs**, recognizing credits from MOOCs after passing an exam.

DELGADO et al. (2015) categorized 6 different hybrid initiatives that integrate MOOC technologies with face-to-face (f2f) instruction: (1) **Local Digital Prelude**, in which the first part of the course is completely online (MOOC-based) and then continues with a second traditional f2f part; (2) **Flipping the Classroom**, in which students work every week with MOOC-based online content at home and then go to class to reinforce their understanding of what they studied at home; (3) **Canned digital teaching with f2f tutoring**, which consists of MOOC-based contents that students use to prepare their exams in semesters where there are no f2f classes, having the faculty available at office hours for tutoring; (4) **Canned digital teaching in f2f course**, which corresponds to using MOOC-based contents as a textbook in a f2f residential course; (5) **Remote tutoring in f2f courses**, which consists of digital interventions (live or canned) from experts to complement a traditional course; and (6) **Canned digital teaching with remote tutoring**, which corresponds to completely online MOOC-based courses complemented with video-conferences for tutoring.

1.2 Measuring the impact of MOOC-based initiatives

The literature about hybrid initiatives provides valuable insights about different type of MOOC based models. Researchers have documented varied experiences that combine MOOC-like content with on-campus courses, acknowledging the challenge of identifying what model integrates online learning with personal experience as expected (DELGADO KLOOS et al., 2015). Today, the challenge is to identify what success metrics matter for each type of hybrid initiative. More metrics are needed in order to facilitate their comparison and inform institutional decision-makers.

Over the last five years, most case studies have reported how students experienced hybrid MOOC-based initiatives by measuring participant demographics, completion rates, students' interaction patterns, and learning gains (BRUFF, 2013). For example, an initiative implemented in Taiwan was characterized by examining different factors affecting student satisfaction (WU et al., 2010), including students' gender, age, self-efficacy, performance expectations, and learning satisfaction, among others. Case studies conducted in other countries also report metrics regarding the learner experience. A pilot study about the implementation of MOOCs in the academic curriculum of Tel Aviv University analyzes data about student participation (e.g., number of students who signed up in the MOOC), learners' pathway (e.g. students' participation in traditional activities such as exams), and their attitudes towards MOOCs (SOFFER & COHEN, 2015).

Still, there are researchers that have diversified the use of metrics in order to describe hybrid MOOC-based initiatives beyond students' perspective. An interim report about the use of MOOCs in the University System of Maryland presents face-to-face time as a relevant indicator, besides using instructor interviews as a legitimate instrument for data collection (GRIFFITHS et al., 2014). A case study about a state-run University in California proposes student effort as a critical success metric of a hybrid initiative (FIRMIN et al., 2014), that is, enrollment, approval rates, retention, completed assignments, face-to-face class time, and the use of support services. Thus, the range of metrics to measure the impact of hybrid MOOC-based initiatives has become wider, including indicators associated with institutional costs and learning benefits.

2 The H-MOOC framework

2.1 A framework to analyze MOOC-based Hybrid initiatives

The H-MOOC framework is proposed to organize and systematically analyze the implementation of any MOOC-based hybrid initiative as a continuum of two factors: (1) the institutional effort to apply the initiative (x-axis), and (2) the alignment with the curriculum (y-axis) (Fig. 1). It is important to notice that the framework assumes that the MOOCs used in the hybrid initiatives are already available (either created by the institution making use of them or by a third party) and therefore does not consider production costs as part of the institutional effort, as they may be very variable among MOOCs and among institutions. That is, as institutional effort we are not considering the costs for creating and producing the MOOC, but the needed services to use it as part of a hybrid initiative, such as the maintenance services.

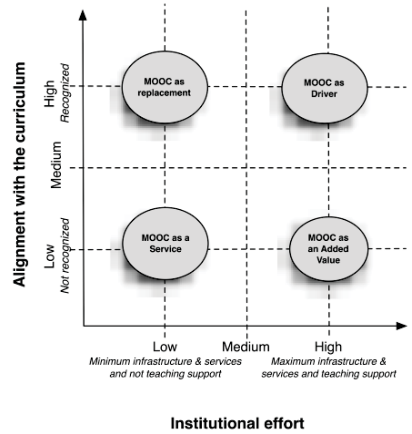

Figure 1. H-MOOC Framework

The **institutional effort** refers to the means in terms of infrastructure, services, and human resources (including teaching effort) required for launching or maintaining the hybrid initiative. A low institutional effort means that the institution invests a minimum on providing infrastructure, services and human resources (typical from a traditional f2f teaching practice. A high level of institutional effort means that the institution invest lots of efforts to provide infrastructure, human resources and associated services to help students advance on the hybrid initiative. I. e., offering open and free study rooms for residential and non-residential students to work on a MOOC requires much less institutional effort compared a flipped classroom model, which will need the maximum teaching effort as well as the infrastructures typical from a f2f teaching practice.

The **alignment with the curriculum** indicates both (1) the degree of institutional recognition of the hybrid MOOC-based initiative, and (2) the alignment with the curriculum of the MOOC-resources employed in the initiative. This is usually associated with the institutional recognition (e.g., in the form of credits or as part of the final grade in a course). A low level of alignment means that the MOOC is used as a complement in the hybrid initiative and the institution does not recognize it as part of the curriculum. However, a high level of alignment implies that the MOOC is the core of the hybrid initiative (used in the course directly by teacher and students), and the institution recognizes it as part of the curriculum. Initiatives at a middle level of alignment make an indirect use of the MOOC like, for example, as a reference textbook.

Through the continuum of these two factors, the H-MOOC framework enables the characterization of hybrid initiatives with different levels of institutional effort and alignment with the curriculum. In Fig. 1 we represent with a circle the four basic models that we place in the four corners of the framework: (1) **the MOOC as service model** (low in 'X' and 'Y' axes), typical from hybrid initiatives in which students use a MOOC (or part of it) voluntarily, and as a complement to the curriculum but no institutional recognition is given for completing this MOOC; (2) the **MOOC as a replacement model** (high in 'X' and low in 'Y' axes), typical from hybrid initiatives in which the MOOC replaces a traditional course (or is used to extend the curriculum), recognizing the institution the completion of the course, but providing no pedagogical nor institutional support in terms of physical infrastructure, nor services or local teaching support; (3) **MOOC as a driver model** (high in 'X' and 'Y' axes), typical from hybrid initiatives in which a traditional course in the curriculum is organized around a MOOC (e.g., flipped classroom), requiring high teaching and institutional effort; and (4) **MOOC as an Added Value model** (high in 'X' and low in 'Y' axes), typical from hybrid initiatives in which all the institutional efforts are provided to help students success in the MOOC (e.g., offering teaching classes, tutoring times, etc.), but no credits are given to them as the MOOC is considered an added-value complement for students' knowledge

Apart from these four extreme models, we could also find other models "in between" the ends of these two axes that could be useful to classify hybrid initiatives. An example model could be the use of MOOCs as textbooks in traditional classrooms, where the institutional support is lower than in a flipped classroom and MOOCs are not fully aligned with the curriculum.

2.2 Metrics related with H-MOOC

From the literature review, we identified three indicators that are important for evaluating any MOOC-based initiative. These indicators are: (1) required infrastructure, (2) teaching and learning benefits, and (3) students' participation (Table 1). Although metrics for each indicator can vary depending on the institutional context, the three of them can inform decision-making. The first two indicators report information for a cost-effectiveness analysis of any hybrid model. Regarding students' participation, this is an indicator that describes the target population of the initiative, in order to assess its coverage and its participant's needs.

Table 1: Examples of metrics that are relevant for all MOOC-based initiatives

Required infrastructure	Teaching and learning benefits	Students' Participation
• MOOC studio rooms • MOOC production equipment • Tutoring rooms • Technology labs	• Teachers' satisfaction • Learning expectations • Teaching expectations • Students' satisfaction • Perceived learning • Students' self-efficacy	• Course enrollment • Demographics • Online participation • Students' interaction patterns • Retention and attrition

We have also identified different types of metrics whose relevance depends on the MOOC-based initiative of analysis. For example, f2f teaching time is an important metric for models that use MOOCs as a driver. In flipped classroom approaches (DELGADO KLOOS et al., 2015), f2f teaching time is an indicator of teacher effort to foster active learning. However, this metric might be less important for hybrid initiatives that use a MOOC as a service (ZHANG et al., 2013), because students are not necessarily participating in traditional teaching instances aligned to the MOOC. Thus, decision-makers need information from different KPIs, depending on the MOOC-based initiatives that their institution is implementing.

In what respects to the two dimensions of the H-MOOC framework, the set of KPIs also varies. Curriculum alignment could be determined by the number of credits students receive from their participation in the MOOC. Regarding institutional effort, the metrics also differ for each hybrid MOOC-based model. In the case of a MOOC as a service model, tutoring time is more relevant than teaching time. No teaching time is expected to be expended in MOOC usage, but tutoring time might be needed in order to guide students' learning. Conversely, f2f teaching time is more relevant when the MOOC is used as a driver, because there is f2f time considered in the hybrid initiative.

In Table 2, we made an effort to organize the different metrics used in the literature, and align them with the H-MOOC framework. This table indicates what metrics could be used to quantify each dimension of H-MOOC, besides clarifying what metric matters more in each hybrid MOOC-based model described in previous section 2.1. This initial approach could be improved with future work about different hybrid initiatives and their institutional implications.

Table 2: Examples of metrics whose relevance varies depending on the hybrid MOOC-based model. The meaning of the '*' is Relevant and '**' More relevant.

Metric Dimenmen-sion	Metric	Relevance			
		MOOC as a Service	MOOC as a Replace-place-ment	MOOC as Added value	MOOC as a Driver
Curriculum alignment	• Number of students' credits	Not applies	*	Not applies	*
	• Faculty qualifications	**	*	**	*
	• Learning gains	*	**	*	**
	• Students' achievement	*	**	*	**
Institutional effort	• Tutoring time	**	*	*	*
	• Use of support services	**	*	*	*
	• Planning and teaching time	*	*	**	**
	• Material course development	*	*	**	**

3 The H-MOOC framework in practice

This section illustrates how the H-MOOC framework works. First, we analyze and organize current hybrid MOOC-based initiatives in the literature according to the framework. Second, we show how to apply the KPIs defined through an actual case study.

3.1 Organizing Hybrid MOOC-based Models from the literature

The six models by DELGADO KLOOS et al. (2015) are classified in the H-MOOC framework (Fig. 2). Two non-hybrid MOOC-based courses are used as reference in the Figure: a fully *remote course*, completely aligned with the curriculum, but with a low level of institutional support regarding infrastructures and services, and a *f2f regular course,* which is aligned to the curriculum and demands an important institutional effort regarding infrastructures, services and human resources.

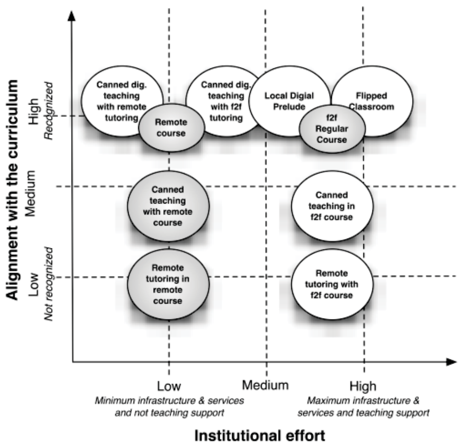

Figure 2. Hybrid MOOC-based models for organized according to the H-MOOC Framework

The two reference models can be hybridized in different ways. The f2f regular course can be hybridized using MOOCs as a **flipped classroom**. In the flipped classroom the f2f class is still present, but there is an extra effort on the teacher (and thus institutional effort) to plan well ahead of class. We can however reduce the number of f2f classes in our course and thus the institutional effort following a **local digital prelude** model, in which the first part of the course is entirely online and the second f2f. In addition, we can maintain the same structure in our f2f course but hybridize it by using MOOCs as reference textbooks (**canned teaching in f2f courses**), which reduces their alignment with the curriculum, or simply as a complement to the course (**remote tutoring with f2f course**), in which case the alignment with the curriculum is lower.

The remote course model can be hybridized as well. For example adding f2f tutoring to the remote course (**canned digital teaching with f2f tutoring**) increases the institutional effort, while adding remote tutoring (**canned digital teaching with remote tutoring**) reduces it. As in the case of f2f regular courses we can maintain the same structure in our remote course and hybridize it using MOOCs as reference textbooks or complements to the course (see the two extra models added to Fig. 2 in grey, *canned teaching with remote course*, *remote tutoring with remote course*).

3.2 A Hybrid MOOC-based model on Calculus: a case study

As an example of how the framework and the KPIs proposed can be applied in an actual context, we analyzed a "MOOC as a service model" a course on Calculus called "Progressions and Summations" at the Pontificia Universidad Católica de Chile (PUC). This course is proposed to support freshmen on engineering with low scores at the entrance institutional exam to improve their calculus competences. Although the MOOC was open to anyone from January 19th to 30th, the sample for data collection and analysis was restricted to engineering students at PUC. 650 (N=650) students were admitted in engineering first year, from which 232 (N=232) had to mandatorily participate in the traditional Progressions and Summations course. At the end of this course, students had to take an exam to evaluate their progress.

As it was explained in section 2.2, students' participation and learning benefits are relevant for evaluating the success of any hybrid MOOC-based model. According to the students' Participation KPI, a third of the students that failed on the pre-test items about progressions and summations used the MOOC. Activity patterns showed that these students were mostly active during the dates a remedial on-campus mini-course was imparted, regarding the fact that this traditional course was also about progressions and summations. Regarding the Learning Benefits KPI, the use of the MOOC affected positively students' performance, but learning gains were not statistically significant.

By applying the H-MOOC framework to this case of study, decision makers were capable of acknowledging the fact that the MOOC was used as a service, so the results previously described were expected. First, students did not earned any credit for using the MOOC, so curriculum alignment was low. Additionally, the MOOC target population had to take more than one mini-course on-campus, so students have little time left for interacting with the online course. Therefore, the hybrid MOOC-based initiative served students' learning effectively, but higher institutional effort and curriculum alignment is needed if decision makers want to use this MOOC as a significant driver of students' learning.

4 Conclusions and future work

This paper has presented the H-MOOC framework. H-MOOC provides a systematic way to define the space of hybrid learning initiatives from the viewpoint of organizations by establishing two key dimensions: curriculum alignment and institutional effort. According to these dimensions, four different hybrid MOOC-based models are proposed: (1) MOOC as a service, (2) MOOC as a replacement; (3) MOOC as a driver, and (4) MOOC as an added value. In a way, these models are a natural extension of how HE institutions think of traditional residential activities, and how they are set up: the university and the department decides on what educational activities are needed to support the curriculum they create, and what institutional support is needed. Some of these activities align strongly with the curriculum, and some could complement learning experiences, requiring more or less support from the institution. Coupled with KPIs, the H-MOOC framework help institutions evaluate which initiatives are more suited for their curriculum, students and faculty. So, different MOOC-based initiatives within and across several institutions can be compared, and HE decision makers can share what they have learned from their experiences and decision-making processes.

However, H-MOOC is only a first approach and presents some limitations that need further study. First, the H-MOOC might fall short to help redefine the way in which institutions deal with MOOCs and curriculum resources (e. g. figuring how to offer courses across institutions). Second, the framework needs to define a systematic way of applying KPIs to evaluate various hybrid MOOC-based initiatives.

As future work, we plan to analyze more initiatives to validate the usage of this framework. We expect running experiments where the same MOOC is used in various models, in order to evaluate their impact using the KPIs defined. During these experimental processes, new KPIs could be redefined and new ones could be proposed. Also, future studies include working with different institutions and report the results obtained from comparing models across universities. Finally, we plan to analyze how this could be used not only as an analytical framework, but also as a means to inspire internal innovations in the use of MOOCs in HE institutions.

Acknowledgements

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A Conceptual Business Model for MOOCs Sustainability in Higher Education

Nor Fadzleen SA DON, Rose Alinda ALIAS & Naoki OHSHIMA

Malaysia-Japan International Institute of Technology,
Universiti Teknologi Malaysia, nor@fadzleen.com

Abstract

The exponential growth of Massive Open Online Courses (MOOCs) has initiated multiplier discussions on viable business models for higher education due to the disruptive innovation in the democratization of learning, encompassing heterogeneous participation worldwide. Nonetheless, based from past studies, business models for MOOCs sustainability are under-researched albeit its importance in perpetuating the competitive advantage of global higher education. Although there is more than 21 million end-users worldwide and millions had been invested in the development and execution of MOOCs in higher education, there is a deficit in research on MOOCs sustainability in global higher education. Hence, this paper aims to explore the past studies on MOOCs business models to propagate its sustainability in higher education. By exploring, studying and analysing the existing MOOCs business models as well as sustainability in higher education, a Conceptual Business Model for MOOCs Sustainability in Higher Education is developed via synthesis and integration of all the constructs and elements of meta-analysis and literature review. The development of the Conceptual Business Model for MOOCs Sustainability is hoped to be be a guideline for policy makers, practitioners and researchers on perpetuating MOOCs sustainability in the hyper-speed era of innovation.

Keywords

MOOCs, business model, sustainability, higher education

1 Introduction

Top management in a broad range of industries are actively seeking guidance on how to innovate in their business models to improve their ability to both create and capture value. Hence, the exponential growth of MOOCs indicates the needs to develop a viable business model that supports the heteregenous participation and diversified demographic background of massive open online learning. One of the main challenges in sustainability that is faced by global higher education is to keep up with the varying demands and needs of the stakeholders (MOHAMED et al., 2014). The cost of producing MOOCs course is escalating yet there has been high demands from stakeholders in producing MOOCs that are of high quality infrastructure, efficiency, viable value proposition of the institutions yet remain cost-effective. There has been increasing concern on shifting the focus of higher education in the aspect of sustainability, yet based on literature and empirical studies, very limited studies have been conducted on business models for MOOCs sustainability. Hence, this research main objectives are twofold. First, it explores MOOCs sustainability in higher education as well as analysing existing MOOCs business models in higher education. Secondly, by synthesizing the findings from both aspects, a Conceptual Business Model for MOOCs Sustainability is developed in providing stakeholders a fortified foundation for optimizing MOOCs success in their respective institutions.

2 Literature Review

For this research, a Systematic Literature Review (SLR) is conducted where the aim is to study the existing MOOCs business models as well as factors influencing MOOCs Sustainability in Higher Education based from four major categories; Education, Socio-culture, Institution and Finance. From this literature analysis, a theoretical framework is developed, as depicted in Figure 1. This leads to the development of Conceptual Business Model for MOOCs sustainability in Malaysian higher education.

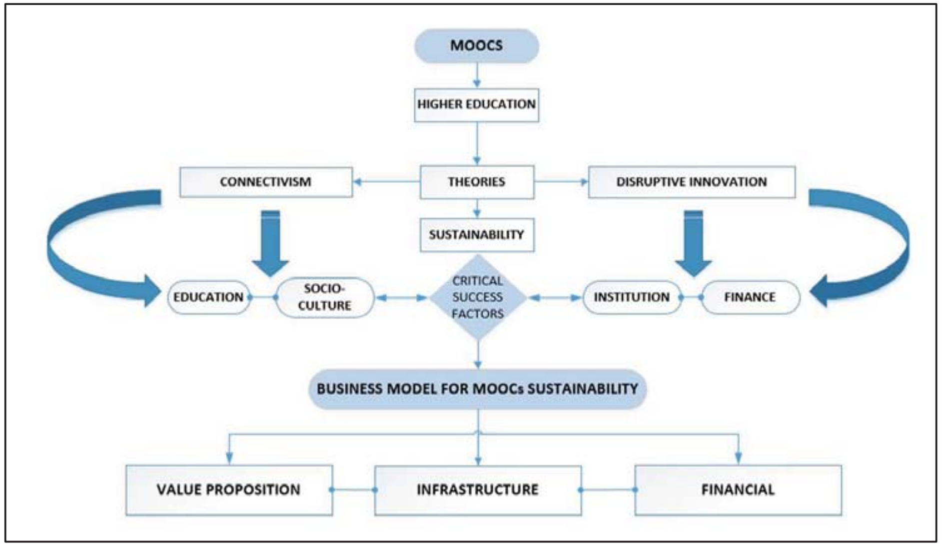

Figure 1: Theoretical Framework for MOOCs Sustainability in Higher Education

2.1 MOOCs in Higher Education

The inception of MOOCs started in 2008 when Stephen Downes and George Siemens initiated Connectivism and Connective Knowledge course that propagates the underpinning learning theory of Connectivism (MCAULEY, STEWART, SIEMENS, CORMIER & COMMONS, 2010). Since then, MOOCs initiative in higher education has globally gained traction where some of the leading MOOC platforms are EdX, Coursera and Udacity. To date, more than 12000 MOOC courses have been offered and more higher educational institutions are using MOOCs or initiating MOOC platforms (LIYANAGUNAWARDENA, 2015; SA'DON, ALIAS & OHSHIMA, 2014). Pertaining to business models, challenges of sustaining MOOCs in higher education have raised concerns, especially on how revenue streams, market positioning, value proposition as well as offering tangible and non-tangible benefits to both institutions and end-users. Hence, analysis on the potential business models by pioneers of

MOOCs, edX, Coursera and UDACITY (YUAN & POWELL, 2013) acts as a foundation to this study, as depicted in Table 1. It is vital in identifying revenue streams as well as factors in MOOCs sustainability in higher educations. EdX is not-for-profit platform while Coursera and UDACITY are for-profit organisations and the business models may vary depending on the value proposition, financial as well as institutional aspects. From the study, certification is a common aspect of revenue stream for all the MOOCs platforms, although both Coursera and UDACITY focuses on trans-institutional partnership, sponsorship, marketing and human-resource capital as pivotal aspects of their business models.

Table 1: Overview of potential business models

edX	Coursera	UDACITY
• Certification	• Certification • Secure assessments • Employee recruitment • Applicant screening • Human tutoring or assignment marking • Enterprises pay to run their own training courses • Sponsorships • Tuition fees	• Certification • Employers pay for recruit talent student • Students résumés and job match services • Sponsored high-tech skills courses

2.2 MOOCs Sustainability in Higher Education

Sustainability refers to policy, situation, product, process or technology that can be perpetually maintained and sustained for an indefinite time (HEIJUNGS, HUPPES & GUINÉE, 2010). In the context of higher education, Disruptive Innovation Theory, a theory coined by Clayton Christensen (CHRISTENSEN & EYRING, 2011) and Connectivism by George Siemens (SIEMENS, 2011) are the underpinning theories for this research. It perpetuates the needs to innovate higher education for higher education sustainability. In the context of MOOCs, higher education needs to shift away from the

focus of increasing the quantity of students in higher education to making a quality post secondary education more cost-effective. One of the main highlights of global higher education as it requires reassessment and realignment of the institution's goals, resources and processes in order to address global and national challenges.

Pertaining to research trends on MOOC scholarship, the review indicated that sustainability as one of the least explored areas, albeit being the main concern of higher education worldwide. One of the prominent research conducted on MOOC was carried out by (YUAN & POWELL, 2013) and the top issue for MOOCs highlighted by the research is sustainability, followed by pedagogy, quality and completion rate as well as assessment and credit. Sustainability is one of major apprehension for global higher education. On top of that, a review conducted by (BOYATT, JOY & ROCKS, 2014) identified lack of evidence, lack of support and unrealistic expectations on beginner learners may lead to issues in MOOCs sustainability. Albeit several attempts studying various issues pertaining to MOOC such as educational, financial, technical and managerial issues, there remains paucity in MOOCs sustainability that has yet been closely examined. In the context of MOOCs, higher education needs to shift away from the focus of increasing the quantity of students in higher education to making a quality post-secondary education more cost effective. One of the main highlights of global higher education as it requires reassessment and realignment of the institution's goals, resources and processes in order to address global and national challenges. Due to its rapid growth in expediting access and cost to quality education worldwide, interests on MOOCs sustainability has escalated, but requires integration with a business model to further optimize its success in higher education.

2.3 Business Models for MOOCs Sustainability

A business model describes the rationale of how an organization creates and deliver values to the business (OSTERWALDER & PIGNEUR, 2009). From literature analysis, the needs of business model for MOOCs has been highlighted in many research pertaining to MOOCs in global higher education. Yet, there is a deficit on the development of business model for MOOCs, specifically that addresses the issue of sustainability. According to (MAZOUE, 2013), MOOCs will dramatically and irreversibly change the existing business model for higher education. Yet, viable business model that allows for sustainability of MOOC in higher education poses major challenge for higher education worldwide.

From literature analysis, business model for MOOCs has been highlighted in many researches pertaining to MOOCs in global higher education. Further studies by (KLOBAS, 2014) indicated that there finding a viable model that allows for sustainability of MOOC in higher education poses major challenge for higher education worldwide. (KALMAN, 2014) developed MOOCs business model where it comprises of three major factors : value proposition, infrastructure and financial. These factors are in tandem with a recent research conducted on MOOCs business models in higher education (BURD, SMITH & REISMAN, 2015) where it was revealed that value proposition is one of the pivotal factors apart from distinguishing financial and infrastructural aspects in MOOCs implementation in brick and mortar institution. In this context, the value proposition is catalytic in the reinforcement of branding of institutions as well as providing accessibility to quality education and narrow the knowledge gap.

3 Methodology and Design

For this study, qualitative approach is adopted to identify the factors for MOOCs Sustainability in Higher Education. Systematic Literature Review (SLR) as well as stakeholder analysis of MOOC are conducted to achieve the aforementioned aims. The qualitative research is conducted using Stakeholder Analysis. The research framework for the preliminary study is depicted in Figure 2.

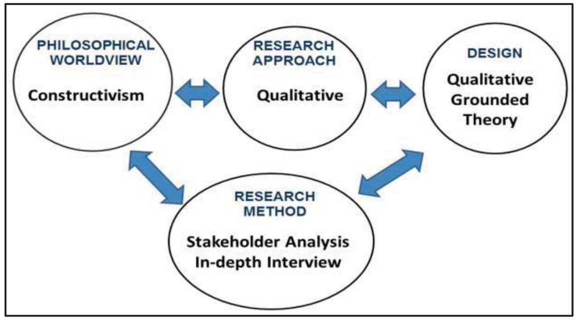

Figure 2: Research Design

4 Data Collection and Analysis

Stakeholder Analysis is chosen in order to study the roles of stakeholders and their influences on MOOCs Sustainability in Higher Education. The main aim is to facilitate divergent viewpoints from stakeholders on MOOCs sustainability. This method is chosen as the current needs of the stakeholders are addressed and potential strategies can be drawn from the synergy of viewpoints. There were ten in-depth interviews with semi-structured questions carried out with ten stakeholders in MOOCs for higher education where the interview was audiotaped and transcribed using qualitative data analysis software for qualitative data analysis. From the synthesis of the interview, a Thematic Concept Matrix is used to map the stakeholders' views on MOOCs Sustainability in Higher Education. From the Thematic Concept Matrix, nine elements have been identified based from the analysis conducted using qualitative data analysis software. The nine elements derived from four main factors; educational, institutional, technical and socio-cultural. This is then followed by three constructs adapted from Kalman's Business Model for MOOCs; value proposition, infrastructure and financial. Comprehensive data analysis on the in-depth interview led to the nine elements of MOOCs sustainability; product, service, market positioning, competitive advantage, organisation, core resources, technological architecture, value-added processes, source of income and revenue of income. The identified factors, constructs and elements are vital findings of this research on impacting MOOCs sustainability in Malaysian higher education. Table 2 depicts the classification of the factors, constructs and elements for MOOCs sustainability from the Malaysia MOOCs' stakeholders views.

Table 2. Thematic Concept Matrix on Stakeholder Views on MOOCs Sustainability in Higher Education

FACTORS AREA	VALUE PROPOSITION	INFRASTRUCTURE	FINANCIAL
Educational	Offer niche subjects. Multi-language MOOCs. Collaboration with top-tier institutions.	Develop course with good Instructional Design. Myriad learning resources. Meet the needs of users.	Free of charge MOOCs. Marketing gateway for potential international students.
Institutional	Marketing positioning via HE branding. Distinguish core competencies of HE. Promote quality of academics.	Policy management. Skilful instructors. Optimize operational management. Complement on-campus experience.	Viable business model. Government grants. Corporate partnership. Revenue through certification.
Technical	Wide accessibility to users. Expedite graduation process upon specific MOOC completion.	Ease of access. Optimum Wi-Fi connection for on-campus students. Efficient tech support.	Cost-effective technological architecture.
Socio-cultural	Zero or low cost of MOOC provision. Transferable MOOCs credit to degree. MOOCs courses that address industry needs.	Establish global networking. Expedite knowledge capital.	Expedite productivity and knowledge capital with lifelong learners.

5 Conceptual Business Model for MOOCs Sustainability in Higher Education

Based from the synthesis of SLR and Stakeholder Analysis, a Conceptual Business Model for MOOCs Sustainability in Higher Education is developed based from Disruptive Innovation Theory and Connectivism Theory that underpinned the business model. Inductive approach is chosen for the development of this business model. The reason

for developing business models is twofold. First, it is a pragmatic way for stakeholders to manage strategically-oriented choices in MOOCs sustainability in higher education. Secondly, it fills the gap of underdeveloped business model for MOOCs sustainability in a long run. Table 3 depicts the Constructs and Elements of MOOCs Sustainability in Higher Education.

Table 3: Constructs and Elements of MOOCs Sustainability in Higher Education

MOOCs Sustainability in Higher Education	
Constructs	**Elements**
Value proposition	Product Service, Market Positioning, Competitive Advantage.
Infrastructure	Organization, Core Resources, Technological Architecture, Value-Added Processes.
Financial	Source Of Income, Revenue Of Income.

For Value Proposition, the three main elements are Product Service, Market Positioning and Competitive Advantage. In the context of this research, Product Service refers to MOOC courses and complementary services such as guidance and tutorials. For Market Positioning, it refers to branding and marketing the institutions via quality courses as well as reputable academics. For Competitive Advantage, it refers to offering niche and in demand MOOC courses that would draw the attention of end-users to sustain their interest in undertaking the MOOC courses.

For the second factor, Infrastructure, the four elements are Organizational, Core Resources, Technological Architecture and Value-added Processes. Organizational refers to the administration of MOOCs by the policy makers at the respective institutions, followed by core resources which could be categorized to physical and human resources. Physical resources could be in the form of computers, Wi-Fi setup in the premise and servers while human resources refer to trained MOOCs trainers and instructors. Next is technological architecture that supports the technological maintenance and sustainability for MOOC in the respective institution of higher education.

Last but not least, value-added processes refer to the sociability aspects of the MOOCs processes such as tutorials, live-streaming chats, discussions, badges and certification.

The third factor for the Conceptual Business Model is financial which encompasses two elements; source of income and revenue structure. Hence, the MOOCs Sustainability Business Model aims to integrate all the factors and elements identified from the prior literature analysis and derived from the existing business models and literature reviews on MOOCs sustainability in perpetuating the current needs of global higher education effectively and efficiently. Figure 3 illustrates all the constructs and their elements that are integrated and synthesized to develop the Conceptual Business Model for MOOCs Sustainability in Higher Education.

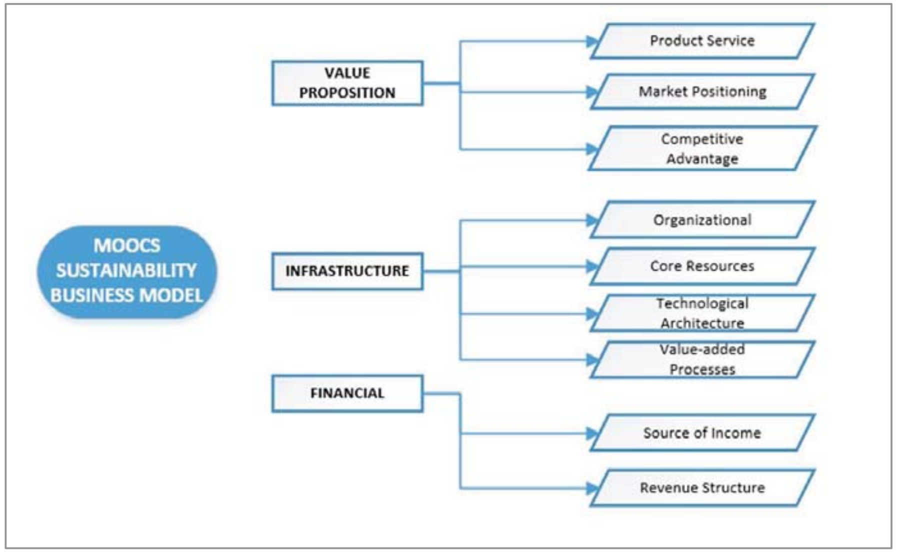

Figure 3: Conceptual Business Model for MOOCs Sustainability in Higher Education

6 Conclusion

Higher education has an eminent influence on expediting global knowledge capital via innovative initiatives such as MOOCs. MOOCs implementation has dramatically shifted the focus of higher education where it exponentially gained attention as one of the main drivers of global learning innovation in higher education. Due to the under-researched aspect of sustainability of MOOCs, this research is timely as it frames the pivotal impacts of streamlining the higher educational strategies in lieu with the stakeholders‘ needs in wider access to cost-effective quality education from highly reputable institutions. A viable business model for MOOCs sustainability for higher education is essential in offering customer value proposition, tangible and intangible benefits to end-users, apart from optimizing revenue stream. The future studies stemmed from this research will explore the stakeholders‘ views of the conceptual business model for MOOCs sustainability in order to optimize competitive advantage to both institutions and end-users. Hence, the conceptual Business Model is hoped to propagate the knowledge capital, wielding it to expedite value and of higher education beyond physical, financial and demographic barriers.

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The MOOC Production Fellowship: Reviewing the first German MOOC funding program

Anja LORENZ

Lübeck University of applied Sciences, Institute for Educational Services, anja.lorenz@fh-luebeck.de

Abstract

With the MOOC production fellowship, the Stifterverband and the MOOC platform iversity started a first funding program in Germany particularly for MOOCs. 10 MOOC projects were chosen out of more than 260 applications and got a funding of 25,000 € each. Two years after, an evaluation of the program's success was conducted via online-surveys and interviews. Next to a complete survey of all fellows, also non-winning applicants were asked to share their experiences and positions. Despite the funding program, further investments i. e. time and personel effort was needed with a wide range of success: some institutions continued with further MOOC initiatives, others did not support the fellows at all. The funding program increased the recognition of MOOCs and their potential to open up higher education, but also disclosed the need of further technical and conceptual support and research on good practices.

Keywords

MOOC Production Fellowship, funding program, Germany

1 Introduction: The MOOC movement in German countries

As in many countries, MOOCs in Germany first appeared as initiatives by single persons or groups. They recognized the US-driven trend and offered their recorded lectures or complete online courses on platforms open to everyone. During this first stage, they had often used US platforms.

In 2013, the *Stifterverband für die Deutsche Wissenschaft* (translated: Donors' association for the promotion of humanities and sciences in Germany) and the German MOOC platform provider *iversity* launched a contest on the *MOOC production fellowship*. With the help of the funding (endowed with 25.000€ as well as technical and conceptual support), 10 MOOC projects were realised.

Two years later, this paper looks back on the results of this first German funding program, on the experiences of the MOOC production fellowship and also on the experience of those who did not win the contest. Therefore, section 2 introduces the MOOC production fellowship program and the research method of this study. Section 3 summarises results and will also focus on the questions, if, why and how MOOCs should be funded – or not. Finally, a summary and outlook is given in section 4.

2 Foundations: Reviewing a funding program

2.1 The MOOC production fellowship

The funding program was initiated by the *Stifterverband* and *iversity* to stimulate the development of innovative concepts for MOOCs und thus give an impulse for digital change in higher education (MOOC PRODUCTION FELLOWSHIP, 2013a). Therefore, the awarded course needs to be offered for free, should meet academic standards, and the applicants or at least one person of their team have to be an "assistant, associate or full professor at a university or college" (ibid.). Each fellowship receives a budget of 25,000 € to realize the MOOC, further conceptual support by workshops and technical support to publish the MOOC on the *iversity* platform.

After the application deadline on 3rd April, 2013 and more than 260 submissions, the videos of the course concepts were presented at the website of the contest. A voting stage from 1st to 23rd May, 2013 was initiated to "give an early feedback about the potential demand for the course idea" (MOOC PRODUCTION FELLOWSHIP, 2013a). Finally, a jury (MOOC PRODUCTION FELLOWSHIP, 2013b) made the final decision and chose the following courses for winners of the contest[1] (titles were translated into English; offered languages are named in brackets):

- International agriculture management (German, Russian)
- The future of storytelling (English)
- Section chirurgica – anatomy interactive (German)
- Changemaker MOOC – social entrepreneurship (German)
- Mathematical thinking and working methods (German)
- Fascination of crystals and symmetry (German)
- Europe in the World: Law and Policy Aspects of the EU in Global Governance (English)
- Monte Carlo Methods in Finance (English)
- Design 101 (English)
- DNA – from structure to therapy (English)

The MOOCs had been produced and were published in winter term 2013/14 and summer term 2014. There was a continuous conceptual and technical support by the Stifterverband, iversity and not at least by the network of the fellows.

[1] All Trailers, MOOC authors and author teams, links to the MOOCs and further information can be found at https://moocfellowship.org/ [06.10.2015]

2.2 Research Design

To review the funding program, gather lessons learned but also statements on the future perspective of MOOCs, the MOOC production fellowship program was evaluated after two years. On the one hand, each team that won the fellowship contest was asked

1. to provide relevant objective numbers in an online survey, such as number of participants, weeks for preparation or issued certificates,
2. to share the experiences of their MOOC production team (i. e. concerning the application process, the MOOC production, its recognition and sustainability) in a guided interview via web conference of phone with one representative person of each team, and
3. to express their personal view on the future development of MOOCs as a final statement via email.

A second online survey was sent to those applicants who did not win the fellowship contest. The aim of that questionnaire was to figure out, if they also had the possibility to realise their MOOC concept, e.g. by alternative financial support. The questionnaire contained various questions depending on the answer if the MOOC could be realised or not, either similar to those for the fellows (e. g. on realisation or opinion on the overall potential of MOOCs), but also on barriers if they did not realise their concept. To get a deeper insight, answers in free text had been clustered and grouped into categories.

Periods and response rates of the evaluation can be found in table 1.

Table 1: Research Design: Evaluation period and responses

	MOOC production fellowship	further applicants
online survey	05.07.–05.08.2015	10.08.–07.09.2015
guided interviews	07.07.–12.08.2015	–
final statements per email	since 18.08.2015	–
total amount	10	ca. 260
number of responses	10	41
response rate	100%	15.77%

3 Results

3.1 The funded MOOCs by numbers

As mentioned in section 2, each MOOC received a funding sum of 25,000 €. There were more than 260 submitted course concepts for the contest, 10 of them won the funding.

To *summarise* the fellowship program by numbers, the fellowship teams consists of 109 MOOC making persons, including all teachers, media developers, student tutors etc. (range from 4 to 20). In addition to the regular MOOC duration time, 95 weeks of preparation (from 8 to 30) and 50 weeks of follow-up (1 to 20) were needed for all 10 MOOCs. They reached a total amount of 224,446 participants (1,500 to 93,018), which is more than the number of students of the 4 biggest non-virtual universities in Germany (191,646 students, STATISTISCHES BUNDESAMT, 2015, p. 39), 6,921 (from 0 to 4,454) of all MOOC participants in the fellowship MOOCs received a certificate (3.1%).

8 of the MOOCs are still accessible [August 2015], 6 of them had been already repeated at least once, and 1 further MOOC plans a repetition.

3.2 Making MOOCs

In guided interviews by phone or web conference, the one representative of each MOOC team was asked to describe experiences in realising a MOOC (numbers in brackets indicate the number of interview partners that mention the appropriate fact; N=10).

As the *funding* was meant as an initial one that needs to be complemented by estimated another 25,000 €, the fellows where asked for total investments to realise the MOOC. All of the interview partners (10) had difficulties to answer the question: They did not spend further "real" money for the production but a high amount of uncounted hours of extra work, also on weekends or holydays. Most were supported by their institutions, i.e. they could use their regular working time and infrastructure to produce the MOOC – but there were also answers where the realisation of the MOOC was not supported by the university or college at all. Some (3) could use further money from other funding projects, 2 got extra resources by their institutions, e.g. financing student tutors.

The fellows primarily reached academics (3). Whereas 3 of the courses focused a much specialised *target group*, 2 stated that they did not directly involve their own students. Half of the interview partners (5) also recognised that they reached interested non-professionals of all ages (Math MOOC: from 14 to 80) that did not meet their usual target group.

Regarding the *sustainability*, 6 of the 10 MOOCs have already been repeated at least once (3 of this on iversity, another 3 on different platforms). 3 of them are archived on iversity, only 1 is not accessible anymore. As reasons to repeat the MOOC, the representatives mentioned the sustainability of efforts and investments (4), the integration within regular (teaching) projects (3), the reuse in other courses (1), the range and success of the first run (1) and overall improvement by repetition (1).

Overall, the fellows appreciate the MOOC projects as an important *experience* also to reflect their own in-class teaching. But some (2) also doubted that the concept of "massive" is appropriate for higher education, also towards the students sitting in their classrooms.

Within the interviews, the fellows also had the chance to report very personal experiences that cannot be described in this article in detail. E. g. one representative reported the story of a participant of the MOOC "Monte Carlo Methods in Finance" that stated that (s)he cannot follow the MOOC because of high demands on knowledge in maths, so (s)he was doing another MOOC on maths in order to return to the fellowship's MOOC with better previous knowledge.

3.3 Beyond the funding program: Stories of non-funding

13 of the 42 responding *persons or teams that did not win the fellowship contest were able to realise their MOOC* by alternative funding possibility, like other project funding e.g. by their federal state (6 | 46.1%), own resources that often means additional workload and -time (4 | 30.8%) or budgetary resources (2 | 15.4%; 1 did not make any remarks on financing). They invested from 0 € (but more than 1,600 hours of work and infrastructure) up to 250,000 € for a whole MOOC curriculum. Next to these both extremes, the other responses estimated investments from 5,000 to 50,000 € per MOOC.

Out of the 22 responding persons that did not realise their MOOC after they did not win the contest, 10 tried to get further funding, but did not received sufficient support (8) and resources (2). The reasons for the respondents that did not try to realise the MOOC anyway were the workload of other projects (4), missing support (2), missing motivation (2), or the realisation as a blended learning course (1).

3.4 Outlook: Shall we fund MOOCs?

All in all, the fellows (N=10) received good *feedback* from their own institutions (6), winning the content gave them much attention (4) and they also could encourage the discussion on MOOCs and eLearning in general at their institution (2). 2 of the institutions even did or plan to do further MOOCs. But there were also some fellows (4) who reported no or only few interest in the MOOC by their institution (4). 2 also stated that their own students felt uncertain concerning the relevance of the MOOC for their exams.

Both groups, the fellows and the persons and teams that did not win the contest (N=52), were asked if they would participate in a similar competition again (cf. fig. 1) and if MOOCs should be supported in general by institutional and university administrators, political and/or NGO actors (cf. fig. 2). Particularly surprising: there were also fellows that answered with "no" to these questions.

Asking the ones that answered with "yes" or "maybe" why MOOCs should be supported, the reasons mentioned were: opening up higher education (6), promote open educational resources in general (4), gain more experiences with this format (4) and because MOOCs were seen as a teaching scenario of the future (1). Reasons against further public support were: the estimated reduction of teaching budget for universities and colleges (2), the very high production costs of MOOCs (2) or because it was not seen as a social task for public funding (2).

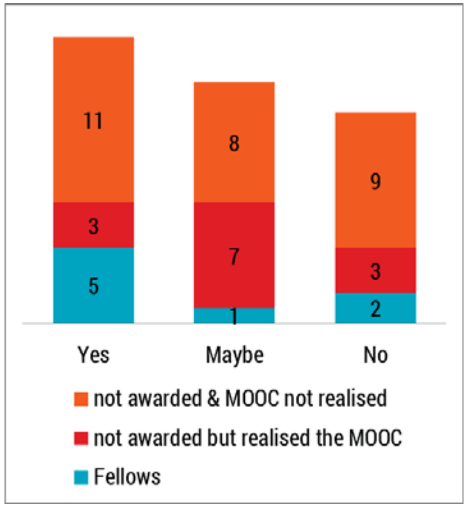

Figure 1: Would you participate again in a similar competition today? (N=52)

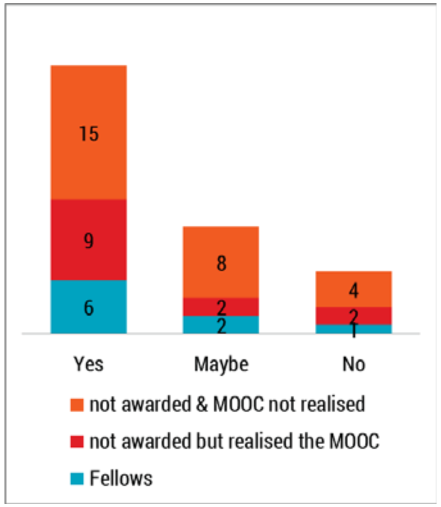

Figure 2: Should institutional and university administrators, political and/or NGO actors (e.g. foundations) promote and support MOOCs in general (more than they did until now)? (N=52)

Finally, all persons or teams were asked how to support MOOCs. Most ones (13) answered, that the production of MOOCs needs to be recognised as regular teaching time for lecturers. Of course, financing MOOCs (12) and supporting the production process (12), i.e. improving IT services at universities or colleges (11) were also recognised as important. Further but less mentioned means to support MOOCs in higher education are: recognition of teaching as academic performance (5), sharing best practices (2), encourage cooperation (2), improve legal position for teaching (2), further training for video production (2), development of sustainable concepts (1), international evaluations (1), information campaigns for decision-makers (1) and a general political commitment to OER (1)

4 Summary and Outlook

The MOOC Production Fellowship program was the first funding campaign for MOOCs in Germany. Two years after, the review of the program should contribute to the discussion of the position and perspectives of MOOCs in higher education. Therefore, not only costs and participation success of the fellows' MOOCs where measured, also the applicants that did not win the contest where asked if they could realise it anyway. As a final step, the personal estimations on the question if MOOCs should be financed by public funding demonstrate the multiple views and reasons.

In many points, MOOCs are facing the same problems as teaching in general: the costs and efforts needs to be recognised more to make them attractive for actors in higher education. MOOC makers need more time, budget, competences and infrastructure to realise MOOCs whereas they are mostly rated by research success. This dilemma was just recognised in the Horizon Report 2015, were rewards for teaching are seen as wicked challenge of the next years (JOHNSON et al., 2015, p. 2).

5 Acknowledgements

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[2] Conference website and documentation: http://hochschulforumdigitalisierung.de/moocs-and-beyond-%E2%80%93-eindr%C3%BCcke-und-ergebnisse-eines-experiments-8-september-2015

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Are higher education students registering and participating in MOOCs? The case of MiríadaX

Laia ALBÓ, Davinia HERNÁNDEZ-LEO & Miquel OLIVER

Universitat Pompeu Fabra, Spain,
{laia.albo, davinia.hernandez, miquel.oliver}@upf.edu

Abstract

Most MOOCs offer open learning opportunities at Higher Education (HE) level. However, it is still unclear how HE students are taking this type of course. This study focuses on the profile of HE students participating in MOOCs, their registration, preferred topics and completion patterns and how they compare to other types of participants. The paper presents a descriptive analysis of the MiríadaX platform data up to the end of 2014, including an analysis of 144 courses and 191,608 participants. Results indicate that current HE students, who are mostly Latin American and Spainish males interested in technology subjects, register for and complete lower numbers of MOOCs than participants who have already completed their HE studies. HE students older than standard ages have a significant presence in MOOCs and have higher numbers of MOOC registrations and completitions.

Keywords

MOOCs, MiríadaX, higher education, student profile, data-driven analysis

1 Introduction

Many universities have opened up courses to diverse target groups by delivering them in Massive Open Online Course (MOOC) platforms (KOVANOVIC, JOKSIMOVIC, GASEVIC, SIEMENS & HATALA, 2015). This is generating increasing options for the population to organize their learning, which some authors argue can lead to disruption in Higher Education (HE) (JANSEN & SCHUWER 2015; SANCHO, OLIVER & GISBERT, 2015; BOVEN, 2013). This situation poses research questions to better understand the social phenomena behind MOOCs so that data-based consideration may be made on their potential future implications and the elaboration of strategies at the level of HE institutions, MOOC platforms, educational policy makers, and so on (SIEMENS, GASEVIC & DAWSON, 2015; JORDAN, 2014).

In particular, this paper examines the extent to which HE students are taking MOOCs in addition to their formal learning courses at their universities. While only few MOOCs are recognized with credits by particular institutions (JANSEN & SCHUWER 2015) or used in a blended learning approach in residential universities (ALBÓ, HERNÁNDEZ-LEO & OLIVER, 2015; DELGADO KLOOS et al., 2015; ADONE et al., 2015), most MOOCs represent informal or non-formal learning actions to the participants (JANSEN & SCHUWER, 2015). This line of research can provide society and universities information about the profile of HE students actually interested in additional courses, the subject areas of those courses and their completion rates (YUAN & POWELL, 2013). Moreover, MOOC providers and platforms could benefit from understanding the behaviour of these specific segment of their participants, when compared to other types of participants (e.g., participants not involved in HE and without a degree or participants having completed a degree), to personalize course recommendation or support decisions on the creation of new MOOCs (SIEMENS, GASEVIC & DAWSON, 2015).

The paper aims to answer the following research questions:

R1) What is the profile of the typical higher education student involved in MOOCs?

R2) What is the average number of MOOCs that higher education students register? How this average number compares to other MOOC participants?

R3) What is the average number of MOOCs completed by higher education students? How this compares with other MOOC participants?

R4) What are the thematic selected/registered by higher education students? How this compares with other MOOC participants?

To answer these questions, the paper uses data from the MiríadaX platform which is the main Spanish MOOC provider, promoted by Telefónica, Universia and Banco Santander (MIRÍADAX, 2013). MiríadaX offers MOOCs since 2013, most of them in Spanish, and only few are in Portuguese and English. The data used for the analysis has been provided by Telefónica Digital Education to the authors in the context of the Cátedra Telefónica-UPF (CÁTEDRA TELEFÓNICA-UPF, 2013).

The remainder of this paper is structured as follows. Section 2 describes the methodology followed to analyse the data. Results presented in Section 3. Finally, Section 4 includes the main conclusions of the study.

2 Methodology

This study is based on a quantitative analysis from MiríadaX data regarding 144 MOOCs which were completed in late 2014. The analysis combines data from two datasets (participants and courses) and applies descriptive statistics to offer results for each research question. Data from participants is provided by two data sources. On the one hand, from the questionnaire which participants respond voluntarily when registering to the MOOC platform. These data include the country of origin, gender, age and education information. On the other hand, data provided automatically by the platform in log files: the number of MOOCs registered and completed for each participant as well as in which courses they have enrolled in. Regarding the data from the courses, the information available refers to the course description, including dates, number of enrollment, and topic.

The global numbers of the two databases offer data from 191,608 participants and 144 courses. Despite this, it has to be taken into account that the final sample changes in the case of the participants data, because part of the information is obtained from a voluntary questionnaire with the following final figures: Country of origin: 94,844 participants have replied (32% of all); Gender: 53,455 participants have replied (18,33% of all); Age: 50,734 participants have replied (17.40% of all); and Education: 48,629 participants have replied (29,94% of all).

3 Results

In this section, the results related to three main themes are discussed: (1) the profile of higher education students involved in MOOCs; (2) the average number of MOOCs that each student registers for and completes, as well as completion rates; and (3) the subject area preferences of higher education students compared to other types of participants.

3.1 Profile of higher education students involved in MOOCs

The majority of the higher education (HE) students taking MOOCs in the MiríadaX platform are male, at 62.06% of the total (Figure 1). This proportion reflects the overall distribution by gender of users of the MiríadaX platform, which is 60.70% male and 39.30% female. This same trend is also observed in the case of the Coursera platform, where females constitute 40% (PIERSON & CHUONG, 2014). Moreover, regarding differences by age, the percentage of males is higher than that of females in all cases (Figure 1).

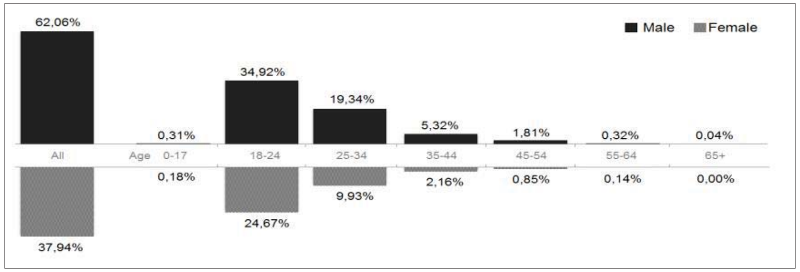

Figure 1: HE students registered in courses by age and gender (N=13.692)

The most common age of higher education students involved in MiríadaX courses is 18-24 years (59.59%). This is an expected result because it is the typical age range for studying at university after completing high school. Despite this, it is worth noting that there are also older higher education students enrolled in MOOCs: 25-34 years (29.27%), 35-44 years (7.48%) and over 45 years (3.16%).

Table 1 shows the number of total higher education students enrolled in MiríadaX courses by their country of origin. The students come from 79 different countries, but mainly from Spain (41.01%) and Latin America (57.5%). The table only shows the specific data of the most common 24 countries since the remaining ones each contributed less than 0.10% of the participants. The Latin American countries with the most students enrolled in MiríadaX are Colombia (16.03%), Mexico (9.87%) and Peru (7.49%). However, Peru has the highest number of MOOC enrollments per student (4.9) while Colombia has the lowest (2.42). The high proportion of Spanish and Latin American HE students in MiríadaX courses is determined by the languages in which the platform offer MOOCs, with Spanish being the principal one.

Table 1: HE students enrolled in MiríadaX MOOCs and registrations per student by country of origin

	FREQ.	CUMUL. FREQ.	%	CUMUL. %	MOOCs REGIST. /STUDENT	SD
Spain	10.690	10.690	41.01	41.01	3.93	5.46
Colombia	4.178	14.868	16.03	57.04	2.42	3.60
Mexico	2.574	17.442	9.87	66.91	3.59	5.48
Peru	1.952	19.394	7.49	74.40	4.90	6.48
Argentina	1.108	20.502	4.25	78.65	3.11	3.96
Venezuela	912	21.414	3.50	82.15	3.66	6.71
Ecuador	782	22.196	3.00	85.15	3.12	4.46
Chile	697	22.893	2.67	87.82	3.55	5.24
Brazil	635	23.528	2.44	90.26	2.76	4.12
Dominican Repub.	406	23.934	1.56	91.82	3.09	3.58
El Salvador	329	24.263	1.26	93.08	2.88	3.88
Guatemala	276	24.539	1.06	94.14	3.61	4.33
Bolivia	189	24.728	0.73	94.86	4.72	6.23
Uruguay	189	24.917	0.73	95.59	3.59	5.18
Costa Rica	185	25.102	0.71	96.30	3.17	3.80
Paraguay	154	25.256	0.59	96.89	3.97	4.85
Honduras	146	25.402	0.56	97.45	2.61	2.91
Nicaragua	120	25.522	0.46	97.91	3.11	3.86
Portugal	107	25.629	0.41	98.32	3.64	5.61
Puerto Rico	101	25.730	0.39	98.71	2.55	2.77
Panama	55	25.785	0.21	98.92	3.69	5.38
United States	39	25.824	0.15	99.07	3.31	4.46
France	28	25.852	0.11	99.18	2.75	3.13
Germany	27	25.879	0.10	99.28	4.19	4.51
55 countries	<25/country	26.067	<0.10/country	100	---	---
TOTAL	26.067	---	100	---	---	---

3.2 Number of MOOCs

In this section, three indicators are analysed in relation to HE students taking MOOCs on the MiríadaX platform: the average number of courses enrolled per student, the average number of courses completed per student, and finally, the ratio between courses completed and courses registered for per student.

The results show that on average, HE students register of 3.56 courses each and complete on average 0.55 courses (Table 2). The results are similar to other types of participants on the MiríadaX platform, though one can note that participants without university degrees are enrolling in and completing fewer courses per student (2.81 and 0.46, respectively). Participants who already hold university degrees, professors, researchers, and university support and technical staff tend on average to register for similar numbers of MOOCs, but their average completion rate is higher than that of HE students.

The third indicator in Table 2 also supports this finding. Participants without university degrees complete 11.84% of the courses they enroll in, while HE students complete on average 12.87%. Results are higher for the other types of participants: while professors or researchers complete 15.50% and university staff 16.27% of the courses they register for, those participants with university degrees (not including professors, researchers, and university support staff) have the highest completion rate (19.88%).

Table 2: Average number of MOOCs registered for and completed per HE student and completion rates per HE student compared that of other types of participants

	TYPE OF MIRÍADAX PARTICIPANTS				
(Averages)	HE student	Without university studies	With university studies completed	Professor or Researcher	Uni. support / technical staff
MOOCs registered / HE student	3.56	2.81	3.40	3.69	3.41
MOOCs completed / HE student	0.55	0.46	0.81	0.71	0.70
Completion rate / HE student (%)	1.87	11.84	19.88	15.50	16.27

Table 3 breaks out these three indicators of HE students by gender and age. The results do not revel significant differences by gender: males on average enroll in 3.84 courses and finish 0.58; while females enroll in 3.69 and finish 0.54 courses. Completion rates show similar patterns for both genders.

Table 3: Average number of MOOCs registered for and completed per HE student and completion rates per HE student (by gender and age)

	GENDER		AGE		
(Averages)	Male	Female	0-24	25-44	44+
MOOCs registered / HE student	3.84	3.69	3.55	4.06	4.51
MOOCs completed / HE student	0.58	0.54	0.46	0.70	1.21
Completion rate / HE student (%)	11.39	11.77	10.33	13.31	19.84

In contrast, clear differences can be noticed between different age groups. Older HE students are enrolling in more courses than younger ones, as well as finishing more courses and having higher completion rates. All three indicators show higher values as the age of HE students increases. HE students below the age of 24 enroll in an average of 3.55 courses and have a completion rate of 10.33%. Students from 25-44 register for 4.06 courses per student and have a completion rate of 13.31%. Finally, students older than 44 register for the highest number of MOOCs per student (4.51) as well as have the highest completion rate (19.84%). It is necessary to point out that a limitation of this analysis is that it ignores the registration date of participants on the platform. The omission of this information may be introducing a bias in results; this bias should be considered in the interpretation of data and will be considered in future analyses.

3.3 Course subject preferences of higher education students

Figure 2 shows the number of registered participants by subject area of the courses offered by MiríadaX – the course subjects used in the analysis are those defined by the MOOC platform. To sort the different subject's areas on the horizontal axis it has taken as a reference the percentages of HE students per subject area – these are ordered from highest to lowest percentage of registrations of this type of participant, therefore, from highest to lowest preferences of this particular group.

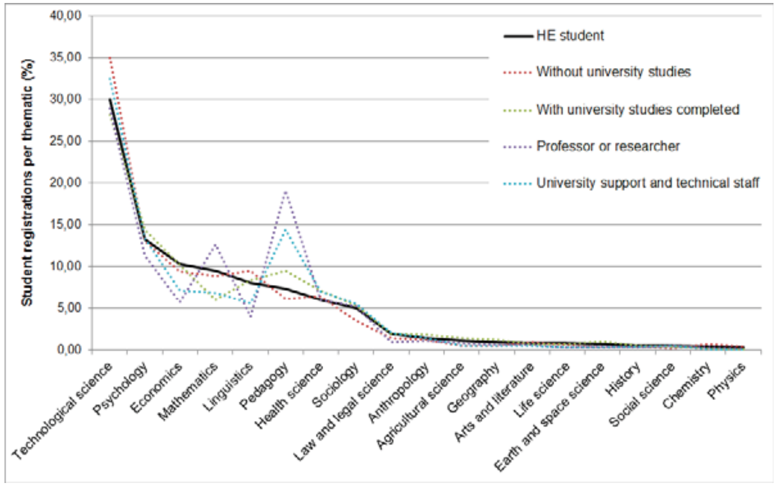

Figure 2: Distribution of registrations per courses' subjects by types of participants

The subject area preferred by HE students is technological science (30%), while the second is psychology (13.27%) and in the third place economics (10.39%). The following are mathematics (9.52%) and linguistics (8.09%). Participants who have finished university degrees share these first three preferences although with different percentages (28.17%, 14.47% and 10.21% respectively). Technological science is also the subject area with the highest percentage of registrations by the rest of types of participants, and chemistry and Physics the less demanded by all participants' types.

Professors or researchers differ to HE students in showing notable preferences in pedagogy (19.09%) and mathematics (12.69%) areas. They also show lower levels of preferences for economic courses and linguistics. Furthermore, pedagogy is also being remarkably preferred by the university support or technical staff, and by the participants with higher education degrees completed.

After analysing the student preferences and differences with other participants, it is also studied how distributed these groups are within each subject area (Figure 3). One of the first results from this graph is that although being physics the subject area less preferred by the HE students, it presents the highest percentage of this type of participants in its registrations distribution – 44.69% of the participants of physics courses are HE students. In addition, in the others subject areas HE students represents less than 40%, being pedagogy the subject area least represented by this type of participants (21.87%), as previously mentioned.

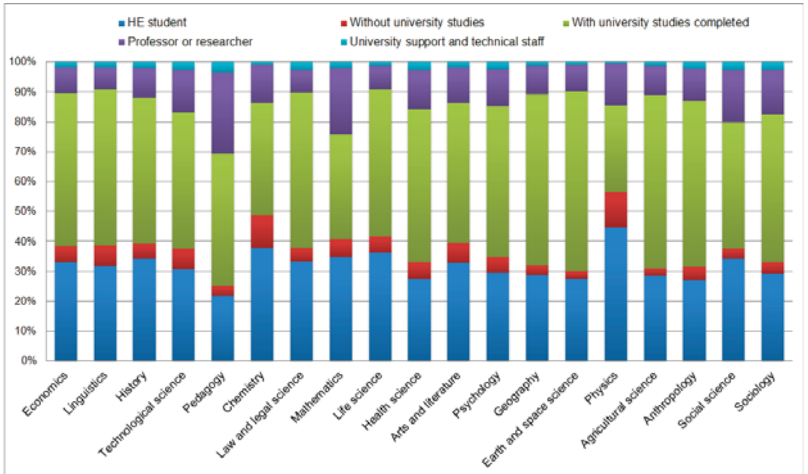

Figure 3: Distribution of the course participants within each subject area

Finally, in order to contextualize the above results, it is necessary to consider the number of courses offered by the platform in each subject area to understand if the number of registrations has been influenced by it. In this way, figure 4 shows the number of participants' registrations per thematic normalized by the number of MOOCs offered per each subject area. Therefore it is showing a visualization of courses offered against demand depending on the type of participants. Behavior among different groups of participants is quite similar for most categories. Differences are found, in the area of pedagogy where the demand by the group of professors or researchers is higher than in HE students. In this graph it can be also observed if the different subject areas are balanced in relation to the courses offered and the number of participants enrolled in. Aligned with this, linguistics, psychology and earth and space science present a higher "saturation" as they have the highest numbers of participants' registrations per course (4.273, 2.707 and 2.282 participants/course respectively). At the same time, physics and chemistry present the lowest ratio (320 and 335 participants/course respectively).

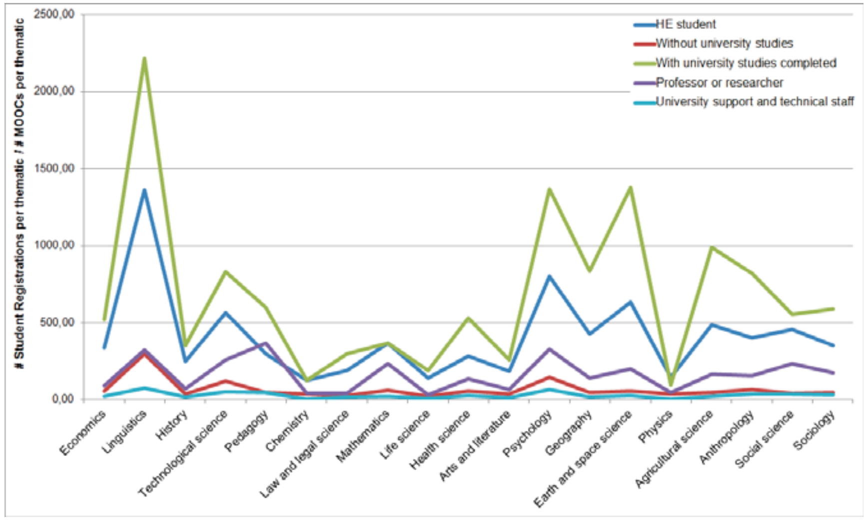

Figure 4: Registrations per topic normalized by the number of MOOCs per subject

4 Conclusions

The obtained results answer the research questions raised in the introduction. Regarding the profile of HE students involved in MiríadaX MOOCs (RQ1) (data collected since MOOCs started to be published in MiríadaX in 2013 up to the end of 2014), results show that there is a majority of male (60.70%) in a range of 18-24. Interestingly enough, there is an important number of HE students participating in MOOCs with ages as from 24 (40%). Most HE students are from Latin American countries (57.5%) and Spain (41.01%).

Concerning the average number of MOOCs that HE students register for and complete, and how this compares to other types of MOOC participants (RQ2, RQ3), we can say that HE students register for on average of 3.56 courses completing only 0.55 courses (similar pattern when comparing men and women). Though results show a similar trend for the other types of participants, participants without HE degrees register for and complete a slightly lower number of courses, and participants with a HE degree register for and complete a higher number of courses. Interestingly, HE students as from 24 years old register for and complete more MOOCs than standard-age HE students.

Finally, with respect to the topic registered for by HE students and how this compares with other participants in MiríadaX (RQ4), it is interesting to see that MOOCs in the technological science subject area, followed by psychology and economics, show higher percentages of registrations for all types of participants. Professors or researchers differ to HE students in showing notable preferences in pedagogy (19.09%) and mathematics (12.69%). In the physics subject area, HE students represent the highest percentage of types of participants registered.

Overall, we can conclude that HE students are taking MOOCs following a pattern of registration and completion of MOOCs in between participants without HE studies (lower numbers) and with HE studies completed (higher numbers). Within the collective of HE students, those more active are older than 24, representing profiles of stronger intrinsic motivation to learn or to improve their professional competences. One interpretation is that MOOCs are generally perceived as useful lifelong learning opportunities and not that much as a resource (comparable e.g. to books) that can support the HE curriculum. The particular result for the case of physics subject may be explained by a use of these MOOCs as remedial (level O) courses for freshmen at universities (DELGADO KLOOS et al., 2014). The recent initiatives on the use of MOOCs to support blended educational approaches (ALBÓ, HERNÁNDEZ-LEO & OLIVER, 2015) may influence the future evolution of the trends identified in this paper.

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What Questions are MOOCs asking? An Evidence-Based Investigation

Eamon COSTELLO[1], Mark BROWN[2] & Jane HOLLAND[3]

[1] **National Institute for Digital Learning, Dublin City University, {eamon.costello, mark.brown}@dcu.ie**

[2] **Royal College of Surgeons in Ireland, jholland@rcsi.ie**

Abstract

Multiple Choice Questions (MCQs) are a core building block of many MOOCs. In this exploratory study we analyze a sample of MCQs from a number of MOOCs and evaluate their quality. We conducted this analysis using a framework informed by a body of empirical research, which describes several common flaws that may occur in the way MCQs are written or phrased. Studies have shown that the presence of these flaws are likely to compromise the reliability and validity of tests containing these MCQs, potentially leading to poorer pedagogical outcomes. Through our study we contribute to the broad debate of whether MOOCs are a force that can enable enhanced and improved pedagogies or whether they will be susceptible to replicating existing poor pedagogies or practises at scale.

Keywords

MOOCs, Multiple Choice Questions, Tests, Quality

1 Introduction

Multiple Choice Questions (MCQs) are ubiquitous in education. They are present in all disciplines, but perhaps more so in STEM and more quantitative areas. They have a long and established history in medical education where an extensive body of literature exists regarding their use (SCHUWIRTH & VAN DER VLEUTEN, 2004). In addition to their use in high stakes terminal examinations, tests (or quizzes) incorporating MCQs are also frequently used in formative assessmenta. They may be used in conjunction with Classroom Response Systems, or within innovative peer assessment systems such as Peerwise, which enables the development of student generated learning tools and peer assessment via MCQs (DENNY, HAMER, LUXTON-REILLY & PURCHASE, 2008).

Currently, MCQs are a key component of many (x)MOOCs. The results that learners receive from these MCQ tests may contribute to their summative assessment grade, and so ultimately towards the certificate or credentials that they receive by MOOC completion or participation, whether this be formal or informal in nature. Given the important role that MCQs may play in MOOCs, the question then arises as to their psychometric quality.

There is a large body of research literature specific to the quality and psychometric properties of MCQ examinations. Two key concepts described within this evidence-base are reliability and validity. When we ask how reliable some measurement tool is we are essentially asking whether if we take several measurements with that tool under similar conditions we would get similar results. The overall reliability of an MCQ assessment, and the performance of individual items within, can be evaluated by models such as Classical Test Theory. In addition to evaluating the reliability of the overall test score, this theory also enables the evaluation of individual questions, by means of item analysis (DE CHAMPLAIN, 2010). This typically involves calculating parameters that indicate whether particular questions are of poor quality, such as item difficulty, or item discrimination (DE CHAMPLAIN, 2010). Such problems may be the result of flaws in the construction or writing of the MCQs (Downing, 2005). For example, various factors can affect the reliability (or repeatability) of an MCQ. If the question posed by an MCQ is incomprehensible to students then they will effectively have to guess – meaning the answers are random. An MCQ that is reliable gives consistent results and we can then ask whether those results are valid – i.e. whether it is testing something meaningful. As a further example, a valid instrument may be expected to discriminate between students of high ability and those of low ability. Therefore, an MCQ which is trivially easy, or too guessable, and which could result in all students getting the same answer regardless of inherent ability, might be described as being *invalid*, or unfit for the purpose of discerning a student's true ability.

There has been some exploratory research into the Quality of MOOCs (LOWENTHAL & HODGES, 2015; MARGARYAN, BIANCO & LITTLEJOHN, 2014). However, this research has not examined MCQs (a key component of MOOCs) in any way. In this study we sought to determine whether a sample of MOOC MCQs exhibited any of the commonly described item writing flaws. Our study makes an important contribution by addressing this gap in the MOOC research literature, and by exploring questions regarding the quality of MCQs in MOOCs. This issue is critically important if MOOCs are to fulfill aspirations to deliver formal learning that can contribute towards recognized awards.

2 Methodology

2.1 Sampling strategy and data collection

Our aim was to evaluate a range of multiple choice questions, sampled from MOOCs that were in English, and primarily in domains where the principal evaluator had expertise. Expertise can be important in determining certain criteria of question quality, however several criteria do not require in-depth expertise and many require none. A survey of existing platforms, aggregators and published research (MARGARYAN, BIANCO & LITTLEJOHN, 2014) revealed approximately 300 eligible courses for our purposes and 12 of these were selected at random from a weighted distribution of the relative spread across the platforms of EdE/X, Coursera, Futurelearn, Iversity and Eliademy. This resulted in 8 courses in the area of Computer Science and one each from Humanities, Medicine and Health, Psychology and Mathematics. Most courses were delivered in collaboration with universities partners, with the exception of two, one of which was from an individual and the second from a non-profit Institute.

Data collection was labor intensive and somewhat complicated, in that each question and all of its options had to be manually copied and pasted from the relevant MOOC quiz into a spreadsheet, which then acted as a data store. Moreover, the correct answer then needed to be determined – which in some cases proved a difficult task. It was originally intended to take ten questions randomly from each of the selected courses; however in some cases the correct answer to a given question could not be determined, or the information could not easily be extracted, and so ultimately it was not possible to collect ten questions from all courses selected. Therefore, in order to maintain our sample size, extra questions were collected from other courses so that in total 116 MCQs were collected (average 9.6 MCQs per MOOC), for which the correct answer (or answers) were determined and recorded (and by corollary the incorrect options). In all this resulted in the collection of 475 data points for analysis.

2.2 Procedure and Instrument

There are various frameworks and guidelines which may be used in order to evaluate the quality of MCQ items and examinations. Guidelines may range from simple five item rubrics (DENNY, LUXTON-REILLY & SIMON, 2009; PURCHASE, HAMER, DENNY & LUXTON-REILLY, 2010) to extensive manuals such as that from the US National Board of Medical Examiners (CASE & SWANSON, 2003). For our study we selected a tool which describes 19 item-writing flaws, and which has previously been used within the context of Health Professions Education (TARRANT, KNIERIM, HAYES & WARE, 2006). In addition to the benefit of utilising an existing, validated framework, we wished to use a tool with the potential to facilitate some comparability of our findings, albeit within a different context.

2.3 Data analysis

The full list of item-writing flaws is given in the results section below (Table 1), but for the purpose of describing our method of analysis, we can divide them into two broad categories: the first are those that can be calculated quite simply and the second are

those that require the qualitative review of a human evaluator. Those that may be identified by means of simple calculation include; long correct option, option position and inclusion of options such as *"all of the above"*. For instance it has been shown that the longest option provided within an MCQ is frequently the correct one. This is due to a cognitive bias of (untrained) question writers who first compose the correct answer, which they may take due care in doing, and then later the distracters (incorrect options) which they spend less time and attention on. The length of the options was simply calculated by counting the character length of each programmatically. The number of the options and the number of correct options were computed in a similar manner, as was the position of the correct option. Once again, the available evidence-base suggests that the third (of four options) is most frequently the correct one. The strings of *"all of the above"* and *"none of the above"* were programmatically detected, as these options are considered flawed in the TARRANT, KNIERIM, HAYES & WARE (2006) framework.

The remaining thirteen items in our framework required the qualitative input of an evaluator to answer questions such as: "are the distracters plausible?", "is the question error free?", "is the language of the question ambiguous?" and so forth (Table 1). All selected MCQs and associated options (including distracters) were reviewed individually and evaluated against our framework to determine whether a flaw was present or not. Potential flaws not covered by our existing framework, and some other noteworthy features, were also recorded when observed, although they do not contribute to the results presented at this time.

3 Results

In total, 116 MCQs were reviewed within this study, and a total of 83 item writing flaws (errors) were detected. At least one error was present in 55 (47.4%) of the MCQs analysed, and 21 MCQs (18.1%) contained more than one error. When grouped by source, one MOOC was found to have only a single error within the ten MCQs sampled from it, but all the other courses selected for inclusion within our study demonstrated more than one error in their sampled MCQs. The most frequently occurring flaw observed in our dataset was the presence of Convergence Clues, which was detected 17 times, in 14.7% of MCQs (Table 1). This flaw may be seen in a few different forms, but in essence occurs when the correct answer includes the most elements in common with the other options, or distracters. This is due to novice question writers including facets or aspects of the correct component more frequently in the alternative options, when attempting to compose plausible distracters. Thereafter, "test-wise" students reading this question can then correctly guess the correct option as being that in which repeated components most frequently occur. Questions with more than one correct answer were identified in 10 instances (8.6% of MCQs), making this the second most common type of flaw observed. Nine occurrences were found of complex or k-type MCQs; these questions ask students to select from a range of possible combinations of correct responses, which can often be guessed by processes of elimination.

Table 1: Presence of MCQ Item Writing Flaws in 116 MCQs from 12 MOOCs

Item Writing Flaw	Number detected	Percentage of Total
Convergence clues	17	14.7%
More than one correct answer	10	8.6%
Complex or K-type question	9	7.8%
Question contains implausible distracters	8	6.9%
Ambiguous or unclear language in the question	5	4.3%
Question is asked in the negative	5	4.3%
Fill-in-the-blank question	3	2.6%
Problem is in the options and not in the question stem	3	2.6%
Word repeats in stem and correct answer	2	1.7%
"All of the above"	2	1.7%
"None of the Above"	1	0.9%
Unfocused question stem	1	0.9%
Logical cues in stem and correct option	1	0.9%
Vague terms used (sometimes, frequently)	0	0.0%
Absolute terms used (never, always, none, all)	0	0.0%
Gratuitous information in question stem	0	0.0%
Grammatical clues in sentence completion	0	0.0%
True/false question	0	0.0%

By contrast, some item writing flaws were not found at all in our selected MOOCs, such as the use of relative or absolute terms including the adverbs *"sometimes"*, *"frequently"*, *"always"* or *"never"*. Such terms can have different meanings to different people – even supposedly absolute terms such as *"always"* or *"never"* may be interpreted differently (Holsgrove & Elzubeir, 1998). Moreover, absolute terms are not recommended because question writers may not always be able to account for all circumstances (*"never"* might hold true today but not tomorrow). Additional flaws not found within our dataset were; gratuitous information in the question stem, grammatical clues in the question as to the answer, or true/false questions.

In addition to the above flaws, we analysed 103 of our sampled to see how frequently the longest option was also the correct option. The longest option was found to be correct more often than would be expected by chance, and this difference was significant (χ^2 [1, N = 103] = 12.28705, p = 0.000456).

In order to examine the position or distribution of correct options, we limited our analyses to those MCQs which had four options, which gave us a total of 73 MCQs. The distribution of correct options is demonstrated in Figure 1 below. We observed that the third option, or option C, was most frequently the correct one, occurring in 23 of our MCQs, or 32% of the time; however this was not statistically significant (χ^2 [1, N = 73] = 4.315068, p = 0.229391).

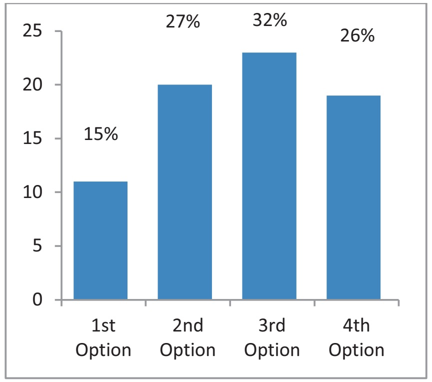

Figure 1: Frequency of Position of Correct Option in 73 Four Option MCQs

4 Discussion and Conclusion

This study sought to answer the question of whether MOOC MCQs exhibit commonly known item writing flaws, and we have demonstrated that this is indeed the case in nearly half of the questions sampled. Flawed MCQs may be confusing to examination candidates, particularly non-native speakers, and may reduce the validity of the examination process, penalizing some examinees (DOWNING, 2005; TARRANT, WARE & MOHAMMED, 2009).

Some item writing flaws were not detected within our dataset, or occurred infrequently; for example, although the third option was the one most often correct, as in previous studies, we did not find this to be statistically significant. However, absence of presence does not mean presence of absence, and the generalisability of this study could be improved upon by increasing the sample size, and analyzing a larger dataset. Likewise, formal evaluation and quality review of MOOC MCQs by established methods such as Classical Test Theory, might uncover additional flaws that are not immediately apparent to human evaluators without access to formal psychometric data or item analyses. These are two potential directions in which this research could be expanded.

We have demonstrated that these item writing flaws exist, and the question then arises as to their potential impact. For example, flawed items may fail to properly discriminate between students of high ability and those of low ability. Another potential impact is that students may fail a question simply because of the inherent fault in the question, such as a second correct option, rather than any error or lack of knowledge on their part. Alternatively, a student may "game" a test by guessing answers to questions with detectable flaws, simply by being "test-wise", or aware of common grammatical errors or convergence clues. One study examining the impact of item writing flaws demonstrated that 33–46% of MCQs were flawed in a series of basic science examinations; the authors concluded that perhaps as many as 10–15% of the examinees were incorrectly graded as failing, when they should in fact have passed, due to the presence of these flawed items (Downing, 2002; Downing, 2005). Another study examined the quality of MCQs used in high stakes nursing assessments, and estimated that 47.3% of the MCQs reviewed were flawed (TARRANT & WARE, 2008). While the interaction between flawed items and student achievement can be complex, they demonstrated that borderline students benefited from these flawed items, which allowed a number of borderline students to pass examinations that they would otherwise have failed, had the flawed items been removed (Tarrant & Ware, 2008). In contrast, they also concluded that flawed items negatively impacted the high-achieving students in examinations, lowering their scores. If the MCQs from MOOCs analysed within our dataset were used in formal assessments, contributing towards credit or other attainment, it is plausible that a similar effect might occur on student achievement, with some students passing tests beyond their ability because of the presence of flawed items within the tests. However, within reliable and valid assessments scores should be an accurate reflection of the knowledge or skills they purport to examine.

A primary lesson that may be drawn from this study is the clear importance of proper training in MCQ writing. All question writers are prone to cognitive biases and errors, which proper training should alleviate but may not always overcome, and for this reason additional peer review and statistical analysis of MCQs is considered best practice. This is of course a time-consuming and expensive activity. Some very simple strategies could be included in MOOC MCQ engines to obviate obvious flaws (even as simple as ensuring question options are randomized which surprisingly few MOOCs seem to enforce). Many other common flaws could be detected through algorithmic means.

Within this study we simply counted the number of characters within each option in order to identify the longest one, but others have used computational techniques to look for the most linguistically complex option instead (BRUNNQUELL et al., 2011). Overall, it is hoped that this study will help remind stakeholders about the importance of a strong underlying pedagogy, supported by reliable and valid assessments. We believe that rich bodies of research exist that can help define, develop and ensure quality in our courses.

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Gamified Competition Features for Corporate MOOCs: The Battle Mode

Jessica DEHLER ZUFFEREY[1], Hamed ALAVI[2], Łukasz KIDZINSKI[2] & Pierre DILLENBOURG[2]

[1] **Coorpacademy, jd@coorpacademy.com**

[2] **Ecole Polytechnique Fédérale de Lausanne, Computer-Human Interaction in Learning and Instruction**

Abstract

We studied an innovative gamification feature called “Battle Mode”, as designed and implemented by Coorpacademy in the context of corporate MOOCs. Two learners asynchronously compete on a set of quizzes related to a specific learning module. In this multi-cases study, data from four company customers with a total of more than 20’000 learners, were analyzed revealing that 1) the battle feature is adopted by up to 37% of learners having access to the Battle Mode and up to 83% of battle invitations get accepted; 2) battle users cover up to 14% of the modules and battle against an average of up to 4.5 peers; 3) engagement is higher among battle players as compared to non-players. Grounded in the descriptive and correlative results we discuss recommendations and design implication for improving the Battle Mode feature.

Keywords

Gamification, Corporate Moocs

1 Introduction

Gamification consists of using game elements for the purpose of motivating people to achieve their goals. It has been shown that this can be achieved under certain conditions, depending on what game mechanics are implemented, the means of actuating them, as well as the context of use (HAMARI, KOIVISTO & SARSA, 2014).

The wave of MOOCs has brought with itself new opportunities and challenges, including questions related to the scalability of gamification features in online learning. In this contribution, we investigate on the effectiveness of gamification in the context of corporate MOOCs. Coorpacademy proposes a platform specifically designed for corporate training (https://www.coorpacademy.com). The platform is particularly interesting for this study because gamification is the main pillar in the design of the learning experience. Its realization includes scoring, badges, leaderboards, a life system, and a competitive quiz mode called "Battle Mode". For the purpose of this contribution, we focus only on the Battle Mode feature. A learner invites a peer to pass a number of quizzes; both competitors will receive points based on their number of correct answers. The game mechanics behind the Battle Mode are "Epic Meaning" and "Status". Epic Meaning refers to the idea that learners would be more motivated if they feel they are working to achieve something metaphorically great. Status refers to players are often being motivated by trying to reach a higher level or status.

We describe the user scenario of the Battle Mode, quantitatively assess its impact on the learning experience, and discuss implications for design.

2 Competitive Gamification in Learning

The Battle Mode is particular because typical features on MOOC platforms are not based on competition between learners. Thus, we briefly review the literature on collaboration versus competition in learning.

Social features in MOOC can be related to a long-lasting tradition on the social dimension of learning in the learning sciences. Collaborative learning was promoted because traditional education was perceived as putting too much emphasis on competition

(BARKLEY, CROSS & MAJOR, 2014). Early research on collaborative learning focused on the conditions under which collaborative learning was better in terms of the learning outcomes compared to individual learning (DILLENBOURG, BAKER, BLAYE & O'MALLEY, 1995). While collaboration is expected to increase the level of cognitive elaboration (e.g. socio-cognitive conflict or giving explanation; DOISE, MUGNY & PÉREZ, 1998 and WEBB, 1989), competition is expected to increase the level of motivation for learning (BURGUILLO, 2010). Hence, collaboration and competition should conceptually be complementary mechanisms in the instructional design of learning environments. There has been, however, some controversy about this, especially in the field of game-based learning (GARRIS, AHLERS & DRISKELL, 2002).

The Battle Mode represents a competition-based feature on the coorpacademy platform, which is combined with rather collaborative features, like discussion forums or chat sessions with advanced peers. This study investigates how learners adopt the Battle Mode and if battle activity is related to engagement and performance.

3 The Battle Mode

The Battle Mode is played by two learners, say Roger and Rafael. Roger starts a battle. He can choose from all modules he already passed on the platform. One module covering one topic includes a set of videos and a set of quiz questions. After selecting module M, Roger can choose an opponent from the list of all learners on the platform that as well have already passed module M. Alternatively, he can let the platform choose a random opponent for him. He chooses Rafael who immediately receives an invitation for the battle. Roger is informed by the platform about the conditions of the game (you win if you have more correct responses or, in case of draw, faster responses) and then responds to a set of questions (half the number of questions from module M). His result is displayed afterwards. Once Rafael accepts Roger's battle invitation (he could also refuse it), he responds to exactly the same set of questions. Players are mutually informed about their results and receive points for their overall ranking depending on the number of correct answers. Both players receive one extra point in their battle counter. After collecting a certain number of battle counts the learners receive bronze, silver, gold, or platinum battle badges.

The Battle Mode encourages learners to engage with the content repeatedly in order to reduce forgetting.

4 Research Questions

The Battle Mode is different from typical features, that seek to strengthen gamification and social learning, in the sense that it is competitive in nature. Hence, the Battle Mode is especially interesting for an investigation of how users react to this feature. This investigation is descriptive in nature as it seeks to provide a first understanding of its usage. The following questions were addressed:

1. To what extent do learners adopt the battle feature?
2. How do learners use the battle feature?
3. How is battle-related behavior correlated with the learners' performance?

5 Method

Sample and Data Collection. As an experimental study design is not feasible in the context of this corporate MOOC platform, we realized a multiple-cases study which of course does not provide results open to strong causal interpretation. The data for this study was collected from four customers with different set of modules covering different topics (see Table 1). We selected these customers because they have been using the platform for more than one year. These customers are based in Europe and their platforms primarily address a European learner population.

Table 1: General information about the four MOOCs selected for this study

Company Costumer	A	B	C	D
Used since	06/2014	06/2014	07/2014	10/2014
Total number of users who logged in at least once	5606	3172	4214	7374
Total number of modules	17	42	19	16

We designed the data analysis process in a reproducible and platform-independent manner.

The analysis was handled in R and thanks to consistent database structure the process was identical for each of the four company customers. The data reported here was collected and processed in September 2015.

Measures. The analysis is run on the logged user data containing the following pieces of information:

- Activities directly related to the Battle Mode:
  - The time when a battle was initiated
  - The time when a battle was accepted
  - User identifier of the initiator and the opponent
  - The learning module on which the battle was done, and the level of the module
  - The number of points obtained during the battle by the initiator and the opponent
  - Status of a battle ("initiated" if the battle was created but not started, "waiting opponent" if the inviter completed her part of the battle and "done" if both users answered questions)
- Measure associated to the learners' engagement
  - Number of videos watched
- Measure associated to the learners' performance:
  - Number of modules completed
  - Number of modules completed without losing a life

Only the aforementioned variables were extracted from the database. They are sufficient for all parts of the analysis reported in this article. In particular, no personal data of learners was used.

6 Results

6.1 To what extent do users adopt the battle feature?

(a) How many learners use the battle feature?

Table 2 shows that between 9% and 37% of all the learners' who have completed at least one module (potential players) played at least one battle.

Table 2: Battle usage on the four selected company customers

Company customer	A	B	C	D
Number of users active in Battle Mode	179	299	70	148
Number of users with at least one module finished	489	1686	276	1610
Battle players among all users with at least one module finished	37%	17%	25%	9%
Battle acceptance rate	83%	67%	53%	47%

(b) How many battles get accepted?

A learner who wants to do a battle depends on finding an opponent agreeing to do the battle with her. Initiating battles that do not get accepted and thus are never played

might decrease learners' motivation for battles and general engagement. Acceptance rate varied between 47% on platform D and 83% on platform A.

(c) Does only a small group of learners initiate battles, the others only accept?

In each battle, a user has either the role of initiator or the role of acceptor. Over the course of several battles, a user can either stick to always the same role or alternate between them. Table 3 shows the distribution of role taking of battle users. The rather high percentages of battle players that are pure acceptors pointed us to the question of to what degree initiating a battle is propagated over the platform population. We additionally analyzed what percentage of users who accepted a battle became initiator later. The result confirmed the former one: On platform A 42% of users accepting a battle turn into initiators afterwards. On the other platforms this rate is lower (B=28%; C=25%;D=27%) (2= 16.772, df = 3, p-value < 0.001, 4-sample test for equality of proportions).

Table 3: Percentage of battle users who are only initiating battles, only accepting battles, or doing both.

Company Costumer	A	B	C	D
Pure initiator	23%	19%	24%	25%
Pure acceptor	22%	39%	58%	40%
Mixed roles	55%	42%	17%	34%

6.2 How are learners actually using the battle feature?

(a) After how much time are battle invitations accepted?

The experience of playing a battle might depend on the time lag between playing a battle and receiving the result of either winning or losing. Given the order described in Section 3 ("The Battle Mode"), the initiator has to wait to see if she won whereas the acceptor receives the result immediately. The time lag varies between 4 and 5.3 days (see Table 4). Future research could address the question of whether or not this time lag affects the user experience of initiators.

Table 4: Time lag between timestamp of initation and acceptence of a battle.

Company Costumer	A	B	C	D
Time	4 days (sd=16.8)	5.3 days (sd=16.9)	4.7 days (sd=22.3)	5.3 days (sd=17)

(b) How diverse are topics on which learners take battles?

The battle feature is supposed to support the learning strategy of repetition. The more modules a user is doing battles on, the wider is the coverage of the repetition regarding the learning material.

Table 5: Mean absolute number (and standard deviation) of distinct modules a user does battles on.

Company Costumer	A	B	C	D
Number of distinct modules	1.8 (sd=2.2)	2.9 (sd=2.9)	2.5 (sd=1.7)	2.9 (sd=2.3)

(c) How many distinct battle partners do users have?

Apart from gamification, the coorpacademy platform also puts an emphasis on creating a community of learners (e.g. with forums, chat with advanced peer). Concerning battles, it is therefore interesting to uncover how they are contributing to tie links between learners. Table 6 shows with how many different partners users are doing battles.

Table 6: Average number (and standard deviation) of distinct battle partners per battle user.

Company Costumer	A	B	C	D
Number of distinct partners	4.4 (sd=7.7)	3.7 (sd=5)	4.2 (sd=4)	3.0 (sd=7.1)

6.3 How is the battle-related behavior linked to engagement?

The Battle Mode seems to appeal to a part of corporate MOOC users. But is it just a “fun” feature or is playing battles related to higher engagement and performance?

In terms of engagement, Figure 1 shows that for all the four customers, learners who played battles watched more videos than the learners who never played (they could as they had finished at least one module). In terms of performance, we found that battle players had higher learning progress as measured by the number of finished modules than the learners who never played battles and again, this was true for all four customers as indicated in Figure 2. Differences in the absolute number of modules finished on the different platforms should not be interpreted as the expectations on how many modules users should complete vary between costumers. In Figure 3 we report the differences between players and non-players in terms of the badge provided for passing a module without losing a life. The fact that players also obtained more of these so called “survivor” badges could indicate that players prepare for battles by redoing the modules’ quizzes. Future detailed analyses on the sequence of working on modules and playing battles on them will shed light on this hypothesis.

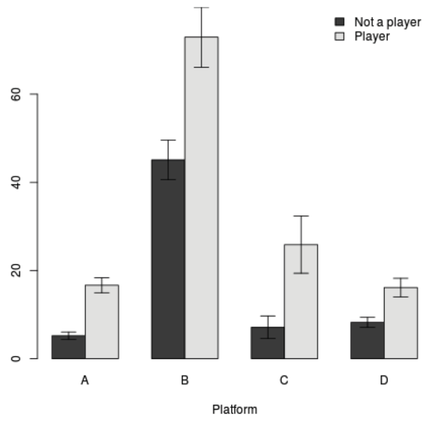

Figure 1: Comparing number of videos watched by participation in battles

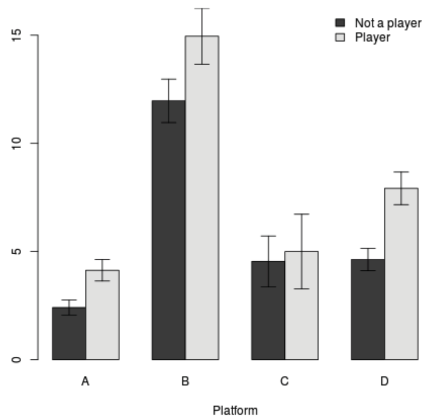

Figure 2: Comparing number of modules finished by participation in battles

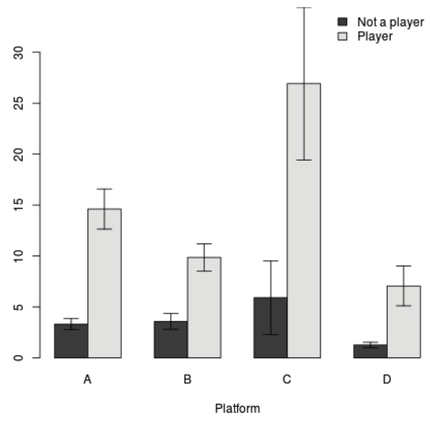

Figure 3: Comparing modules finished without losing life by participation in battles

7 Discussion

The Battle Mode has been introduced on the coorpacademy platform to strengthen the gamification approach, to provide a competition-based peer activity and to encourage the repetition of learning material. The results of this multi-cases study are restricted in their generalizability, as the analyses have revealed high variance of how the Battle Mode was used between the different costumer platforms in the sample (and due to the limitations of the research design). Therefore, results are primarily discussed in order to exploit them for improving the feature in the context we studied.

Between 9% and 37% of the potential battle players adopted the feature, showing that it is a feature attracting a part of the learner population and that this part varies a lot between companies. The majority of battles is accepted. Customers C and D revealed a majority of battle players who only accept and never initiate battles, which can be criticized from an engagement point of view. The management of company C was not actively promoting the platform, and access was not straight forward for users. Learners in company D seem to have a particularly low participation level in battles (9% of potential battle users). It can be explained by the fact that the coorpacademy platform is integrated into the company's LMS in a way that the features related to the Battle Mode are not as visible to the users. A possibility to avoid this problem could be to recommend a battle to users when they just finished a module. Currently, three modules are recommended after a successful completion of a module and one of those recommendations could be replaced with a battle recommendation. Generally, the idea to recommend battles actively to users could also reduce the percentage of pure acceptors and push more users to initiating a battle. Regarding the recommendation of battles, future research could investigate on how specific the recommendation should be (e.g. suggest an opponent and if so how to identify an optimal opponent depending on performance differences, the time when she passed this module, etc.).

If company customers wanted to increase the number of battle players, they could provide the Battle Mode also for the modules that have not yet been finished. Users might start with a battle and only then work on the module, and potentially redo battles after completing it. Future research could investigate if battling before passing the module increases the motivation to completing it.

While the Battle Mode revealed itself as an attractive feature, the conditions analyzed for platforms C and D showed that it needs adequate managerial and technical integration to exploit its potential.

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Multicriteria Decision Aid Approach to “Referent Learners” Identification within a MOOC

Sarra BOUZAYANE & Inès SAAD

University of Picardie Jules Verne, MIS Laboratory, France, {sarra.bouzayane, ines.saad}@u-picardie.fr

Amiens Business School, France, ines.saad@esc-amiens.com

Higher Institute of Computer Science and Multimedia, Tunisia, MIRACL Laboratory

Abstract

This paper proposes a methodology to identify the “Referent Learners” who will be mobilized to animate the Massive Open Online Courses’ (MOOC) forum in order to strengthen the pedagogical team. Our objective is to help learners find the information they need so as not to drop the MOOC. This method consists of four steps: The first is to eliminate redundancy and the missing data in the original data set of learners. The second step is to construct a family of criteria characterizing a “Referent Learner”. The third step consists in constructing a representative learning sample, called “Learners of Reference”, using the 10-Fold Cross-Validation technique. The last step is based on the Dominance-based Rough Set Approach (DRSA) to infer a Preference Model, resulting in a set of decision rules to classify learners either in the decision class Cl1 of the “Non Referent Learners” or in the decision class Cl2 of the “Referent Learners”. Our method is validated on a French MOOC proposed by a Business School in France.

Keywords

MOOC, Multicriteria Decision Making, DRSA, Preference Model, “Referent Learner”.

1 Introduction

The MOOCs are a form of online social learning taking into account the changing affordances of a world in which social activity increasingly takes place at a distance and in mediated forms (BUCKINGHAM, SHUM & FERGUSON, 2012). According to DOWNES (2013), the MOOC must not only be a simple transmission or use of a course, but rather a set of interactive activities and skills development. Initially, the MOOCs were proposed only to fulfill an academic purpose. But actually, they are being integrated into the organizations. In fact, according to a survey made by Future Workplace[1] and completed by 195 corporate learning and human resource professionals, 70% of the respondents are for the integration of MOOCs into their own company's learning programs. Other statistics[2] show that 34% of companies already offer corporate MOOCs for some of their employees, 32% of them plan to introduce MOOCs by 2016 however 34% of companies do not yet plan any MOOC integration.

However, MOOCs still so far suffer from a high dropout rate that is up to 90% (RAYYAN et al., 2013). Generally, a dropout action is linked to difficulties in the support process. In effect, when the pedagogical team is unable to lead a better support process, learners would dropout the MOOC. For instance, according to a report prepared by CARON et al., (2014) on a French MOOC broadcast on the platform FUN (*France Université Numérique*), 32.6% of the learners were dissatisfied with the pedagogical support, and 16.9% of them were very dissatisfied. Equally, among the learners who requested assistance, 25% were dissatisfied with the answers they have received. In addition, our study on a French MOOC proposed in a Business school, revealed that more than 39% of the questions asked by the learners on the forum have been neglected, only 20% of them were treated by the pedagogical team and about 41% were handled by the learners themselves. Moreover, only 49% of the answers were provided at the same day.

1 http://futureworkplace.com/

2 http://blogs.speexx.com/blog/companies-already-use-corporate-moocs/

Therefore, the dropout rate in a MOOC can be linked to an incorrect support process. Indeed, the MOOC is characterized by a huge number of learners and a growing mass of data coming from heterogeneous sources, which makes it difficult to the pedagogical team to manage a satisfactory support process. In addition, the learners communicate remotely, each from his country. They also have disproportionate study levels and different cultural backgrounds. This gives rise to a multicultural dimension. However, according to GOODERHAM (2007), it is the geographical and cultural distance between the transmitter and the receiver of the information that complicates the information transfer process and consequently the support process.

Our objective in this paper is, thus, to reduce the dropout rate by helping learners be supported by "Referent Learners" throughout their participation in the MOOC. These "Referent Learners" aim to strengthen the pedagogical team by helping them animate the Forum. To this end, we propose a method for characterizing a decision class of "Referent Learners" based on a multicriteria decision making method. Yet, using a single criterion, such as the study level, to characterize a "Referent Learner" is not enough especially when we take into consideration the multicultural dimension, the geographic dispersion, and the remote communication through computer tools.

Three major issues should be addressed in the characterization of the decision class "Referent Learners". The first issue concerns the construction of a family of criteria that allows characterizing a "Referent Learner" within a context of MOOC. In this paper, we used a constructive approach based on the expertise of the pedagogical team of the MOOC. The second issue is defining a learning set of "Learners of Reference" that must be a representative sample used to infer a Preference Model. It is based on the k-Fold Cross-Validation technique (REFAEILZADEH et al., 2009). The third issue concerns inferring a Preference Model to classify learners either in the decision class Cl1 of "Non Referent Learners" or in the decision class Cl2 of "Referent Learners".

To deal with these issues we propose a methodology based on the approach DRSA (GRECO et al., 2001). It allows to classify learners as either "Referent Learners" belonging to the decision class Cl1 or "Non Referent Learners" belonging to the decision class Cl2. A "Referent Learner" is a learner having the required skills to assist other learners when they need help at any time during their participation in MOOC. He/She will be mobilized to animate the MOOC's forum in order to strengthen the pedagogical team. The characterizing phase is based on four steps: First, the cleansing of the initial data set of learners. Second, the construction of a family of criteria to characterize a "Referent Lerner" based on the expertise of the pedagogical team. Third, the construction of a learning set of "Learners of Reference" using 10-Fold Cross-Validation technique. Fourth, the inference of a Preference Model resulting in a set of decision rules using DRSA approach. This method is validated on a French MOOC proposed by a Business School in France.

The paper is structured as follows: Section 2 presents the related work. Section 3 details the methodology of "Referent Learners" identification. Section 4 presents a case study. Section 5 concludes our paper and advances some perspectives.

2 Related Work

In literature, many works proposed a model of prediction of the learners who will plan to drop the learning environment. The work of WOLF et al. (2014) associated the high dropout rate to the absence of the face-to-face interaction. They proposed a prediction model to predict learners who will have a poor rating, and who are called "At-risk" learners. They combined the attribute of the number of clicks made by a learner on the learning environment, his demographics data and his access frequency to the evaluations space. A reduction of the number of clicks between two evaluation periods means that there is a strong probability that this learner will dropout the training. The solution proposed is a telephone intervention to motivate the "At-risk" learner to continue his training. VIBERG & DAHLBERG (2013) linked the dropout rate to a commensurability problem. It is the fact when the meaning given by the pedagogical team is not the same understood by the learner. Besides, KIZILCEC et al. (2013) proposed a clustering method based on the completeness of the responses made by the learners on the proposed activities. The result was four clusters. The cluster "Completing" grouping learners having achieved the majority of assessments offered in the MOOC. The cluster "Auditing" representing learners who rarely make evaluations but who remain engaged in the MOOCs. The cluster "Disengaging" gathering learners who responded to assessments only at the beginning of the course. The last cluster is that of "Sampling". It contains learners who have watched the video conference for only one or two evaluation periods. Finally, we cite the classification proposed by BARAK (2015) and that is mainly based on the motivation of the learners concerning their involvement in the MOOC. In this context, the author has divided the students into three classes: the "Random visitors" who participate just to discover the MOOC, the "Novices students" who are beginner learners having a certain experience in distance education and who may drop the MOOC in a more advanced period, and finally, the "Experts Students" who are enrolled with the firm conviction to carry it on to the end to advance their knowledge.

The previous works have proposed methods to predict the dropout behavior or to characterize classes or clusters of learners on the basis of the identified behaviors. However, no work has proposed a concrete solution to improve the support process in order to reduce the dropout rate. Such a missing solution would allow the pedagogical team to manage the MOOC and the learners so as to improve their learning process.

In this paper, we propose a method of characterization of "Referent Learners" to strengthen the pedagogical team in a context of MOOCs.

3 Methodology

In this section, we present a methodology based on the DRSA approach to construct a Preference Model resulting in a set of decision rules. This Preference Model allows to characterize the "Referents Learners". This method consists of four steps:

Step 1: Cleansing the initial set of learners

This step aims to remove redundant and incomplete information from the initial set of data concerning all the enrolled learners. In effect, learners can repeatedly enter their data to ensure that their registration is taken into account. In the case of MOOCs, where we are faced with a growing body of data, removing redundancy is highly recommended. Also, learners can interrupt the registration phase which leads to missing data. These are the learners who have to be neglected since we do not have the necessary information to characterize them.

Step 2: Construction of a family of criteria

In this step, we used a constructive approach based on literature review related to the e-learning domain to construct a criteria family allowing the characterization of some learners as “Referent Learners”. MORRIS et al. (2015) showed that the experience that a learner acquires on the online learning and his study level are attributes permitting to predict the dropout rate of the learners in a MOOC. The study of BARAK (2015) proved that the MOOC language mastery is a factor motivating the learner to carry on the MOOC. Otherwise, Learners who do not master the MOOC language are more likely to drop it. This author stressed the importance of the learner’s motivation in relation to his participation in the MOOC. In fact, a learner who participates in a MOOC just to discover it is more likely to drop it than a learner who participates to enrich his knowledge. Likewise, SURIEL & ATWATER (2012) emphasized the importance of the cultural background in guaranteeing a successful learning process to the learner since a rich background related to the subject proposed by the MOOC helps learners build a knowledge approximated to that referred by the MOOC’s tutor. Other than the static data, experts consider the dynamic data which are traced according to the learner’s activity on the learning environment. In the e-learning field, WOLFF et al. (2014) distinguished three types of activity that permit to predict the dropout of a learner. The activities are the access to a resource or to a course material; the publishing of a message on the forum and the access to the evaluation space.

This list must to be validated by expert decision makers who are in our case the pedagogical team of the MOOC. This pedagogical team has to define a scale of preference for each criterion. The constructed criteria family is presented in Appendix 1.

Step 3: Construction of the “Learners of Reference” set

The learning set of “Learners of Reference” is used to infer a Preference Model. Thus, the higher the quality of the “Learners of Reference” set is, the more efficient the Preference Model becomes. Thus, to select a profitable sample of “Learners of Reference”, we have applied the 10-Fold Cross-Validation technique (REFAEILZADEH et al., 2009) which divides the original sample into 10 ones. Then, each one of the 10 samples is selected as a set of validation and the 9 other samples as training set. The operation is repeated k times until each subsample was used exactly once as a validation set.

This technique is applied on a decision table that has to be completed by the pedagogical team. The lines of this table form the set of learners retained at the first step. The columns are the family of criteria constructed in the second step. The last column of this table contains the decision of assignment of the leaner into one of the two decision classes: the decision class Cl1 of “Non Referent Learners” or the decision class Cl2 of “Referent Learners”. The last column should be completed by the pedagogical team during several meetings. The application of the 10-Fold Cross-validation technique on this decision table provides ten training samples that correspond, each one, to a validation sample. Finally, on each training sample we apply the DOMLEM algorithm proposed by the approach DRSA. The result is ten Preference Models.

Step 4: Construction of a Preference Model

To select a Preference Model, we apply each of the ten Preferences Models previously inferred on the corresponding validation samples. Then, we have to compare the classifications given by each Preference Model to the manual classifications made by the pedagogical team. The comparison is based on four measures:

- True positive (TP): the “Referent Learners” classified by the model as “Referents Learners”.
- True negative (TN): the “Non Referent Learners” classified by the model as “Non Referent Learners”.
- False positive (FP): the “Non Referent Learners” classified by the model as “Referent Learners”.
- False negative (FN): the “Referent Learners” classified by the model as “Non Referent Learners”.

Then, we calculated the precision and the recall measures. The precision is the rate of the classified “Referent Learners” that are correct. The recall is the rate of “Referent Learners” who are properly classified. The F-measure represents the model’s accuracy.

$$Precision = TP/ (TP+ FP); \quad Recall = TP / (TP + FN)$$

$$F\text{-}measure= (2*precision*recall) / (precision + recall)$$

The preference model that must be selected is the one whose F-measure is maximal.

4 Case study

This methodology is applied on real data collected from a French MOOC proposed by a Business school in France. This MOOC lasted five weeks. Our methodology of identifying "Referent Learners" was run as follow:

Step 1: Following the MOOC, we obtained a Comma-Separated Values (CSV) File containing data about 2565 learners. We identified 15 redundant lines and 1030 learners whose data is missing. Thus, the retained file contained data about 1,520 learners.

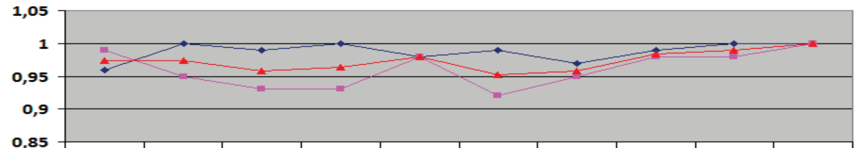
Step 2: To construct a family of criteria we conducted several meetings with the pedagogical team to consider their viewpoint about the importance of each criterion. During these meeting the pedagogical team intervened to elicit its preferences concerning each criterion. The output of this step is presented in the Appendix 1.

Step 3: We filled with the MOOC pedagogical team the column D of the decision table. Such a column shows the classification of each learner either as "Non Referent Learner" in the decision class Cl1 or as "Referent Learner" in the decision class Cl2 (see Table 1). Then we applied the 10-Fold Cross-Validation on this decision table. We got ten learning samples and ten validation ones. Finally, on each learning sample we applied the algorithm DOMLEM. We ultimately obtained ten Preference Models.

Table 1: An excerpt from the decision table

	g_1	g_2	g_3	g_4	g_5	g_6	g_7	g_8	g_9	g_{10}	g_{11}	g_{12}	g_{13}	D
L_1	3	3	1	1	1	0	2	3	0	0	1	30	10	Cl_1
L_2	2	2	3	2	1	0	4	2	1	0	0	44	10	Cl_2

Step 4: To select the best among the ten Preference Models previously inferred we have calculated the precision, the recall and the F-measure of each model. The obtained measures are given in Figure 1.



	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Precision	0,96	1	0,99	1	0,98	0,99	0,97	0,99	1	1
Recall	0,99	0,95	0,93	0,93	0,98	0,92	0,95	0,98	0,98	1
F-mesure	0,974	0,974	0,958	0,963	0,979	0,952	0,958	0,984	0,989	1

Figure 1: The precision, the recall and the F-measure of the Preference Models

Based on the F-measure results, we have selected the tenth preference model because it represents the maximal F-measure. This Preference Model is presented in Table 2.

Table 2: Preference Model

Preference model based on the sample 10
Rule 1. ***If*** g_9>=1 and g_1>=2 and g_{12}>=23 and g_3>=3 and g_4>=2 and g_8>=2 and g_{13}>=8.5 ***Then*** $L_i \in Cl_2$; **Rule 2**. ***If*** g_9>=1 and g_{12}>=24 and g_1>=2 and g_7>=4 and g_8>=2 ***Then*** $L_i \in Cl_2$; **Rule 3.** ***If*** g_9>=1 and g_2>=3 and g_3>=3 and g_{13}>=9.5 and g_1>=2 and g_{12}>=17 and g_7>=3 and g_8>=2 ***Then*** $L_i \in Cl_2$; **Rule 4.** ***If*** g_9>=1 and g_{12}>=35 and g_1>=2 and g_3>=3 and g_5>=1 ***Then*** $L_i \in Cl_2$; **Rule 5**. ***If*** g_9>=1 and g_1>=2 and g_6>=2 and g_{12}>=32 and g_{13}>=9.5 ***Then*** $L_i \in Cl_2$; **Rule 6**. ***If*** g_9>=1 and g_6>=2 and g_8>=3 and g_{13}>=9.5 and g_{12}>=21 and g_1>=2 ***Then*** $L_i \in Cl_2$; **Rule 7**. ***If*** g_1>=2 and g_9>=1 and g_{12}>=45 and g_{13}>=10 ***Then*** $L_i \in Cl_2$;

For example, the rule 7 can be translated as follows:

If the learner is "at least" a high school student and he added "at least" one message per week on the forum and he consulted "at least" 45 times per week the resources and he got "at least" 10 on the proposed activity of this week **Then** he is affected in the decision class "Referent Learners".

4 Conclusion

In literature there are no works concerning the characterization of the "Referent Learners" despite the fact that this necessity was reported by some experts in this domain. Thus, in this paper, we proposed a methodology of four steps to identify the "Referent Learners" in a MOOC. A "referent learner" has the role to animate the forum of a MOOC in order to strengthen the pedagogical team. This proposed method is based on the construction of a coherent family of criteria, the construction of a representative sample of "Learners of Reference" using the 10-fold cross-validation technique and the application of the approach DRSA to infer a Preference Model resulting in a set of decision rules. The DRSA approach relies on the expertise of the human expert decision makers, in our case the pedagogical team, which permits to infer a set of decision rules of good quality. Our perspectives for future work, is to use this Preference Model to classify learners at the beginning of each week during the MOOC.

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Appendix 1. List of the constructed criteria family

Criterion	Description	Scale	P
g_1:The study level	It Indicates the actual study level of the learner or the last diploma he obtained	1: Scholar student; 2: High school student; 3: PhD Student; 4: Doctor	↑
g_2: The familiarization Level of the learner with the computer tools	It Indicates the extent to which the learner masters the use of the computer tools	1: Basic; 2: Average; 3: Expert	↑
g_3: The mastery Level of the MOOC language	It indicates the extent to which the learner masters the language of the MOOC	1: Basic; 2: Average; 3: Good	↑
g_4: The motivation in relation to the participation in the MOOC	It Indicates the motivation behind the participation of the learner in the MOOC	1: Just to discover the MOOCs; 2: To exchange ideas with the other learners or to have a certificate ; 3: To exchange ideas with the other learners and to have a certificate	↑
g_5: The experience level on the MOOCs	It indicates whether the learner has a previous experience on learning via MOOCs or not.	0: No experience at all; 1: At least one experience	↑
g_6: The mastery level of the theme proposed by the MOOC	It Indicates to which extent the learner masters both the topic and the theme addressed by the MOOC	0 : No knowledge at all; 1: Average knowledge; 2: Deepened knowledge	↑
g_7:The probability of taking a MOOC in its integrality	It indicates the probability for a learner to carry-on the MOOC activities until the end.	1: Very weak; 2: Weak; 3: Average;4: Strong; 5: Very strong	↑
g_8:The weekly availability of the learner.	It indicates the estimative weekly availability of the learner to follow the MOOC.	1: Less than one hour ; 2: Fromone to two hours; 3: From two to three hours; 4: Four hours or more	↑
g_9: The number of the added messages.	It indicates the number of the messages added on the forums per week.	n ∈n; n ≥ 0 is the maximum number of the added messages per week. .	↑
g_{10}: The number of responses published on the forum.	It indicates the weekly number of the responses to an asked question published on the forum	m ∈n; m ≥ 0 is the maximum number of answers per week.	↑
g_{11}: The number of questions asked on the forum	It indicates the weekly number of questions asked by learners on the forum	k ∈n; k ≥ 0 is the maximum weekly number of questions	↑
g_{12}: The frequency of navigation on the MOOC site	It indicates the capacity of the learner to interact with the site. It is calculated upon the number of resources consulted by week.	p∈n such that p ≥ 0 is the weekly number of site consultation by the learner	↑
g_{13}: The score	It indicates the weekly score the learner got on the set of activities he made.	The Note ∈ [0, 10]	↑

Influence of employer support for professional development on MOOCs enrolment and completion: Results from a cross-course survey

Jonatan CASTANO-MUNOZ[1], Marco KALZ[2,3], Karel KREIJNS[2] & Yves PUNIE[1]

[1] European Commission Joint Research Centre, Institute for Prospective Technological Studies[1], {jonatan.castano-munoz, yves.punie}@ec.europa.eu

[2] Open University of the Netherlands, Welten Institute – Research Centre for Learning, Teaching and Technology, {marco.kalz, karel.kreijns}@ou.nl

[3] Open University of the Netherlands, Faculty for Management, Science and Technology

Abstract

Although the potential of open education and MOOCs for professional development is usually recognized, it has not yet been explored extensively. How far employers support non-formal learning is still an open question. This paper presents the findings of a survey-based study which focuses on the influence of employer support for (general) professional development on employees' use of MOOCs. Findings show that employers are usually unaware that their employees are participating in MOOCs. In addition, employer support for general professional development is positively associated with employees completing MOOCs and obtaining certificates for them. However, the relationship between employer

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[1] The views expressed in this article are purely those of the authors and should not be regarded as the official position of the European Commission.

support and MOOC enrollment is less clear: workers who have more support from their employers tend to enroll in either a low or a high number of MOOCs. Finally, the promotion of a minimum of ICT skills by employers is shown to be an effective way of encouraging employee participation in the open education ecosystem.

Keywords

Professional development, open education, MOOCs, employer recognition, employer support

1 Introduction

The impact of adult learning on labour market has been widely analyzed by the literature. Human capital theory states that the value of people's knowledge and competences declines with time. Therefore, lifelong learning is a key issue in a time when, due to fast socio-technological changes, workers need to update their skills throughout their working lives (CASTAÑO-MUÑOZ et al., 2013; LAAL & SALAMATI, 2011). In this context, lifelong learning has become an important aspect of many European educational policies (EUROPEAN COMMISSION, 2011).

Although Open Education and MOOCs are recognized as offering opportunities for lifelong learning due to their flexibility, there is surprisingly little interest in analyzing their relationship with the labour market.

Earlier approaches to supporting professional development with open education have focused on the development of dedicated search interfaces to find open educational resources for self-learning e.g., business and management skills (HA et al., 2011). CASTAÑO-MUÑOZ, CARNOY & DUART (2015) focused on the economic payoff of a predecessor of MOOCs: the virtual university. They carried out a follow-up telephone survey of students at the Open University of Catalunya (UOC), who enrolled in the early 2000s. Results show that online degrees were especially valuable to young people on relatively low salaries. However, these students were a minority since most UOC students were adult learners who were already on high salaries before they started online degrees.

MOOCs offer many new options for professional development and lifelong learning (KALZ, 2015). On the one hand, they can provide access to open (higher) education for people who were previously denied this opportunity because they lacked the necessary qualifications, or for, financial and other reasons. On the other hand, MOOCs can offer professionals a plethora of opportunities to acquire more knowledge or develop skills and competences related to their current jobs. They can also help professionals to acquire the knowledge and skills they need to take a new professional direction.

MILLIGAN AND LITTLEJOHN (2014) identified the benefits and challenges to using MOOCs for professional learning for health professionals. Their research showed that there was a mismatch between learners' initial learning intentions, which were linked to the challenges of their profession, and their behaviour, which mainly consisted of the completion of activities that led directly to a certificate. Furthermore, they did not share experiences with each other or transfer their own learning to on-the-job practices. These results led the authors to report that there is still a need to explore how MOOCs should be designed for professional training.

Despite the design problems mentioned above, ZHENGHAO et al. (2015) reported that MOOCs can benefit learners' careers. The authors analyzed data from a 2014 survey of people who had completed MOOCs on the Coursera platform. They found that many of them (52%) were looking for tangible career benefits (increasing their salaries, finding new jobs, or starting new businesses) and also intangible ones (being better equipped to do their current job, improving their chances of getting a new job). Moreover, their research showed that, in general, career benefits were more likely to be mentioned by individuals with high socioeconomic status (SES). Tangible career benefits, however, were referred to equally by individuals with both low and high SES. In addition, in developing countries respondents with low SES and education levels were significantly more likely to indicate tangible career benefits.

Moving from the perspective of workers to the perspective of employers, RADFORD et al. (2015) analyzed how human resource professionals in the USA perceive MOOCs. These researchers sent a questionnaire to a sample of 398 organizations in North Carolina and obtained responses from 103 employers. This low response rate and the self-selection of respondents could have generated a selection bias by over-representing companies which were more aware of MOOCs. The field work was carried out between November 2013 and January 2014 and the results revealed that MOOCs reached nearly half the employers in the sample. Only a few companies used MOOCs actively for recruitment, though two thirds of the sample agreed that the information that an applicant had taken job-related MOOC would positively influence their hiring decisions. Approximately 7% of the surveyed organizations had used MOOCs for professional development and most of these were part of the public administration. According to this study, this could change because 83% of employers were using, considering using, or could see their organization using MOOCs for professional development in the future.

All in all, the studies presented showed that in the future MOOCs could play an important role in professional development, although to date there is little research available on this area. Our study aimed to contribute to this knowledge by providing a better understanding of how far employers support MOOCs and how they support employees. The central research questions, therefore, were: A.) What is the impact of employer support for general professional development activities on an employee's decision to take MOOCs? B.): What are the probabilities of employees completing the MOOCs (with or without a certificate)?

2 Method

To analyze the impact of employer support on the decision to take and complete MOOCs (with and without certificate), we conducted several analyses based on a dataset from 4 different MOOCs. These analyses were part of the MOOCKnowledge project, which studied European cross-provider data in order to find out more about how learners perceive open online courses (KALZ et al., 2015). The data (n=1553) were collected via an online survey, carried out between October 2014 and February 2015, on MOOCs in the different areas presented in Table 1. We focused on salaried participants from the Eurozone, bringing the initial dataset down to 376 participants.

Table 1: Data set overview

	MOOC A	MOOC C	MOOC D	MOOC E
Topic	ICT in Education	Test Anxiety	Business Intelli-gence	Entrepreneur-ship
N respondents	173	316	349	715
N respondents Employed for wages & Eurozone	34	181	121	40
Country focus	Internatio-nal	ES	ES	ES

In the first phase, a descriptive analysis of the variables related employers support professional development and appreciation of MOOCs was carried out (see Section 3.1). In the second phase, a series of ordinary least square regression analyses were conducted to estimate the impact of employer support for general professional development activities on three dependent variables: the number of MOOCs employees enroll in during their lives, the number of MOOCs they complete and the number of MOOCs for which they obtain a certificate. Additionally, the regression models controlled for several variables identified as important for MOOC enrolment and completion: employee age, gender, level of education and ICT skills[2].

[2] ICT skills were measured as a composed index integrating 7 items that measure information skills and 7 items that measure interaction skills.

3 Results

3.1 Support of professional development and MOOC appreciation

Though most of the employers in our sample population were not aware of their employees' professional development activities, more than one fourth of them were. About 80% of the employees who said their employers were aware of their professional development activities also received support by them. Of those who said they received support by their employers, 85.9% revealed that this was simply encouragement rather than tangible support, such as time or payment of the costs involved. These figures may indicate that MOOCs, due to their flexibility and the fact that they are free, are especially appreciated as a means of professional development by those who do not receive time or financial support from their employers.

Table 2: Employer awareness and support of professional development activities

	N	%
Employer not aware	270	71.8
Awareness but not support	21	5.59
Awareness and support	85	22.6

Table 3: Types of employer's support

	N(*)	%
Encouragement	73	86
Time	11	13
Costs	8	1

* Multiple responses possible

No consensus could be identified among employers regarding the adequacy of MOOCs as a means of professional development for their employees. 29.4% of the employers who support the professional development activities of their employees did not approve or only slightly approved of their employees' participation in MOOCs. On the other hand, 21.8% approved or very much approved this participation. Employers who allow their employees time for professional development (mean=4.8) tend to appreciate MOOCs more than those who simply encourage their employees to participate or pay for them to do so (mean= 3.88 and 3.63 respectively). However, this trend is not statistically significant due to the low number of respondents who were supported with either time or money (t= -1.2, p=0.232).

When examining whether formal certification affects employer appreciation of MOOCs, about one third (33%) of the respondents stated that it had much or very much influence. These findings may indicate the existence of a group of employers that appreciates MOOC certificates as evidence of completion by their employees.

3.2 Influence of employer support on MOOC enrolment and completion

The mean number of courses each respondent was enrolled in was high, at 5.5. Only 16.2% of them said they had had no previous experience. Respondents with experience were enrolled on average in 6.5 courses, and completed 4.9, of which 3.73 had certificates.

As explained in the methods section, in order to analyze the influence of employer support for general professional development activities on the number of MOOCs employees enrolled on in the past (without counting the current one), the number they completed, and the number they completed with a certificate, we carried out a series of OLS regressions. The models also controlled for other variables that may influence the decision of taking and completing a MOOC: employee age, gender, level of education, and ICT skills. Table 6 shows the results of the analysis.

Table 4: OLS regression models

	N enrol-led	N enrol-led	N comple-ted	N comple-ted	N certi-fied	N certi-fied
Age	0.018	0.018	0.007	0.007	0.032	0.032
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Gender (woman)	-1.281*	-1.250*	-1.384**	-1.338*	-1.102*	-1,060
	(0.71)	(0.71)	(0.69)	(0.69)	(0.66)	(0.66)
4nd quintile ICT skills	3.635***	3.576***	3.299***	3.200***	2.134**	2.023*
	(1.10)	(1.10)	(1.08)	(1.08)	(1.04)	(1.04)
3rd quintile ICT skills	2.452**	2.401**	1,690	1,605	1,626	1,545
	(1.11)	(1.11)	(1.08)	(1.09)	(1.04)	(1.04)
2th quintile ICT skills	1,041	0.979	1,314	1,205	1,112	0.983
	(1.05)	(1.06)	(1.04)	(1.04)	(1.00)	(1.00)
1th quintile ICT skills	2.425**	2.342**	1.964*	1.819*	1,396	1,217
	(1.07)	(1.07)	(1.05)	(1.05)	(1.01)	(1.01)
Non tertiary education	0.695	0.647	0.682	0.578	0.937	0.845
	(1.21)	(1.21)	(1.22)	(1.23)	(1.18)	(1.18)
2nd stage tertiary education	1.794**	1.768**	1,000	0.952	1,171	1,127
	(0.87)	(0.87)	(0.85)	(0.85)	(0.82)	(0.82)
Support (yes)	0.809		1.507*		1.731**	
	(0.82)		(0.83)		(0.80)	
Type support: Encouragement		0.893		1.589*		2.007**
		(0.90)		(0.93)		(0.89)
Type support: Time or cost benefits		1,701		2,735		2,707
		(1.89)		(1.93)		(1.85)
Constant	2,870	2,838	3,419	3,411	1,397	1,371
	(2.16)	(2.16)	(2.18)	(2.18)	(2.10)	(2.09)
N	376	376	315	315	315	315

p<0.10 **p<0.05 ***p<0.01 (a) Standard errors of coefficients in parentheses

Our estimates showed similar patterns for the 3 dependent variables. This is probably due to the high correlation between these variables, with more enrolments leading to more completions and therefore more certificates. Some differences were also found, especially regarding the effect of employer support on taking, completing and obtaining certificates for MOOCs. Age was not an important factor in any of the three outcomes studied. However, gender does seem to have an influence. According to our results, women tended to participate, complete, and obtain certificates less often than men. The model estimates indicated that women took, completed and received certificates for around one MOOC less than men did. While it was clear that those respondents with highest levels of education (2nd stage tertiary education) are more often enrolled than those with first stage of tertiary education, no significant differences have been detected in completion or certification levels.

ICT skills played a key role in the decision to enroll and also in completion and obtaining certificates. The results indicated that the learners in the last quintile of ICT skills distribution enrolled in 3.6 courses fewer than those in the 4^{th} and, although the difference was lower with the next quintiles, it remained. The same pattern applied to completing MOOCs and obtaining certificates for MOOCs with a significant difference of 3 completed MOOCs and 2 certified between the last quintile and the 4th quintile. These results showed how important it is to have a minimum level of ICT skills to be able to take advantage of MOOC education. However, it seemed that once this minimum is achieved, more ICT does not necessarily result in more enrolment, completion or certificates obtained. As regards our research questions, the estimates highlighted that employer support for general professional development did not have a linear relationship with the number of MOOCs employees enroll on. It did, however, have a linear relationship with the number of MOOCs they completed and the number of MOOCs for which they obtained certificates. On average, those respondents who indicated they received support from their employer completed around 1.5 more MOOCs than those who did not. When analyzing the role of the type of support, it was clear that simple encouragement had strong effects (1.5 more completed MOOCs and 2 more with certificates). Although the estimates were higher for individuals with more concrete types of support (time or cost payments), there was no significant difference to respondents who did not receive support. This was most probably due to the low number of respondents who received support in form of time or cost coverage.

In order to understand better the relationship between support for professional development and the number of MOOCs employees enroll in, we divided this last variable into five quintiles and calculated the percentage of individuals who received employer support in each (Figure 1). In the first quintile (from 0 to 1 MOOCs), 33% of learners receive employer support, in the second quintile (from 2 to3 MOOCs) only the 16% does, in the third quintile (from 4 to 5 MOOCs) this number falls to 14%, in the fourth quintile (from 6 to 8 MOOCs) the percentage is 19% and in the fifth quintile (more than 8 MOOCs) it is 29%. All in all, the results indicate the possible existence of a quadratic relationship that shows how the learners with higher levels of support for professional development enroll in either a low or a high number of MOOCs.

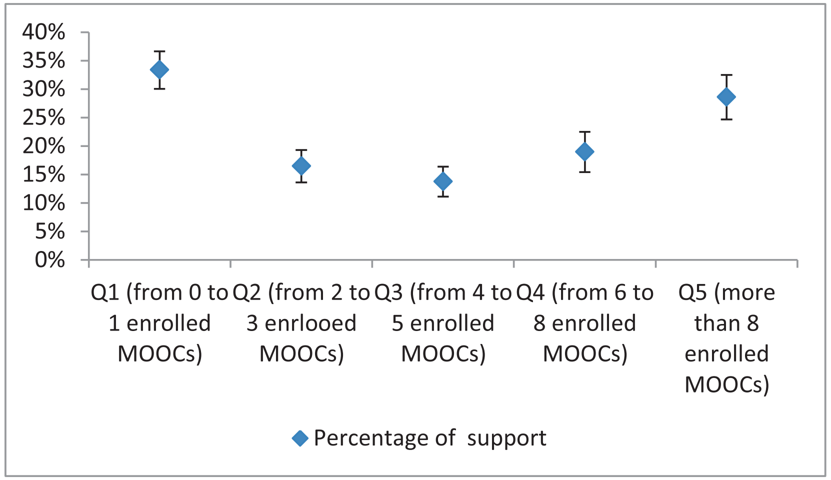

Figure 1: Percentage of individuals that receive employer support by number of MOOCs enrolled (quintiles). Lines represent the confidence interval at 95%.

4 Discussion and Conclusions

In this paper, we have investigated the relationship between employer support for general professional development activities and the probabilities that their employees participate in and complete MOOCs (with and without certificates). Our results showed that, in most of the cases, employers didn't know about their employees' participation in these activities, or their participation in MOOCs. However, employers' decision to support general professional development activities affects how their employees relate to the current MOOC offer. One important finding of our analysis was that employer support for general professional development activities does not have a linear effect on an employee's decision to take MOOCs. Further analysis points to the existence of a quadratic relationship: those workers who have more support from their employer enroll on either low or high numbers of MOOCs. The reasons can be diverse. A possible explanation is that the left side of the distribution (where support from the employer is high and the number of MOOCs enrolled on is low) consists of those individuals who wouldn't have taken a MOOC if it had not been for the support of the employer. On the other hand, there are also some individuals whose decision to enroll on MOOCs was negatively affected by the type of support they were offered. For instance, some of them may be working for companies that support traditional ways of professional development which may cause them to enroll on relatively few MOOCs in their lifelong learning activities. On the other side of the distribution, it is clear that employees who take more MOOCs are in a position to access more support for professional development activities, but this does not necessarily imply causality. Regarding the probability of employees completing and obtaining certificates for MOOCs, data show that employer support (even if it is only encouragement) can work as an incentive for completing MOOCs. This is an interesting finding in the sense that it suggests employers may still be critical about the non-formal character of open education for the professional development of their employees. By recognizing this form of professionalization, they would contribute to the success of their employees and to some extent even to the formalization of these activities. In this sense, it is interesting to note, that employers, appreciation and recognition of MOOCs can be influenced by the offer of certificates.

Another interesting finding was that ICT skills were the most critical factor in enrolling in MOOCs, completing them and obtaining certificates. This finding shows that employers could also invest in the digital skills of their employees to equip them with the necessary requirement to be active learners in an open education context. All in all, this paper has given an initial picture of the relationship between employer support to professional support activities and the participation of employers in MOOCs. However, though our analysis was cross-course, the dataset for some parts of the analysis was too small and specific to produce highly reliable results. These findings need to be replicated in future studies with more data which cover more MOOC topics and geographical variety.

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Portraying MOOCs Learners: a Clustering Experience Using Learning Analytics

Mohammad KHALIL, Christian KASTL & Martin EBNER

Graz University of Technology, Educational Technology,
{mohammad.khalil, martin.ebner}@tugraz.at, kastl@sbox.tugraz.at

Abstract

Massive Open Online Courses are remote courses that excel in their students' heterogeneity and quantity. Due to the peculiarity of being massiveness, the large datasets generated by MOOCs platforms require advance tools to reveal hidden patterns for enhancing learning and educational environments. This paper offers an interesting study on using one of these tools, clustering, to portray learners' engagement in MOOCs. The research study analyse a university mandatory MOOC, and also opened to the public, in order to classify students into appropriate profiles based on their engagement. We compared the clustering results across MOOC variables and finally, we evaluated our results with an eighties students' motivation scheme to examine the contrast between classical classes and MOOCs classes. Our research pointed out that MOOC participants are strongly following the Cryer's scheme of ELTON (1996).

Keywords

MOOCs, Learning Analytics, Clustering, Engagements, Patterns

1 Introduction

In the last years, Technology Enhanced Learning (TEL) has been developed rapidly so that now is including modern online classes in which they are called MOOCs (MCAULEY et al., 2010). The word MOOCs is an abbreviation of four letters, 'M' which is Massive, and it means massive in the number of enrollees than what is in regular classes. 'O' and this is Open, and that is an implication of a field that has no accessibility limitations. Furthermore, openness also means that these massive courses should be open to anyone. The second 'O' stands for Online where all courses are held on the Internet without any borders. In the end, 'C' means courses, this represented a structured learning material and is mostly embodied as filmed lectures, documents and interactive social media such as discussion forums or even social media channels.

The first version of MOOCs was named cMOOCs, which were developed by George Siemens and Stephan Downes back in 2008, and it adopted the connectivism theory that is based on the role of social and networks of information (HOLLAND & TIRTHALI, 2014). After that, other versions of MOOCs become available, but it was noticeable that the *extended MOOCs* or so-called *xMOOCs* attracted the eyes of today's online courses learners.

One of the prominent and most successful activities of xMOOCs has been done by Sebastian Thrun in 2011. He and his colleagues launched an online course called "Introduction to Artificial Intelligence" which attracted over 160,000 users from all over the world (YUAN et al., 2013). xMOOCs follow theories that are based on guided learning and the classical information transmission (RODRIGUEZ, 2012). FERGUSON & CLOW (2015) argued that xMOOC is an extended version of cMOOC with additional elements of content and assessment as well as a larger-scale role of educators to be part of the content; in other words, an online course for hundreds of learners simultaneously (CARSON & SCHMIDT, 2012).

The benefits of MOOCs are crystallized to be welfare in improving educational outcomes, extending accessibility, and reducing costs. In addition, Ebner and his colleagues addressed the advantages that MOOCs can add to the Open Educational Resources (OER) movement as well as lifelong learning experiences in TEL contexts (Ebner, et al., 2014). Despite their advantages, MOOCs suffered from students who

register and afterwards do not complete the courses. This has been cited in several scientific researches and is now commonly named as "the dropout rate" (MEYER, 2012; JORDAN, 2013). Various investigations have been done to identify the reasons behind the low completion rates, such as the research studies by KHALIL & EBNER (2014; 2016), LACKNER et al. (2015). Furthermore, lack of interaction between learners and instructor(s), and the controversy argument about MOOCs pedagogical approach, are the negative factors that obstruct the positive advancement of MOOCs. In addition to all this, recent research publications discussed the patterns of engagement and the debates about categorizing students in MOOCs (KIZILCEC et al., 2013; FERGUSON & CLOW, 2015; KHALIL & EBNER, 2015a).

Since MOOCs include a large quantity of data that is generated by students who reside in an online crucible, the heed toward what is so-called Learning Analytics steered the wheel into an integration of both sectors (KHALIL & EBNER, 2016). KNOX (2014) discussed the high promises behind Learning Analytics when it is applied to MOOCs datasets for the principles of overcoming their constraints. The needs for Learning Analytics emerged to optimize learning, and for a better students' commitment in distance education applications (KHALIL & EBNER, 2015b).

In this research study, we employ Learning Analytics, using a clustering methodology, on a dataset from one of the courses offered by the leading Austrian MOOC platform, iMooX[1]. The sought objectives behind clustering are to portray the engagement and behaviour of learners in MOOC platforms and to support decisions of following up the students for purposes of increasing retention and improving interventions for a specific subpopulation of students. In addition, this research study will contribute with an additional value to ease the grouping of MOOCs participants.

The publication is organized as follow: Section 2 covers the research methodology of this research study. Section 3 gives an overview about the MOOC platform itself as well as the demographics of the course. Section 4 covers in details the clustering methodology and data analysis. Section 5 is the discussion and the comparison with the Cryer's scheme, while section 6 concludes the findings.

[1] http://www.imoox.at (last visited October 2015)

2 Research Methodology

This research study is based on data collected by a formal Learning Analytics application of the iMooX MOOC-platform. By tracking their traces, the application records learners actions within the divergent MOOC indicators such as videos, files downloads, reading in forums, posting in forums and the quizzes performance. In the present study, a MOOC named "Social Aspects of Information Technology", shortly *GADI* (abbreviated from the original German title), was chosen for further analysis and research.

The collected information after that, which takes the form of log files, was parsed to filter the duplicated and unstructured data format. The data analysis was carried out using the R software, and the clustering methodology was performed using an additional package called NbClust (CHARRAD et al., 2014). We followed content analysis in which units of analysis get measured and benchmarked based on qualitative decisions (NEUENDORF, 2002). These decisions are founded on sustained observations on a weekly basis and examination of surveys at the end of the course by one of the researchers.

3 Stats and Overview

3.1 The MOOC-Platform

iMooX is the leading Austrian MOOC platform founded by the cooperation of Graz University of Technology and University of Graz (NEUBÖCK et al., 2015). The offered courses vary in topics between social science, engineering and technology topics and cope with lifelong learning and OER tracks. The target groups are assorted among school children, high-school students and university degree holders. Additionally, iMooX offers certificates and badges to successful students who fulfilled courses requirements at no cost.

3.2 Course Overview and Demographics

Our analysis of portraying learners is based on a summer course provided by Graz University of Technology in 2015 called "Social Aspects of Information Technology" abbreviated in German and in this research study as GADI. This course was selected because it is specialized of being mandatory for the university students of Information and Computer Engineering (Bachelor-6th semester), Computer Science (Bachelor-2nd Semester), Software Development, Business Management (Bachelor-6th semester) and for the Teacher's Training Certificate of computer science degree (2nd Semester). Furthermore, the course was also opened for external participants and not only restricted to university students. The main content of the course is based on discussions about the implications of information technology on society.

The course lasted 10 weeks. Every week includes 2 or 3 video lectures, a discussion forum, further readings and a multiple choice quiz. Each quiz could be repeated up to five times. The system is programmed to record the highest grade of these trials. MOOC's workload was predefined with about 3 hours/week, and the passing grade for each quiz was set to be 75%. Students of Graz University of Technology gain 2.5 ECTS (credits) for completing the MOOC but they have also to do an additional essential practical work.

Finally, there were in summary 838 participants in the course, 459 of them were university students, while 379 were voluntary external participants. Because this MOOC is obligatory to pass the university class, the completion ratio was much higher compared to other MOOCs. The general certification rate of this particular MOOC is 49%. The certification ratio of the university students was 80%, and 11.35% of the external participants.

Candidates, who successfully completed all quizzes, were asked to submit answers for a predefined evaluation form. The collected data showed that most of the external participants are from Austria and Germany. University students' average age was 23.1 years old, while the average age of the external participants was 46.9 years old. Table 1 reports the course demographics based on the evaluation results.

Table 1: The GADI MOOC Demographics of completed participants

	Gender (M/F)	High School	Bachelors	MSc & PhD	Others
Students	327/40	357	4	4	2
Others	23/20	13	3	3	4

4 Clustering and Analysis

The main goal behind clustering is to assign each participant in the MOOC to a suitable group with common behaviours. Each group should be as distinct as possible to prevent overlaps. The elements in these groups should fit tied to the defined group parameters. Therefore, clustering using the k-mean algorithm with the Euclidean distance was selected as our tool of choice. In order to begin clustering, we labeled the variables that will be referenced in the algorithm. The expected results should be clustered with activities and characteristics that distinguish the MOOC participants.

Due to the relations between certain variables, we excluded the high correlated indicators as this will not affect the grouping sequence. As a consequence, the used variables in clustering were:

1. Reading Frequency: This indicates the number of times a user clicked on particular posts in the forum.
2. Writing Frequency: This variable determines the number of written posts in the discussion forum.
3. Videos Watched: This variable contains the total number of videos a user clicked.
4. Quiz Attempts: It calculates the sum of attempts that have been spent on all ten quizzes.

Because of the structure of the examined MOOC, which is obligatory for university students and opened for external participants, the clustering was done independently in both groups. The intention of each group could vary. For example, are the university students attending the MOOC for learning purposes or are they *only seeking* for the grade?

4.1 Case 1: University Students

In this case, the k value was assigned with a value from 3 to 6, as long as we do not really want more than 6 groups. The suggested cluster, based on the variables value and the NbClust package, resulted to four clusters. Figure 1 illustrates the four clusters of the MOOC university students.

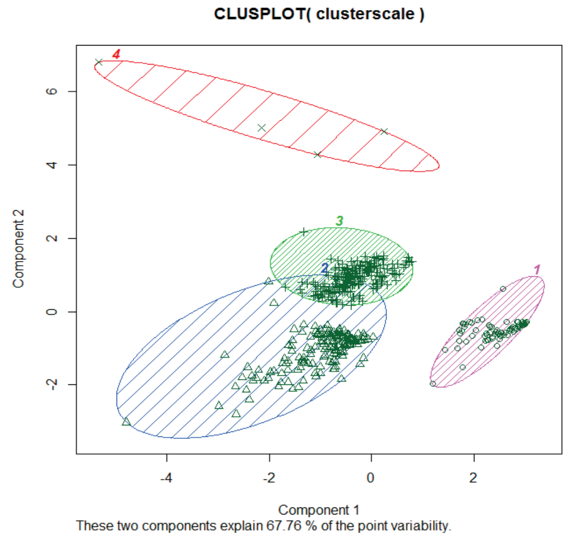

Figure 1: MOOC's University Students Clusters

Figure 1 shows a cluster amount of four classes. Two of the groups, the blue and the green are overlapping. The relation between components in x-axis and y-axis is valued at 67.76%. This percentage means that we have nearly 70% of unhidden information based on this clustering value[2]. The clusters are characterized as the following:

Cluster (1) with the pink oval shape contains 95 students. This group has low activity among the four variables. Only 10 students are certified, and the dropout rate is high.

Cluster (2) with the blue oval shape contains 154 students. Most of the participants in this group completed the course successfully. This cluster is distinguishable by their videos' watching.

Cluster (3) with the green oval shape has 206 participants. The certification rate was 94%. Both of cluster 2 and cluster 3 share a high certification rate, but differ in watching the videos.

Cluster (4) is the smallest cluster, containing 4 students. By observing the variables, we noticed that the students in this cluster are the only ones that had been writing on the forums. The amount of certified students in cluster 4 totals to 50%.

4.2 Case 2: External Learners

Figure 2 shows the proposed cluster solution of the external participants who do not belong to the university class. Again, k value was set to be from 3 to 6. The point variability shows a competitive rate of 88.89%, which indicates a steep seclusion among the three groups. The clusters of this case are characterized as the following:

Cluster (1) with the blue oval shape contains 42 participants. The certification rate of this group is 76.20%. The social activity and specifically reading in forums are moderate compared to the other clusters. Whiles the number of quiz trials is high.

Cluster (2) with the red oval shape holds only 8 participants. The certification rate in this group is 100%. Participants from cluster 2 showed the highest number of written contributions and the highest reading frequency in the forum.

[2] Explanation: http://stats.stackexchange.com/questions/141280/understanding-cluster-plot-and-component-variability (Last accessed, 15th October 2015).

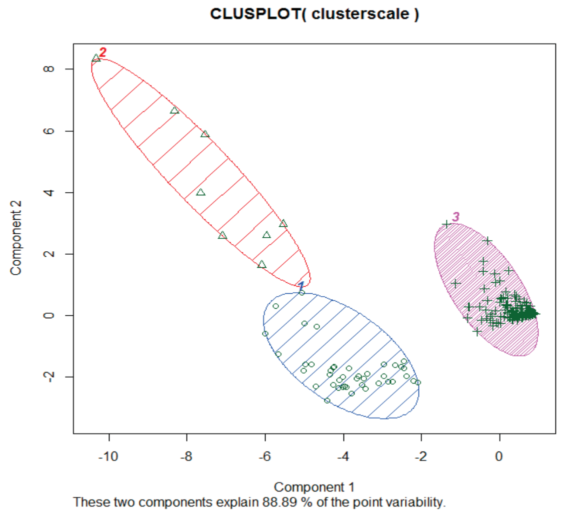

Figure: 2 MOOC's External Learners Clusters

Cluster (3) with the pink oval shape includes all the other participants. This group showed a high dropout rate and a completion rate of only 1%.

5 Discussion

Within the previous clustering results in both cases, we studied the values of each variable in each cluster. The next step was to make a classification scale of "low", "moderate" and "high" that describes characteristics and the activity level of each group. Table 2 shows them for both of the cases, university and external participants.

Table 2: Characteristics of each cluster of both MOOC cases

Case: University Students					
	Reading Freq.	Writing Freq.	Watching Videos	Quiz Attempts	Certification Ratio
Cluster 1	Low	Low	Low	Low	10.53%
Cluster 2	High	Low	High	High	96.10%
Cluster 3	Moderate	Low	Low	High	94.36%
Cluster 4	High	High	Low	Moderate	50%
Case: External Participants					
Cluster 1	Moderate	Low	Moderate	High	76.19%
Cluster 2	High	High	High	High	100%
Cluster 3	Low	Low	Low	Low	1%

By analyzing the clusters, we think the opportunity to portray students' behaviours in the MOOC becomes possible nearby. However, a study by ELTON in (1996), which examined the general strategies to motivate learners in the classes, meets a similar scheme of our clustering results. Figure 3 illustrates the so-called Cryer's scheme, which shows student behavior within a course. The x-axis represents intrinsic factors, which are achievements and subject. The y-axis includes the examination preparation, which is named as the extrinsic factor. It must be stated that this scheme does not only include the shown specific profiles, but it also contains other learners who reside between these four profiles.

The students, on the bottom left of the Cryer's scheme, describe the ones who are not interested in the course subject nor score positive results.

Figure 3: Cryer's Scheme Based on Levels of Student Commitment

This class represents Cluster (1) of our university students' case, and Cluster (3) of external participants' case. An appropriate profile name of this cluster would be simply "Dropout". This profile shares common patterns of being inactive among all the MOOC variables. The certification rate in this profile is low.

The class, on the top left in the scheme, describes learners who *play the system*. This term comes from a case when students are treated and just doing what instructors want to do for getting a grade. Using Learning Analytics, some students were determined watching the learning videos with various skips, or even they start a quiz without watching the weekly video. Such students were named as "Gamblers". In spite of certain questions that are hard to answer without watching a video, some of them could pass the exams. It should also be considered that the MOOC platform offers up to five trials per week quiz, which might be the reasons behind a high percentage of *gamblers* among university students.

Rebellions are those who show interest in the course, but fail because of bad exam preparations. In the Cluster Analysis, this group was available in the university students' group, which is represented by Cluster (4). However, it was hard to detect in the external participants' group. Cluster (4) was distinct for being very active with the social activities in the forums. We named them as the "Sociable Students".

The last class is the students whom their commitment is high. "Perfect Students" might be the appropriate name for them. Every MOOC platform looks to have such students. With their high certification rate, Cluster (2) in both cases embodied this profile.

6 Conclusion

This research study examined learners' behavior in a mandatory xMOOC offered by iMooX. Because the course was also opened to the public, we studied patterns of the involved students and separated them into two cases, internal and external participants. Within our research study, we performed a cluster analysis, which pointed out participants in MOOCs, whether they did the course on a voluntary basis or not. Furthermore, we found that the clusters can be applied on the Cryer's scheme of ELTON (1996). This leads to the assumption that tomorrow's instructors have to think about the increase of the intrinsic motivation by those students who are only "playing the system". Our research study also pointed out that online courses behave very similar to traditional face-to-face courses. Therefore, we strongly recommend researching on how MOOCs can be more engaging and creating new didactical concepts to increase motivational factors.

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How to integrate and automatically issue Open Badges in MOOC platforms

Mario WÜSTER[1] & Martin EBNER[2]

[1] Graz University of Technology, Institute for Information Systems and Computer Media, mario.wuester@student.tugraz.at

[2] Graz University of Technology, Educational Technology, martin.ebner@tugraz.at

Abstract

Though MOOC platforms offer quite good online learning opportunities, thereby gained skills and knowledge is not recognized appropriately. Also, they fail in maintaining the initial learner's motivation to complete the course.
Mozilla's Open Badges, which are digital artifacts with embedded meta-data, could help to solve these problems. An Open Badge contains, beside its visual component, data to trustworthy verify its receipt. In addition, badges of different granularity cannot just certify successful course completion, but also help to steer the learning process of learners through formative feedback during the course. Therefore, a web application was developed that enabled iMooX to issue Open Badges for formative feedback as well as summative evaluation. A course about Open Educational Resources served as prototype evaluation, which confirmed its aptitude to be also used in other courses.

Keywords

MOOC, Open Badges, iMooX

1 Introduction

In 2011, Mozilla[1] developed an open technical standard, which allows everyone to issue, earn and display standardized digital badges (MOZILLA, 2012). Thereby, digital artifacts contain embedded meta-data that link back to the issuer, the badge description, the moment the badge was awarded and also the earner identity. Therefore, everyone can anytime verify the receipt of those badges by taking the data from the badge and check their originality on the issuer's web server. Also digitally signing them ensures authentication, non-repudiation and integrity.

Open Badges can therefore assist to capture individual learning paths from any environment (ELLIOTT, CLAYTON & IWATA, 2014), be awarded from multiple sources and for theoretically limitless individual skills or achievements of any granularity (FINKELSTEIN, KNIGHT & MANNING, 2013). Learner can manage earned badges centralized and share chosen ones on places that matter. Thereby, which badges are shared and published is completely up to the earner. So one can stack together badges that relate to a certain job description or the earner is especially proud of. Collections of badges can serve as virtual résumés that capture ones competencies and qualities (FINKELSTEIN, KNIGHT & MANNING, 2013).

As provision of proper formative as well as summative feedback is essential for the success of learning processes and their outcomes (HODGES, 2004) it could be beneficial to use Open Badges as such feedback instrument (GOLIGOSKI, 2012). Related studies like (LASO, PERNÍAS PECO & LUJÁN-MORA, 2013) and (CROSS & WHITELOCK, 2014) made confirming experiments which made it highly interesting to investigate how to integrate badging capabilities in MOOCs and in addition, how to automate that issuing process. The automation aspect is important because MOOCs typically handle a huge amount of users and thereby manually awarding badges to each course participant is obviously unfavorable. However, that automation process demands a certain dependency from the underlying learning environment, as user and course data has to be made available for the badging system to trigger badge awarding properly.

[1] Funded by the McArthur Foundation (https://www.macfound.org)

Our research question therefore was, if and how it is possible to realize the automation process by simultaneously maintaining simplicity in managing and earning badges.

2 Research Method

The realization of badging capabilities on a MOOC platform strongly followed the prototyping approach of (ALAVI, 1984) and of (LARSON, 1986) which basically contains four stages: identifying and declaring initial requirements, developing a working prototype, usage and evaluation followed by revision.

As MOOC platform the Austrian wide system, called iMooX, has been chosen (NEUBÖCK, EBNER & KOPP, 2015; EBNER, SCERBAKOV & KOPP, 2015). Founded in spring 2014 iMooX holds today about 6000 users and 19 courses (EBNER, SCERBAKOV & KOPP, 2015).

We defined three base requirements. First, to enable iMooX to issue digitally signed Micro- and Meta-Badges that are conform to the Open Badges specification. Second, if user fulfill certain predefined criteria, those badges should be awarded automatically. The third and last requirement was that the iMooX system should mostly be considered as black box, so the badging should be outsourced and performing as independent as possible. The developed prototype was then used in and evaluated on the Course for Open Educational Resources 2015 (COER15) where badges have been awarded for mastering self-assessment quizzes (as Micro-Badge) and course completion (as Meta-Badge). Suggested minor design changes by voluntary given feedback was then used to improve the usability.

3 Prototype Implementation

As the iMooX system itself should have been considered as black box, we implemented a service-oriented web application named *badgeit*. That name adumbrates the action *to badge* with *it* as the badge to issue. It has been realized as Java web application using Java Servlets (3.1) as controlling- and Java Servlet Pages (JSP) as presentation technology. It has been deployed on the iMooX's Tomcat 7.0 web server. For storing badge and assertion data, a MySQL 5.1 database has been used. However, as the application was programmed database-agnostic utilizing Hibernate also various other database systems could have been used.

Signed badges are represented as Java Web Signatures (JWS), secured by a 2048-bit RSA key. To increase data privacy, the earner identity is always salted and SHA-256 hashed before it is added to the badge assertion. To be file and URL-safe, image data as well as the JWS header and payload is Base64url encoded.

3.1 iMooX Interaction

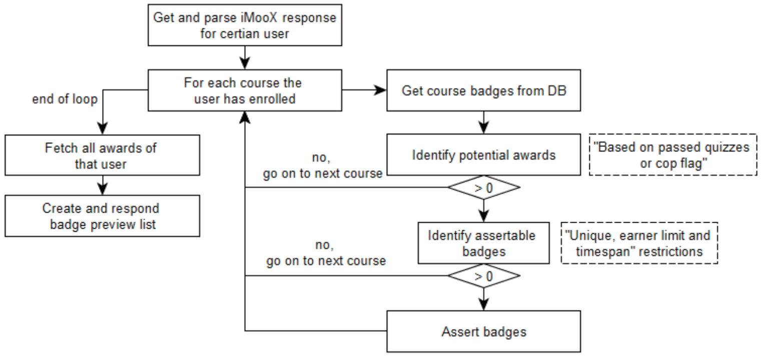

Figure 1: Badge awarding process

As earning a badge basically depends on user activities, the badging system has to be aware of them. In the case of iMooX, especially course data and corresponding user performances have to be provided. Course data contain the unique course identifier within iMooX, the corresponding course name and the amount of course specific self-assessment quizzes. User related data contain the email address of the user as well as the information, which courses have been attended and which self-assessment quizzes have been passed. To get that data, *badgeit* calls two special prepared Groovy scripts, returning appropriate JSON objects. Conversely, to get earned badges of a certain user, iMooX calls a specific Servlet appending the system intern user name of the concerning user. The Servlet then checks if new badges have to be awarded and if that is the

case, awards them. Independent thereof, it always returns a list of JSON formatted badge preview objects of all already earned badges. This procedure is illustrated in Figure 1.

3.2 Badges

Within this study, we considered two badge types, only differing in their defined criteria. One has been awarded for mastering a certain amount of quizzes (Quiz-Mastery-Badge) and the other one for completing a course (Certificate of Participation Badge). Just the ratio of passed to all quizzes of a course does not necessarily mean to also complete the course as additional requirements may be demanded. As example, in the case of the course under evaluation (COER15), users who passed all quizzes then also had to answer a special iMooX questionnaire to entirely complete the course.

3.3 Badge delivery

Figure 2: Personal badge collection web page for a user on iMooX.

The automatic awarding process is always triggered by the user, which requires to assign each badge to a specific course. If one badge should be issued for two distinct courses, then this badge has to be added twice, certainly with different course assignments. Every time a user navigates to his or her personal badge collection web page (see Figure 2) within the iMooX environment, the badge look-up process (see Figure 1) is triggered. As response, a list of already earned badges is displayed to the user. If the user hovers over the presented badge image, the corresponding description is shown as tooltip (see Figure 2).

If a user clicks on the download button right beneath each badge (see Figure 2), another Servlet is called that responds with the complete badge, which means the badge image with all its needed embedded (baked) meta-data. That approach was used as it maximizes the choice the badge earner has concerning backpacks and further sharing.

4 Evaluation

Table 1: COER15 Badges and their criteria

Badge				
Type	Quiz-Mastery	Quiz-Mastery	Quiz-Mastery	Course Completion
Criteria	Quiz 1 & 2	Quiz 1–4	Quiz 1-6	Quiz 1-6 & Questionnaire
Issued	41	35	33	28

To evaluate the suitability of the developed prototype, it was used in the Course for Open Educational Resources (COER15), which took place from May to July 2015. The course was split into six units where each of them implemented one self-assessment quiz. Such a quiz contained 6 to 10 multiple-choice questions where zero, one, multiple or all answers were correct. To pass such a quiz required the user to give at least 75% correct answers. 432 distinct accounts where enrolled to the course, where 124 (28.7%) of them have been considered to be active as they attended at least one quiz. After passing all quizzes, the user had to fill out a certain questionnaire regarding the course and iMooX in general. Those who also did that got a link to their personalized certificate of participation. In addition, participants earned badges depending on their performance. Achievable badges, their criteria and the amount of actual awards are summarized in table 1.

5 Discussion

The badging system performed well from a functional point of view. There have been no problems regarding triggering, awarding and data fetching. Due to its service-oriented approach, that badging system could also be used for any other learning environment, as long as it provides the same data structure. The simple design and the amount of features suffice for a smooth usage, also for many courses at once. However, voluntary feedback given by badge earners revealed some usability issues. First, the downloaded file was hardcoded set to “badge.png”, but one badge earner wanted to have that file named similar to the badge name to have instant clarity on his local drive when downloading multiple badges. Second, linked criteria were represented as simple JSON strings which was understandably unsightly to read.

6 Conclusion

This paper presented a service-oriented approach to integrate badging capabilities into the MOOC platform iMooX and pointed out a possible solution for automatically issuing Open Badges based on certain criteria. We used Mozilla Badges due to they are following an Open approach and are widely accepted. Results revealed the absolute suitability of the developed web application, which lead to its usage also in other courses. As there is always something that could be made better, searching for certain badges and enhanced statistics would increase the back-end experience for those who manage badges. iMooX could also provide additional information to the user, like which courses provide which badge and what does a user have to do to earn it. During the course, the progress for each badge could be displayed, which means to visualize what is needed to achieve the next badge. Beside others, that information could help to increase the motivation to make the quizzes, even if that has not been the user’s initial intention.

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“Clinical Supervision with Confidence”: Exploring the potential of MOOCs for faculty development

Veena RODRIGUES & Sam LEINSTER

Norwich Medical School, University of East Anglia, Department of Medical Education, v.rodrigues@uea.ac.uk, Twitter: @vcrodrigues_uea

Abstract

Background. Postgraduate medical trainees require named clinical supervisors. Given the time pressures and difficulties of geographical access, there is a need to identify appropriate solutions for faculty development. We developed and launched a clinical supervision MOOC (FutureLearn platform) in March 2015.
Objective. To assess the potential of the clinical supervision MOOC for faculty development.
Methods. Quantitative data was obtained from FutureLearn course analytics and course surveys; qualitative data was obtained from learner feedback within the MOOC.
Results. Learners (1,938) from over 75 countries signed up for the MOOC. Of the 899 individuals who began the course, 334 (37.2%) completed. Learners were highly satisfied with the course design and delivery, and enjoyed the opportunities for interprofessional and social learning.
Conclusions. MOOCs have great potential for faculty development without geographical boundaries.

Keywords

Clinical supervision; MOOC; Faculty development; Technology enhanced learning

1 Introduction

Regulatory body guidance for postgraduate medical training in the UK requires recognition and approval of named educational and clinical supervisors against a professional standards framework, for all postgraduate medical trainees by July 2016 (GMC, 2012; AoME, 2010). Ensuring that appropriate faculty development processes are in place to support this is challenging. Traditionally, face to face courses have been used for this purpose but geographical access and high cost have been a hindrance. More recently, distance learning courses based on sound educational theories and practice have been developed for busy health professionals but uptake and completion rates are varaiable. Although resource intensive to set up, these courses can be tailored to individual learners' preferences. Massive Open Online Courses (MOOCs) have made free, online learning on a variety of topics accessible and appealing to learners worldwide; these include several MOOCs suitable for postgraduate medical training (LIYANA-GUNAWARDENA, 2014; SUBHI, 2014; HOY, 2014). The role of MOOCs for faculty development in medical education has not really been explored within the UK or elsewhere at present.

We developed and delivered a two-week MOOC on clinical supervision on the Future-Learn platform in March 2015 (RODRIGUES, 2015) focussing on 'giving & receiving feedback' and 'managing trainees in difficulty', and using contemporary research evidence and best practice in technology enhanced learning. The MOOC was designed with the busy health professional in mind – videos were succinct with transcripts provided; real case scenarios were presented by practicing clinicians; key and optional reading materials were provided; each week had a quiz to test knowledge and understanding; and several opportunities for learner engagement were provided. Learners were able to check their progress at any stage. We assessed the suitability of the clinical supervision MOOC as a pedagogical vehicle for faculty development of busy health professionals.

2 Methods

Data was obtained from FutureLearn course analytics and responses to pre- and post-course surveys. The pre-course survey provided information such as demographic characteristics, reasons for taking the course, preferences for learning methods, employment status, and previous experience of online courses/MOOCs. The post-course survey covered topics such as learner satisfaction with the learning environment and methods used, perceptions of the course design, delivery, and level of difficulty, engagement with educators, time spent on the course, and devices used. Course analytics provided information on the numbers of learners and their degree of engagement with the course. Learners used the discussion boards to engage in reflection, discussion and social learning with each other and the course educators, and to provide feedback on the week's learning experience.

3 Results

3.1 Demographic Characteristics of Learners

A total of 1938 individuals from over 75 countries signed up to take the MOOC (Figure 1); 410 learners completed the pre-course survey and 27 completed the post-course survey.

Figure 1: Worldwide Reach of Clinical Supervision MOOC

The pre-course survey indicated that 56% of learners (230/410) were from the UK; 59% (222/377) were female; 56% (212/378) were aged 26-45 years; 72% (268/375) were employed full time; and learners came from a range of health and social care backgrounds. Forty nine percent (181/369) and 47% (172/369) of respondents had an undergraduate or postgraduate degree respectively. Familiarity with learning environment was good – 52% reported having previously taken an online course/ MOOC.

3.2 Learner engagement with MOOC content

Of the 46% (899/1938) registrants who began the course, 334 (37%) completed. Post-course survey respondents (27) liked the course orientation materials, study skills advice, availability of written transcripts, ability to download videos and audios, and discussions between subject experts, with a majority feeling that the course level was about right. Learners accessed the course from once a week to more than once per day, spending 10 minutes to two hours each time. Most respondents felt the time required by the course and length of the course was about right.

The MOOC was accessed from work, during a commute, at home at a desk or on the sofa, and while out and about. Learners also reported that they had enjoyed learning flexibly around their other commitments, interacting with other professionals, improving career prospects, and supplementing existing studies. The course met or exceeded their overall expectations, with 52% rating their overall experience as excellent.

3.3 Learner Interaction via Discussion Boards

3.3.1 Interaction Statistics

By the end of the course, a total of 2,350 comments and 2,000 'likes' had been contributed by 325 learners across the various course steps. Eighty five percent (763/899) of learners actively participated in the course, with 37% (330/899) classed as social learners who interacted with each other on the discussion boards. Only a small proportion of the MOOC completers (18%, 74/399) appeared to have worked through the course materials, without participation in the discussions.

3.3.2 Learner satisfaction with the course content, delivery and clinical relevance

Comments from learners indicated that the content, design and delivery of the course material met or exceeded their expectation. Several learners commented on finding this platform/course far easier to work through than MOOCs they had tried out on other platforms. Feedback was overwhelmingly positive especially because of the ease with which they could fit the learning around their working days and busy lives (Box 1).

Course Content, Delivery and Clinical Relevance

"I enjoyed the test…and also short videos, in my case with Internet issues, long videos are really a problem."

"I found the course easy to navigate and encouraged further reading/study, which was facilitated by offering links to additional material. A very good course I was able to dip in and out to suit my work and life. It is very well written and presented. I never felt under pressure at all."

"I shall use a lot of what we have learnt here with my students and also in my own reflective practice and development plans."

"I'm glad I stumbled across it, and I feel it has already helped me and a couple of GP registrars who I have been supervising over the weekend...It has opened up new a learning adventure and also helped in the personal development growth .Will implement it in my workplace too."

Box 1: Learner satisfaction with course content, delivery and clinical relevance

The course was planned to be directly relevant to each learner in their workplace setting. The two key areas chosen resonated with most learners as areas of difficulty, uncertainty, or those that definitely required development and to be kept up-to-date. Several learners expressed not having had access to supervision training prior to taking on a supervisory role which made this course feel very relevant to their clinical practice. Others reported that they found the content so valuable and relevant that they had already begun to put it into practice, which encouraged several of their colleagues to join the MOOC themselves. Some learners also found the course very relevant to their continuing professional development and reflective learning (Box 1).

3.3.3 Social and inter-professional learning within a community of practice

A key factor identified by learners as facilitating and enhancing their learning was the opportunity to have discussions with fellow learners and course educators. Learners engaged with each other to share and comment on each other's experiences and to

share additional resources related to the course content (Box 2). Building a community of practice appeared to have made learning much more engaging and fulfilling.

Although this course was designed primarily for doctors, the open access nature of MOOCs made it possible for several different categories of health professionals to participate fruitfully in it. Inter-professional learning developed as an unintended consequence of this MOOC and resulted in making the learning experience much more powerful as it mirrored the real life workplace setting.

Social and Interprofessional Learning

"A very useful course, lots of great resources provided by the course staff and the community members.

"The ideas suggested by others on the course have been equally as valued as the course material itself. I've got some good new ideas to take back to try in practice."

"I've found this course really engaging and it's brilliant to see so many different professions engaged in developing a common understanding of educational processes… It's been wonderful to interact with everyone and each contributor has added an additional shade of perspective to the topics."

Box 2. Social and Inter-professional Learning

Overall, comments from learners indicated that the course had addressed an identified learning need which they had been aware of but remained unmet for various reasons (no formal course available/ offered, no access to learning in resource poor settings, and negligible emphasis on professional standards for clinical supervisors in some countries).

4 Discussion

Tailoring the MOOC content to identified learning needs of clinical supervisors made the course directly relevant to their clinical practice. The use of contemporary, evidence-informed teaching-learning methods and strong theory-practice links led to learners enjoying the course design and deliver. Opportunities for an enriched learning experience through engagement with course content, tutors, and other learners, and the variety of teaching-learning tools used (short videos, animations, reading materials, Twitter chat, discussion boards & quizzes). They found the MCQs appropriately challenging (analysis of performance & learner feedback) and reported appreciating the ability to complete the bite-sized steps in the course at the end of a busy working day.

The nature of the course design made it easy to fit it around the busy working life of health professionals and the relevance of the content far exceeded learner expectations. An added bonus was the opportunity for interprofessional learning. The FutureLearn MOOC platform encourages social learning and this contributed greatly to the positive learning environment and experience, with individuals forming a community of practice and engaging in conversations with each other and sharing experiences, resources, and learning, in moving towards a common goal.

MOOC completion rates are known to be notoriously low worldwide (SUBHI, 2014). Possible reasons might be the lack of negative consequences of dropping out, the desire to sample parts of the course rather than completing it, and the diversity of learners drawn to a MOOC that might feel lost within the large sized cohort and unable to keep up. Of the learners that began our MOOC, 37% participated fully in it. This is significantly higher than the average (22%) for FutureLearn MOOCs in 2014 (NELSON, 2014). We believe that this is partly due to the specially tailored course design and delivery for the busy health professional, the content which met identified learning needs, and social learning which enabled learners to form a community of practice.

The limitations of this study include potential selection bias due the small number of post-course survey respondents. However, the learner feedback comments at the end of the course indicates a broad fit with the responses in the post-course survey. The global learning environment & time differences impacted negatively on the planned Twitter chat; many learners also indicated unfamiliarity with use of Twitter for professional purposes. This will be considered in future iterations of the course design and content.

5 Conclusion

Well-designed and delivered MOOCs have great potential for faculty development on a large scale. However, care must be taken to develop the content against a sound backdrop of educational theory and contemporary practice that can be easily integrated into the busy lives of today's health professionals, and accessed through mobile devices. Building a community of practice enables social learning which improves learner participation, interaction and experience.

Future research is being planned to assess the extent to which healthcare professionals use the learning gained from the MOOC within their workplaces, and the impact of this on the educational environment, trainees, colleagues and patient care and safety in the workplace.

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Bringing together MOOCs and e-books: theoretical considerations and a concrete educational scenario

Michael RAUNIG & Elke LACKNER

University of Graz, Academy of New Media and Knowledge Transfer, michael.raunig@uni-graz.at, elke.lackner@uni-graz.at

Abstract

Although MOOCs and e-books (or e-textbooks) are sometimes mentioned in the same contexts, there has not been much profound research on their relationship yet. This paper tries to deal with their manifold relations in two ways: on the one hand, the commonalities and differences are investigated from a more theoretical, i.e. technical and especially educational point of view; on the other hand, a concrete MOOC and its special framework are presented and the preliminaries for adopting it in classroom education are discussed. Together with a complementary e-textbook based on the MOOC's content, this educational setting is expected to shed further light on the relations between MOOCs and e-books.

Keywords

MOOC, e-book, textbook, educational setting

1 State of the art

It has often been stated that MOOCs and e-textbooks manifest a high conceptual adjacency: J. HARRIS (2013) asserts: "I don't see how a MOOC can be much more than a digitized textbook." J. REICH (2013), in contrast, challenges the "C" in MOOC, i.e. the course character: "Is a MOOC a Textbook or a Course?" None of them has yet scrutinized the similarities and differences between these formats in a sophisticated way and deduced the potential of the one or the other for an educational use. The main question is to identify the strengths and weaknesses of both formats from an educational point of view. This article gives a first insight into a project that regards the potential of e-textbooks based on MOOCs and presents preliminary considerations for a framework to talk about the relationship of textbooks and MOOCs.

2 MOOCs and e-(text)books

Although there have been some attempts or suggestions to transform MOOC content into e-books, their relationship has not yet been examined systematically. In fact, both have some features and possible fields of application in common, but also minor differences which make them a good complement to each other (yet to be used in learning contexts). Before looking at the details, however, it should be made clear that we employ a narrow understanding of the terms "e-book" or "e-textbook" (RAILEAN, 2012) – namely, publications following the EPUB standard (http://idpf.org/epub). The main reasons for concentrating on the EPUB format is its affinity to web technology and special features, e.g. its openness, which make it a perfect candidate for educational settings where MOOCs are also employed (HARRISON & HEIKOOP, 2014).

2.1 Commonalities and differences

From a technical point of view, both rely on current web technologies – mainly (X)HTML for content mark-up, CSS for styling, and JavaScript for dynamic features. However, whereas there is only static content in e-books, MOOCs are rather complex systems consisting of server-side pre-processed content (dynamic web pages, but also interactive parts, e.g. quizzes, forum), embedded external web content and static multimedia files (images, audio, and video). E-book content is (in general) not generated on web servers and requested from them like web pages, and in addition, e-books do not need (and their reading environments mostly do not provide) a server connection – they are packed "finite" bundles of different content (text, multimedia) and can be downloaded as a single file to be consumed offline (HORCHER & TEJAY, 2012). MOOCs, on the contrary, are online by definition. They are neither single "objects" or files, nor "portable" like e-books; an Internet/server connection is essential. Thus, MOOC providers can directly track the participants' activities and performance, known as Learning Analytics (LA), which is only possible for e-books if proprietary reading environments are provided. The diverging online/offline design of MOOCs and e-books also affects their interactive capabilities: e-books only allow for simple interactive components based on client-side scripting technology (e.g. quizzes built with JavaScript) and do not offer any community features or social components; but forums, Q&A, peer assessment and exercises or social media integration can be seen as integral parts of MOOCs.

Though more interactive and more social, MOOCs are not really open (HOLLANDS & TIRTHALI, 2014): their content is only partially accessible and downloadable, depending on the MOOC platform's design. E-books and the EPUB standard, in contrast, meet the requirements of open educational resources by providing a structured container format (WENK, 2013). A special problem of e-books, however, is their non-standardized reading environment (reader hardware or software): whereas web browsers have become mature and standardized, many e-book clients do not support features needed for advanced instructional design (e.g. integrating multimedia or interactive exercises) (RAILEAN, 2012).

Structurally, e-books and MOOCs are in principle linear media, i.e. they are consumed in a (more or less) linear manner. Because of their hypertext nature, however, both offer advanced navigation features compared to traditional print media, e.g. linked chapter markers, or references. Though the linear structure of e-books is more book-style (consisting of sequential chapters and pages) and that of MOOCs is more modular, for design purposes they are both possibly best treated as "granular systems" (LACKNER, EBNER & KHALIL, 2015). Due to their modular nature, MOOCs provide only limited search functionality, whereas e-books are searchable as a whole.

For the learner, it is important to personalize learning resources; e-book content can be annotated, highlighted and bookmarked, but MOOC participants often have to rely on external services and resources for note-taking and structuring their learning experience. Furthermore, citation is a vital component of academic research; the flexible layout of e-books (missing fixed pages) makes it harder to cite resources, but it can be done using ISBNs as identifiers and special methods to point to certain parts (e.g., citation of chapters). MOOCs, in contrast, are not intended to be cited, unless proper persistent identifiers (URLs) have been considered and implemented by MOOC providers.

These differences between e-books and MOOCs finally lead to research on educational contexts where they are on their most impressive and can complement each other.

2.2 Relations and educational applications

Although it seems not very imaginative, e-books could be used as a portable "copy" of MOOCs. Due to the different design and technical details mentioned above, some features of MOOCs – e.g. advanced exercises, social communication, or LA – cannot be mapped to an e-book. For the purpose of a "portable MOOC", it would therefore be better to develop a mobile version of the MOOC platform, as Internet connections become more and more available nowadays.

What seems more promising is to think of e-books as archived, or better: recorded MOOCs. Although e-book formats as EPUB do not meet archival standards or cannot be seen as a sophisticated solution for digital preservation, their offline and package character could serve for "recording" MOOCs for later (offline, portable, and file-based) use. These recorded MOOCs are better citable; their content will be more accessible and structured (due to the open format and the navigation provided by e-books). In order to achieve this, MOOC platforms would have to offer EPUB export functions (which should not be a hard technical issue).

Besides these technical considerations it seems crucial to think of educational settings where MOOCs and e-books can complement each other. The first and most simple idea would be using the e-book as an alternative "course format" – which reminds of the "copy" and "record" approach mentioned above. Here, the features of e-books such as

their focus on linear reading, portability, personalization, book-style structure and navigation could result in better learning experiences for certain learning types and levels (RAILEAN, 2012; HOLLANDS & TIRTHALI, 2014). More elaborated scenarios could picture e-books as a supplement or extension of MOOCs ("MOOC readers"), providing "bonus material" and further reading. Due to its affinity to text and Gutenberg legacy, an e-book could also serve as an extensive MOOC transcript – not only including the MOOC's audio and video parts, but also transcripts or translations, if available. And finally, an e-book could consist of selected MOOC content (a MOOC's "best of"), including even user generated content such as forum entries.

In general, it depends on the content and the educational setting which way of bringing together MOOCs and e-books should be taken. To give a concrete example, the EU-MOOC ("Österreich und die Europäische Union") at the iMooX-platform[1] and its instructional framework will be presented.

3 EU-MOOC – a MOOC for schools

In 2015, Austria commemorates the 20th anniversary of its accession to the European Union. Therefore, in October 2015 the EU-MOOC is offered, aiming to provide Austrian teachers and students with (supplementary) teaching and learning resources.[2] The eight-week MOOC treats different topics, e.g. an introduction to the European Union's common ideas, Austria's accession negotiations and EU Council Presidency in 2006, and it looks behind the scenes, explains the Union's (political) structure, and dips into the European Union's future. Its focus and educational surplus lies on the applicability within a (virtual) classroom setting in secondary schools.

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[1] http://imoox.at/wbtmaster/startseite/eumooc.html

[2] All MOOCs provided at iMooX (http://imoox.at) are licensed under Creative Commons which enables their classroom use without any hesitation regarding copyright issues.

3.1 Instructional framework

MOOCs, notably xMOOCs, are content-oriented multimedia and multilateral learning settings providing video content, supplementary reading materials, text documents, a specific assessment form, or peer assessments of digital artefacts (HOLLANDS & TIRTHALI, 2014). Interactivity and communication are forced within course forums and beyond, e.g. on social media channels. The EU-MOOC incorporates this traditional setting and integrates a multiple choice quiz at the end of each weekly module, provides interviews with contemporary witnesses, e.g. former Austrian Federal Chancellors, telling their experiences, and even some anecdotes, and supplementary reading resources provided by Austrian educational publishers who made relevant extracts from their licenced textbooks freely available to be used. Parts of the MOOC are therefore "digitized textbook[s]" (HARRIS, 2013).

Teachers in Austria were invited to use the MOOC in the classroom. Hence, it was made accessible for teachers in September, so they could get familiar with the resources and integrate them into their lesson planning. Thus, the MOOC was delivered as an ensemble, abandoning the weekly module unlocking; it lost its genuine weekly course structure (HARRISON & HEIKOOP, 2014). The different weeks were replaced by content-oriented chapters with an in-course navigation conform to the demand made on e-textbooks. The lines between MOOC and textbook are blurring (REICH, 2013).

3.2 Instructional settings

In terms of an instructive approach, MOOC resources and e-textbooks are content units. Their instructional surplus derives from the knowledge construction, e.g. the interaction in discussions, in-depth analysis, in terms of a constructivist approach. It has already been proved that MOOCs and e-textbooks as means of knowledge transfer can be integrated into the learning and teaching process using student-centered, interactive instructional settings, e.g. an inverted classroom (HARRISON & HEIKOOP, 2014). Hence, the instructional setting, namely the integration into a didactical framework, makes the difference. Neither MOOCs nor e-textbooks as content-based and -delivering media launch the learning process automatically; it is the media-use,

the choice of specific methods in specific situations whereupon the framework, e.g. (technical) infrastructure and time resources, have to be taken into account.

Two main requirements have to be considered in order to guarantee the MOOC's instructional surplus: (1) free broadband (wireless) Internet access, which cannot be presupposed in Austria (STATISTIK AUSTRIA, 2014), and (2) a mobile (optimized) version of the MOOC because mobile devices and mobile learning are part of the students' learning process nowadays (MPFS, 2014). If an in-classroom use of a MOOC is planned, these two aspects, in any case, have to be taken into consideration. A MOOC-based e-textbook could be a simple but effective solution: It can be designed to be offline available and optimized to be used on mobile devices; i.e. it could display its "book" strengths, e.g. the possibility to annotate and to cite resources. The above mentioned lack of communication and social interaction as a consequence of the impossibility to integrate a traditional forum are counterbalanced by fostered communicative processes in an inverted classroom setting of a (virtual) classroom (HARRISON & HEIKOOP 2014).

3 Conclusion

MOOCs and e-textbooks do not substitute but complement each other, as their strengths lie on different aspects: whereas e-textbooks focus on the instructional aspect, MOOCs integrate both instruction (e.g. learning resources) and interaction (e.g. forum discussions or peer assessment techniques). For an in-classroom use they are equally suitable, as both formats, from an instructional point of view, are content units and can be integrated into an inverted classroom. Nevertheless, taking into consideration the current infrastructural framework and mobile usage habits of younger learners, it has to be stated that an e-textbook has two unneglectable advantages: its offline and mobile availability. The EU-MOOC and the teachers' reactions to it will give us a first insight into different ways a MOOC can be used in the traditional classroom setting. These lessons learned, in turn, will render it possible to answer the question which of the above mentioned educational applications of MOOCs and/or e-textbooks is the most appropriate – at least for the Austrian school system.

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Distributed teaching: Engaging learners in MOOCs

Ann-Kathrin WATOLLA

Leuphana University of Lueneburg, Digital School, watolla@leuphana.de

Abstract

The Mentored Open Online Course "Managing the Arts: Marketing for Cultural Organizations" was a collaboration project by Leuphana University of Lueneburg and Goethe-Insitut e.V., conducted in the first half of the year 2015. It amalgamated a mentored peer-learning approach with a hands-on learning experience by means of using real-world cultural institutions as case studies. Incorporating a variety of teachings, ranging from a multilayer of course instructors, mentoring and peer-to-peer learning to distinct video inputs and reading materials, it opened the MOOC to a many-to-many teaching approach. This paper elaborates on the opportunities for teaching opened up through online courses by implementing a distributed teaching approach.

Keywords

MOOC, distributed teaching, collaboration, mentoring, peer-to-peer learning

1 Introduction

In February 2015, the Mentored Open Online Course "Managing the Arts: Marketing for Cultural Organizations" was launched. It was offered jointly by the Goethe-Institut e.V. and Leuphana University of Lueneburg. Over 17,000 learners from more than 170 countries signed up for the fourteen-week online course and formed a heterogeneous learning community. Based on Leuphana's experience in providing online education, the MOOC was grounded on the core principles of peer-to-peer learning, mentoring and tutoring, a balanced variety of teaching materials and a project-based learning approach. Drawing from Goethe-Institut's extensive network and years of experience in international cultural cooperation, this MOOC was designed around the use of real-world cultural institutions as comprised case studies. The implementation of the variety of teachings in this MOOC acts on the discussion around MOOCs' implications for teaching. It addresses questions for the way teaching needs to be designed to ensure stimulating learning experiences and how online teaching methods need to be framed to suit a different learning community than to be found in the traditional classroom setting. This paper dwells on incorporating different teaching approaches within one MOOC to not only make use of the opportunities that are opened up through this format but to also tap learners' experiences in a way that complies with contemporary digitized learning habits, thus, moving away from a one-to-many teaching model to a many-to-many teaching approach. This aims at creating a multidirectional learning scenario rather than unidirectional teaching from one instructor to multiple learners. It reports on the experiences made and the learning process for the course providers. In the interest of feasibility, this paper will only focus on the learning experiences of a specific learner type of the course, the *participants*, based on their responses to an online survey that was sent to all learners 22 days after the MOOC has ended. In total, 155 participants completed the survey.

2 The course

"Managing the Arts" was designed for cultural managers and practitioners aiming to acquire additional skills in the field and gain academic insights into the management and marketing of cultural organizations. The MOOC was structured in six consecutive

modules, each addressing a different aspect of establishing and running a cultural organization: cultural economy, socio-political contexts, project management, audience building, brand-building and co-creation, strategic implementation.

Depended upon the time to be invested in this MOOC, learners had the option of joining the course either as a *participant* or as a *supporter*. As a participant, leaners were assigned to intercultural heterogeneous teams of five working together on the assignments provided with each module throughout the course. Participants were able to obtain a course certificate after successful completion of the course, awarding them with 5 Credit Points (ECTS) to be counted towards their home university's degree program. In contrast to that, supporters were not part of a distinct team and thus, not confined to the deadlines of the respective assignments, but were able to support the teams in their work by offering feedback and further insights, as well as work on the assignments individually or in self-created teams outside of the learning platform. All learners, participants and supporters alike, had access to all course materials, discussions in the forum, peer evaluations as well as being part of the course network. Additionally, all leaners were able to obtain a statement of accomplishment, validating their efforts in peer-review throughout the MOOC.

Apart from the learning community being subdivided dependent on their role of contribution to the course, the participants' teams were further assigned to one of the four case studies: the *Bangkok Arts & Culture Centre*, Thailand, the *HAU Hebbel am Ufer* in Berlin, Germany, the *Trafó House of Contemporary Arts* in Budapest, Hungary, and the *Centre for Contemporary Arts* in Lagos, Nigeria. This allocation of cases allowed learners to not only collaborate beyond their team with other teams working on the same case study but to exchange and transfer experiences, ideas and insights among the different cases.

Throughout the MOOC, different kinds of teaching were implemented in an effort to enrich the learning experiences of all users. Figure 1 shows how these teachings (except for the multilayer instructors) were perceived by the learners who completed the survey and the impact they made:

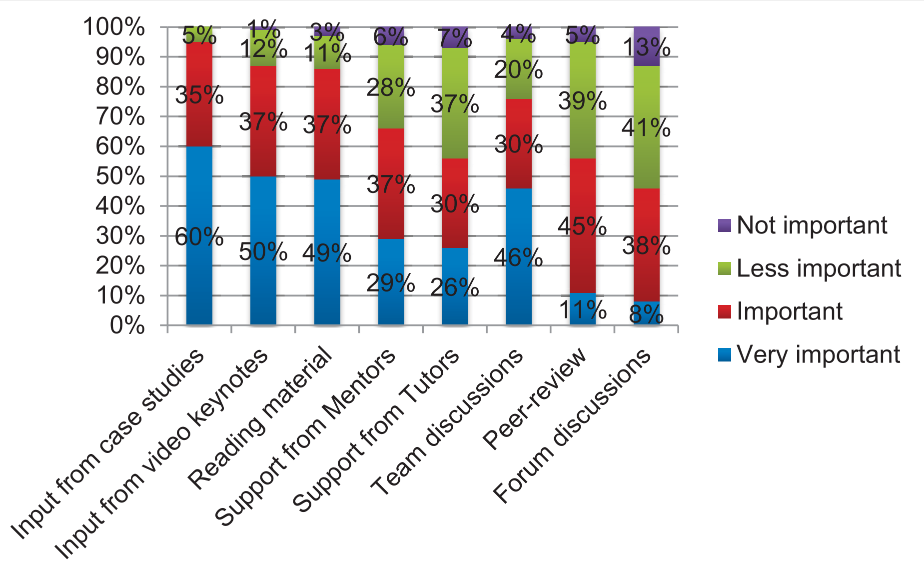

Figure 1: "Looking back on the course, how important were the following aspects of this MOOC for your learning experience?"

This figure shows that the learners' perception of the various teachings differ from the way it was anticipated by the designers of the course which can be seen by looking at the distribution of the possible answers ("very important", "important", "less important", "not important at all"); instead of placing importance on peer-review processes, mentoring and team discussions, participants perceived to put more emphasis on the former two as well as value the teaching materials provided. Following the prominent assumption of online collaborative learning theory that forum discussions are at the core of the teaching (HARASIM 2012), this does not seem to correspond to the learners' statements in the survey. Instead, the instructional teaching materials such as the videos, be it the case studies or the video keynotes, as well as the reading materials have the greatest perceived influence on the learning experience. However, working within a team is also perceived to be one of the main accelerators for learning. The

different kinds of teachings as listed in the figure above will be further examined in the following, while also adding further insights into the role of the instructors.

3 Multilayer instructors

The demands and skills of MOOC instructors cannot be compared to the ones in the traditional classroom setting, as a collaborative online learning environment calls for a different set of needs and challenges. Therefore, a variety of instructors were appointed within "Managing the Arts", each with a different range of duties and perspectives. The most prominent one was the course director, whose main responsibility was to guide the learners through the course and to frame the assignments of the six modules. However, in terms of the operational facilitation of the MOOC, he mostly remained in the background. The academic director provided content-related support and new perspectives on the subject matter by engaging with the learning community via course news (the internal "MOOC blog"), posts in the forum or private messaging. The MOOC facilitator, though using the same means of communication as the academic director, took charge on matters of course design, community dynamics and the structure of the modules. Complementary to these three instructors, 17 keynote speakers with a diverse set of backgrounds shared their knowledge and experience via several short video clips, each between 3-6 minutes in length. All speakers were given the option of directly engaging with the learners of the course, of which thirteen took advantage to and discussed their keynote videos with the course community and to suggest further readings.

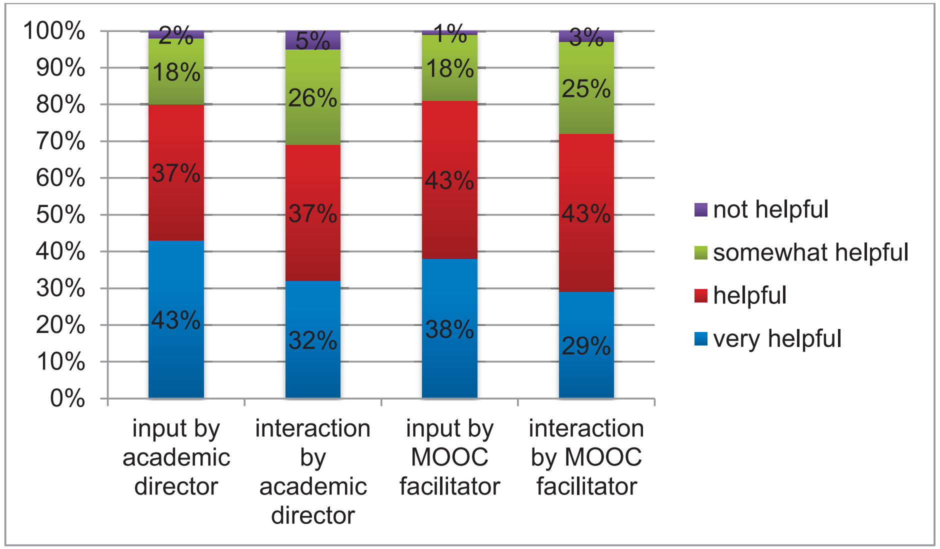

Figure 2: Learners' assessment of the Academic Director and the MOOC facilitator

In figure 2, participants' answer to the two statements "The input provided by the Academic Director/MOOC Facilitator enabled me to contextualize the given tasks and assignments" and "The Course Updates and Forum posts by the Academic Director/MOOC facilitator were of great interest to me" are displayed. Participants were able to select one of the following answers "Applies fully", "Applies", "Applies slightly", and "Does not apply at all". With only a small percentage of learners stating that the input or interaction provided by the academic director or the MOOC facilitator has not proven to be helpful, Figure 2 leads to the assumption that offering an additional layer of support and instruction by means of these roles within the course is beneficial to the learners. As much in the same way the teacher offers assistance in the traditional classroom setting, the academic director and the MOOC facilitator took up these responsibilities and transferred them to the online learning context. Considering the large amount of registrants in this MOOC as well as their divergent backgrounds, these instructors are not only necessary to handle the diversity and quantity of questions and

issues coming up within the course, but also act as mediators to facilitate learning and help learners' engagement with the course topics.

4 Mentoring and Tutoring

At the beginning of the course, each team of participants was assigned one mentor and one tutor. The four tutors' responsibilities included support in technical or organizational matters during the course, as well as offering assistance with team communication and organization. All of the seven mentors had experiences in working within or research of the sector of cultural management, marketing and/or curation. Their expertise was needed to offer guidance throughout the course modules, via personal messages, forum discussions and commenting on their intermediate work, and to evaluate the final submissions of the teams. Both mentors and tutors received training in advance to familiarize with the learning environment and the course structure as well as information on communicating with their assigned teams and within the course community.

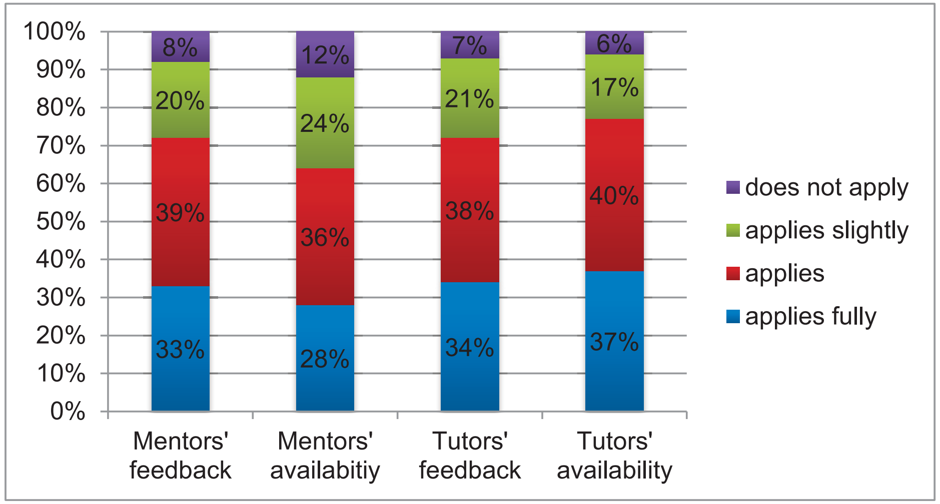

Figure 3: Learners' assessment of tutoring and mentoring

Figure 3 represents the assessments of the two statements "The Mentors'/Tutors' feedback was helpful" and "The Mentors were available to help us at all times" using the options of "Agree strongly", "Agree", "Agree somewhat", "Disagree strongly". Looking at figure 3, it becomes obvious that for more than one third of the participants, the feedback received from their tutors and mentors was of high value to participants. It was perceived to help them in proceeding in their learning experience. Although there is a high number (between 25 per cent and 30 per cent) of participants who did not regard the mentors' or tutors' assistance as helpful and beneficial, these numbers suggest that having a contact person in case specific questions or problems arise to lend support promotes learning experiences. This also reflects Leuphana Digital School's assumption that support in online education formats is even more important due to the physical separation between the various members of the course community.

Table 1: Messages sent during the MOOC

	1st module	2nd module	3rd module	4th module	5th module	6th module
Messages sent by mentors	554	202	160	130	127	88
Messages sent by tutors	896	689	655	296	197	209

Table 1 further indicates that learners need more support at the beginning of a MOOC. Especially the familiarization with the unknown learning environment and course design, this does not seem surprising. However, these numbers further suggest that learners rely more on the sheer technical and organizational support offered by the tutors than on content-related assistance by the mentors – at least in terms of frequency. Drawing from the experiences made, it can also be stated that the process of making oneself familiar with a specific learning environment is an important aspect that is not to be undervalued, as it sets the tone for the entire learning experience. The decreasing amount of messages sent by mentors and tutors over the course of the MOOC furthermore suggests that the learners have positioned and acquainted themselves within the MOOC.

5 Community learning

Seeing that managing and marketing cultural institutions is no isolated endeavor but rather set within a context of multiple stakeholders, influences and dependencies, the collaborative nature of the MOOC attempted to mirror this sphere. Learners worked together not only within a team of five leaners per team (at the maximum) to engage in the diverse assignments of the MOOC, but also within the larger network of the course community. Research shows that learners feel more compelled to engage with the learning materials and contribute to the discussions in a social context (SHARPLES, ADAMS, FERGUSON, GAVED, MCANDREW, RIENTIES, WELLER, WHITELOCK, 2014), thus creating 'peer-group pressure' among learners. Therefore, all members of the course community were encouraged to engage in discussions among peers, debate controversial topics and exchange different ideas using the learning platform's forum. For this purpose, a trailer explaining the didactic approach of the course as well as its methodology has been produced. Additionally, a separate FAQ section helped learners navigate on the learning platform. During the first module of the course, a total of 1364 forum posts were published. This high number is most likely related to the fact that a majority of learners posed questions about the learning environment, the organization of the course and introduced themselves to the learning community. This number decreased over the course of the MOOC, with 890 forum posts in the second module, 659 posts in the third module, 321 posts in the fourth module and 296 posts in the fifth module. Interestingly enough, the number of posts published in the forum increased again during the sixth and final module to 329 posts. The increasing engagement towards the end of the MOOC is most likely traceable to the augmented demand for information on certification and post-course engagement. Going back to the 'peer-group pressure' of social learning which suggests learners' motivation to enhance, this seems to be only partly applicable to the MOOC "Managing the Arts". However, such means that give learners the opportunity to further engage with the course as well as with the learning community are needed to encourage learners to interact with each other (ONAH, SINCLAIR, BOYATT). In other words, the sheer existence of these channels is important for learners to feel that they can engage if they want and need to.

5.1 Engaging learners in peer-review processes

Another example of the way community learning was integrated into the MOOC "Managing the Arts" is the peer-review process. At any point during each course phase, the teams had the option of publishing the drafts of their current work to the course community in order to receive feedback on their intermediate status. By incorporating the comments provided by peers, the teams were able to iterate their work before submitting it for evaluation by the mentors, which took place after each consecutive module. In providing feedback to other teams' work, learners take up the role of the teacher; they can offer supplementary insights on the work produced, appraise the work of others, draw from their own knowledge and experiences to, subsequently, facilitate the learning processes of their peers. These feedback processes did not only take place before the deadline of the respective module but also beyond them to allow learners to further engage in other learners' work by evaluating their final submission. More precisely, learners were able both to comment on the current work of their peers to support them in improving the assignment they are working on and to evaluate their peers' previous work using the same evaluation criteria as the mentors so as to offer assistance throughout the entire learning process. In turn, learners could rate the evaluations they received. In doing so, users learned more about the value of their feedback and were given the opportunity to reflect their skills in the area of giving feedback as well. All of these processes aimed at creating an equated learning community by embracing each and every individual perspective and challenging learners to engage not only with their own work but also with the work of other learners, while fostering reciprocal respect in this learning environment.

Table 2: Peer-evaluations during the MOOC

	2nd module	3rd module	4th module	5th module	6th module
Number of peer evaluations by participants	1013	834	690	618	735
Number of peer evaluations by supporters	1135	885	637	421	559
Number of participants submitting evaluations	289	231	190	176	171
Number of supporters submitting evaluations	406	219	132	117	120

Interestingly enough, the number of participants submitting evaluations is higher than of supporters despite the fact that the number of supporters far exceeds the number of participants. This suggests that peer evaluations offer more value to participants, probably due to the fact that they are the ones directly benefiting from it. Hence, it comes as no surprise that 94% of participants submitted at least one peer evaluation, with 59% evaluating more than 10 submissions.

6 Incorporating different teaching materials

Following the assumption that learners' engagement in MOOCs increases when the learnings can be applied in real-life scenarios rather than in the abstract, this MOOC aimed at reflecting the challenges, opportunities and obstacles cultural managers are faced with on the road to creating high quality art experiences – not by means of a theoretical approach but by drawing on four exemplary cultural institutions to provide insights into their day-to-day work. This allows learners to not only gain insights into cultural organizations but to also contribute their own experiences to the case studies. This was further promoted by use of reading materials and video keynotes, as well as introductory videos providing a larger context for every module. While the reading materials were selected and created in close coordination with the curriculum design, the videos were intended to provide additional perspectives for the learners. Instead of simply presenting one perspective on the subject matter, the variety of teaching materials were consolidated in the 'library' and offered multiple perspectives and approaches, requiring the learners to reflect upon and scrutinize so as to conceive their own opinion. Additionally, resources – articles, videos and web links – that were shared by learners throughout the course were also integrated into the course' library.

The 75 video keynotes were produced as 'talking head' videos using a green screen recording technique to embed visuals adding value to what is being said or integrate keywords highlighting important terms and concepts during post-production. Following the notion of interventions rather than lectures, the videos had a maximum duration of seven minutes each, requiring the keynote speaker to present their hypotheses in a clear and concise way. As for the 74 case videos, they were produced as on-location and interview videos, thus allowing to engage learners by bringing the cultural institutions closer to them in telling their story (HANSCH, HILLERS, MCCONACHIE, NEWMAN, SCHILDHAUER, SCHMIDT, 2015). Complying with the extensive case narrative that has been developed to target the respective peculiarities of each of the case institutions, the guided interviews with relevant actors and decision-makers provided insights into the day-to-day work processes of the organizations. Additional b-roll allowed the learners to get a feel for the contexts and circumstances in which these cultural managers work.

Despite the amount of teaching materials provided, the course data shows that participants spent a great deal of time engaging with them. According to this, 77% of the participants read more than 50% of the mandatory literature, 90% of the participants watched more than 50% of the keynote videos, with 71% watching more than 75% of the total keynotes provided. 71% of participants watched more than 50% of case videos. The initial assumption was that the learners would learn the most through being granted insights into specific cultural institutions and seeing first-hand how these deal with the challenges they are facing. For that, participants were asked to assess the statement "The literature/ video keynotes/case studies helped me a great deal to learn new things about arts management and arts marketing", using the options of "Agree strongly", "Agree", "Agree somewhat", and "Disagree strongly" (see figure 4). However, it shows that all teaching materials – readings, case studies and keynotes videos alike – had approximately the same perceived impact on the learners' acquisition of new knowledge on arts management and marketing.

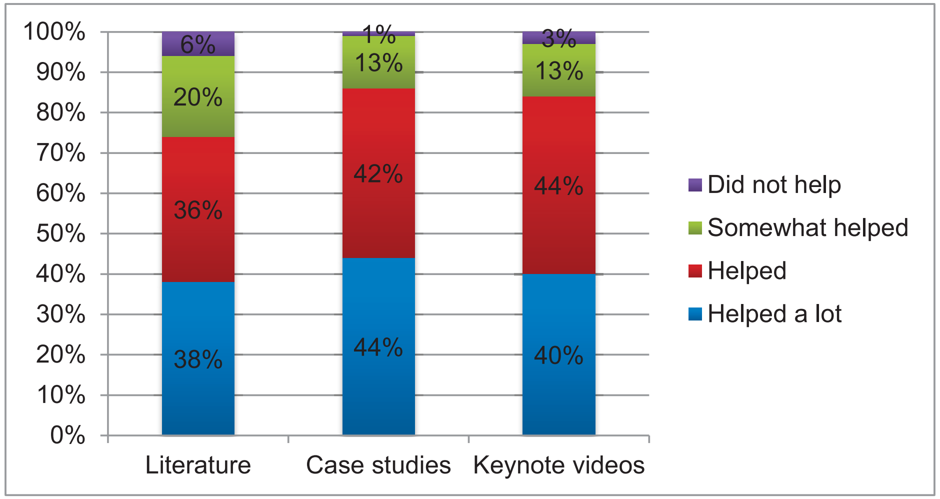

Figure 4: Participants' learning about arts management and marketing

7 Conclusions

Drawing from the experiences gained by implementing a myriad of teachings into the MOOC "Managing the Arts: Marketing for Cultural Organizations", it can be stated that this distributedness of teaching offers perceived benefits to the learners. It facilitated the juxtaposition of different perspectives, concepts and approaches, while encouraging the course community to critically reflect upon them to draw own conclusions. Likewise, the distribution of teaching methods fosters deep engagement with the course, which is reflected by the course completion rate of 43%, a rate higher than the average completion rate among MOOCs (BRESLOW, PRITCHARD, DEBOER, STUMP, HO, SEATON, 2013). The challenge here is to recognize the learners not as mere recipients of knowledge but as co-creators of content. However, the complex system of teachings requires more resources, preparation and planning than a one-to-many teaching approach, especially in a scenario that includes the recognition of efforts by certification according to ECTS standards. Manual mentoring and tutoring, a thoroughly conducted video production, carefully designed curriculum and intensive project management to coordinate the distributed teaching approach exhaust funds rarely available for higher education. All of this shows that despite the positive impact this approach had on the learners' experiences, the effort needed for its sustainable implementation is extremely high. Therefore, the various elements of this proposed teaching approach would need to be individually analyzed in terms of their impact on the users' learning processes so as to be able to scale them for further iterations and application. Such scaling would also provide an option to reduce the production costs by integrating for example teaching videos in several iterations to distribute costs.

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Interactive activities: the key to learning programming with MOOCs

Carlos ALARIO-HOYOS, Carlos DELGADO KLOOS, Iria ESTÉVEZ-AYRES, Carmen FERNÁNDEZ-PANADERO, Jorge BLASCO, Sergio PASTRANA, Guillero SUÁREZ-TANGIL & Julio VILLENA-ROMÁN

Universidad Carlos III de Madrid, Departments of Telematic Engineering and Computer Science, calario@it.uc3m.es

Abstract

This paper presents the experience of the MOOC "Introduction to Programming with Java – Part 1: Starting to Programming in Java". This five-week MOOC was deployed in edX and ran from April to June 2015. More than 70,000 learners registered for this course, which had no prerequisites on programming skills. This MOOC was carefully designed to enhance learners interactivity with the learning contents through numerous formative activities supported by both edX built-in tools and other external tools aimed at helping to learn programming gradually, such as Blockly, Codeboard and Greenfoot. The results show the usefulness of including a large number of formative activities for checking the learning process and a very positive feedback of the selection of tools included in this course.

Keywords

Programming, Java, interaction, activities, MOOC

1 Introduction

Programming is one of the areas that has experienced a higher demand for learning in the recent years. More and more learners, regardless of their previous background, are demanding courses on topics related to programming. In edX (EDX) for example it is possible to find courses dedicated to programming in general, but also to learning about specific languages, such as C#, R, Python, etc. In early 2015, Universidad Carlos III de Madrid (UC3M) released on edX a MOOC on programming (in general), but using Java as the driving language, as this is one of the most popular programming languages nowadays (CASS, 2015). This MOOC was entitled "*Introduction to Programming with Java – Part 1: Starting to Programming in Java*", and was the first of a series of three introductory courses on programming designed following the guidelines for preparing learners for the Advanced Placement (AP) Computer Science A exam. This MOOC was published about the same time that two other related courses: "Introduction to Java Programming – Part 1" from The Hong Kong University of Science and Technology and "Preparing for the AP* Computer Science A Exam – Part 1" from Cooper Union. Unlike these two other courses, the MOOC designed by UC3M has a strong practical and interactive component as it includes a large number of formative exercises supported by both edX bult-in tools and other external tools such as Blockly, Codeboard or Greenfoot. This paper focuses on describing the aforementioned MOOC from the interactive perspective, detailing the activities and tools used in this course and presenting the results of learners' opinions about their usefulness for learning.

2 Overview of the MOOC

"*Introduction to Programming with Java – Part 1: Starting to Programming in Java*" is the first five-week MOOC of a series of three dedicated to teaching basic principles of programming using Java as the driving language. This first MOOC started on April 28 and was open until June 30 2015. More than 70,000 learners from more than 190 countries enrolled in this course.

This MOOC follows a similar structure during its five weeks. Each week (section in the edX terminology) includes four main subsections with videos presenting the theoretical concepts and a number of formative activities for reinforcing these concepts. In addition, there are from five to six complementary subsections: a laboratory subsection to keep practicing the main concepts using mazes and games in a fun way to increase learners' engagement; a recap subsection to summarize the main concepts of the week and provide solutions to the most challenging formative activities; one or two subsections with the graded exams (summative activities); a subsection with additional formative exercises for those who want to learn more; and a subsection with videos collecting learners' view about that week.

The MOOC follows a bottom-up approach for teaching programming going from imperative programming to object-oriented programming, using different levels of abstraction. Week 1 introduces programming going from the simple calculator to the computer. Week 2 explains state transformation. Week 3 deals with functional abstraction. Week 4 presents the basics of object-oriented programming. Week 5 finishes with packaging of classes and interfaces.

The summative evaluation system is based on two types of activities: exams and peer-review activities. In total there are five exams (one per week), with a weight of 15% of the final grade each, and two peer-review activities in weeks 3 and 5 with a weight of 10% and 15% of the final grade. In addition and as previously mentioned, there are numerous formative activities to foster learners' interaction with the learning contents along the four main subsections, and as part of the laboratory subsection and subsection with additional formative exercises for those who want to learn more.

3 Interactive activities

This MOOC has been designed to foster learners' interaction with learning contents, as we, as instructors, believe that one of the keys to understand programming is actually by practicing, and making mistakes while coding your own programs. In total 578 exercises were designed as part of this MOOC, besides 70 videos of 5-6 minutes average each. Over 90% of these exercises correspond to the formative evaluation and are distributed throughout the five weeks. To prepare these exercises the teaching staff used mainly edX built-in tools: multiple choice questions, multiple response questions, text input questions, drop-down list questions, drag and drop exercises and peer-review activities. 496 activities (85.8%) were done using these tools (see Table 1). The remaining activities were created using three external tools, Blockly, Codeboard, Greenfoot, and some additional JavaScript ad-hoc developed activities. Most activities with edX built-in tools (except peer-review ones) were focused in the lower levels of Bloom's pyramid, testing the degree of understanding of the main concepts, their application in controlled environments and forcing the learner to face recurrent mistakes. Activities with external tools (especially in upper weeks), and peer-review ones challenged learners to combine their knowledge in the creation of more complex programs.

Table 1: Distribution of exercises of each kind in the MOOC

Type of tool	*Number of exercises*
edX - Multiple choice questions	150
edX - Multiple response questions	49
edX - Text input questions	182
edX - Drop-down list questions	98
edX - Drag and drop exercises	15
edX - Peer-review activities	2
Blockly activities	15
Codeboard activities	38
Greenfoot activities	19
JavaScript ad-hoc developed activities	10
TOTAL	**578**

3.1 EdX built-in tools

EdX built-in tools are the backbone of interaction in this MOOC. All the summative assessment activities (exams and peer-review activities) are supported by edX built-in tools only, to avoid problems in the integration of external tools with the edX grading system. It is worth noting the effort that teachers put in enriching interactive activities

and problem sets supported by edX built-in tools, avoiding for instance simple multiple-choice questions that can be almost immediately answered after watching a video lecture, as it happens in many other MOOCs. Instead many activities are preceded by code snippets over which the learner is questioned. Detailed feedback was provided after each activity to reinforce learning.

3.2 Blockly activities

Blockly (BLOCKY) is a web tool by Google that allows creating simple games using visual representations. The learner assembles blocks of pseudocode dragging and dropping from the central frame to the right frame without having to worry about language syntax. In this MOOC, Blockly was adapted to generate Java code, and customized to create a set of mazes (left frame) of increasing levels for the laboratory assignments of the first two weeks (see Fig. 1), engaging learners through failing in a fun way.

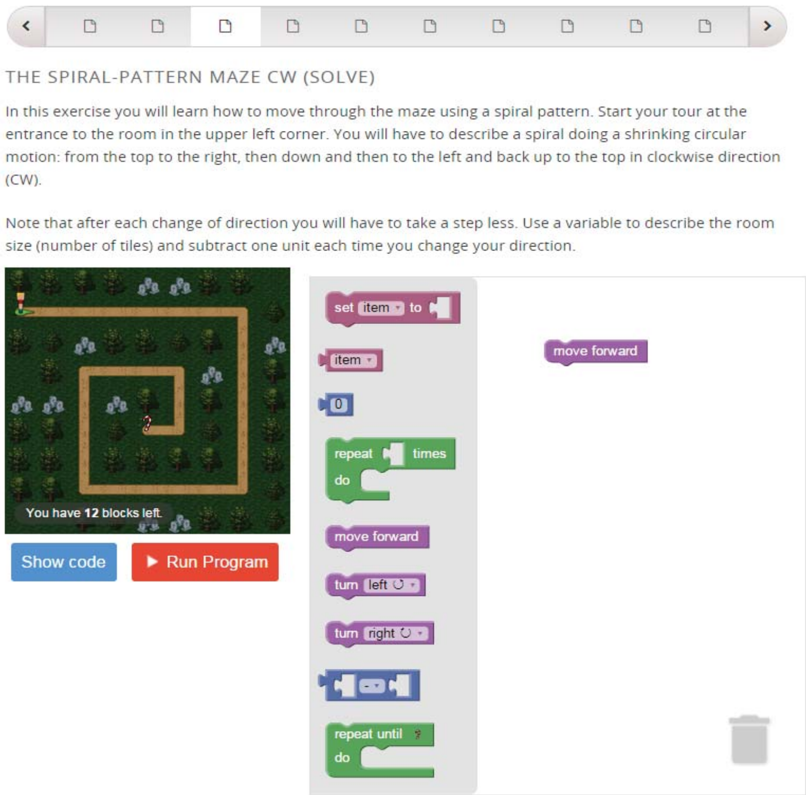

Figure 1: Screenshot of the MOOC in edX integrating a Blockly activity

3.3 Codeboard activities

Codeboard (ESTLER & NORDIO) is a web-based development environment by ETH Zurich. This external tool was used in this MOOC to include numerous supporting activities throughout the four main subsections of each week, and also in most of the laboratory assignments from week 2 onwards. Codeboard is integrated in edX through

the IMS LTI standard (IMS GLC, 2014), although its connection with edX grading system was not used in this MOOC. The teacher creates base programs in Codeboard and afterwards the learner can modify, save, compile and run them directly in edX, using only the browser; if the learner makes a mistake he can reload the page to start over. Codeboard was also useful to support the creation of small programs by learners.

3.4 Greenfoot activities

Greenfoot (KÖLLING, 2010) is a standalone development environment by University of Kent. Greenfoot is designed to teach object-orientation in Java and allows an easy development of games offering a twofold view of both the code and the graphical user interface. Greenfoot was used to support the understanding of object-oriented programming concepts (e.g., objects, classes, inheritance, etc.) in weeks 4 and 5 of the MOOC. Teachers created base programs that learners had to tune and extend.

4 Learners' view of interactive activities

Learners had the opportunity to answer an optional survey at the end of the MOOC to express their opinion about various aspects of the course, including interactive activities and the different tools supporting them. In total, 470 learners completed (totally or partially) this questionnaire. Figure 2 presents an overview of the results. Firstly, learners were asked, in general, about the usefulness for learning of the interactive activities in this MOOC, and also about their quality (two top charts, Likert scale from 1 to 5). Then, they were asked about the usefulness for learning of each type of activity in a Likert scale from 1 to 5 and their difficulty in a Likert scale from 1 (very easy) to 5 (very difficult). It is convenient to note that quizzes include multiple choice questions, multiple response questions, text input questions, and drop-down list questions.

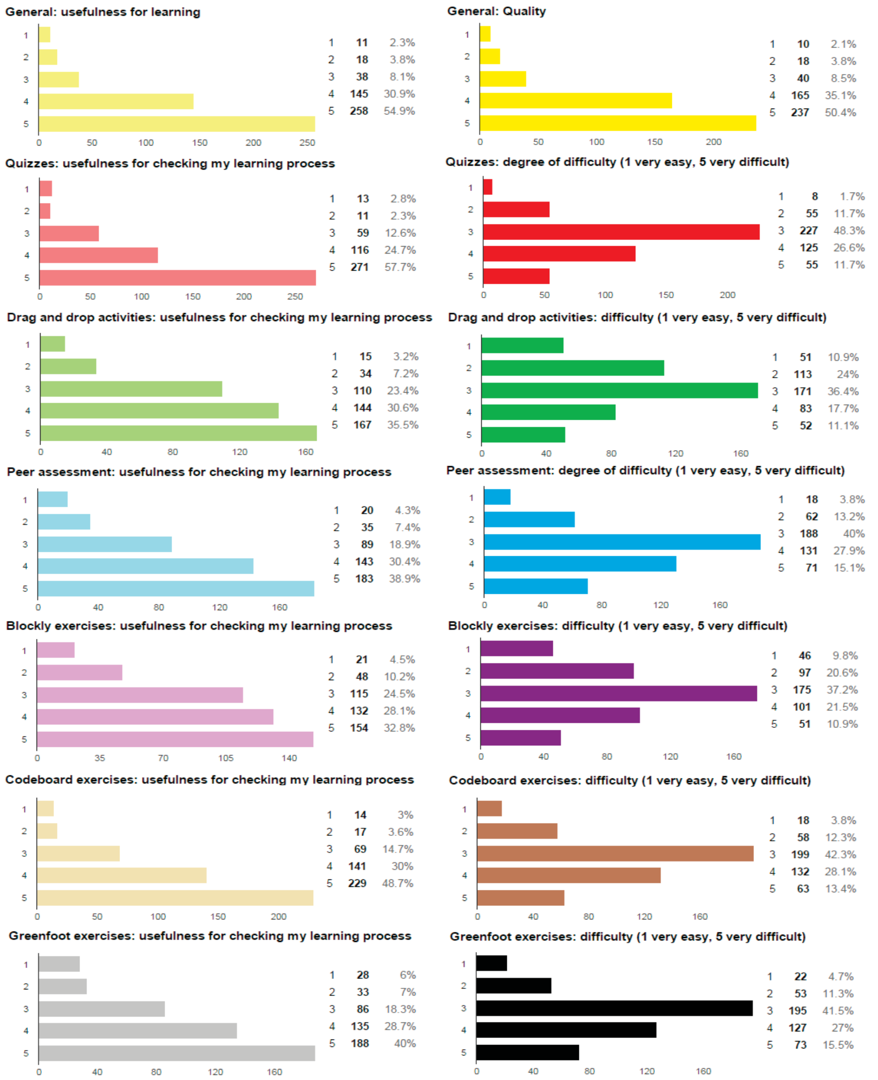

Figure 2: Summary of learners' view of interactive activities (N = 470).

5 Discussion

The data obtained from the survey shows learners' positive perception about the usefulness of having a large number of interactive activities in this MOOC on programming with Java (85.8% of learners reported 4 or 5). These activities should be carefully designed and developed to achieve a satisfactory level of quality, as it was the case in this MOOC (85.5% of learners assessed the quality of the activities with 4 or 5).

As for the type of activity, all of them received good ratings from learners in terms of their usefulness for learning. Perhaps it may be worth highlighting the thoroughly-designed quizzes (82.4% of learners reported 4 or 5) and also the activities with Codeboard (78.7% of learners reported 4 or 5), which allowed learners to compile and run Java code directly from their browsers. Regarding the difficulty of the activities, it can be seen how Blockly activities were perceived as easier than the others, as they were used to introduce novice learners in the programming world; while Codeboard activities, Greenfoot activities and the peer-review activities were added in advanced stages of the course. It is also interesting to note how learners perceived that quizzes were non-trivial at all. These positive results need to be balanced with the trade-off between the number of interactive exercises and the workload for teachers of creating them.

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How can motivation and completion rates be improved in a MOOC? Data analysis of IFP School's first two interactive MOOCs

Maria THIROUARD, Olivier BERNAERT & Lucie DHORNE

IFP School, maria-alejandra.thirouard@ifpen.fr

Abstract

The past few years have seen an exponential growth of the number of MOOCs worldwide. However, it is proven by the avaivalable completion rate data that motivation can quickly fade even for students who are highly motivated at the beginning of the courses. Faced with this realty, it seems crucial for the future of MOOCs to adress this motivational issue and to find ways to improve the completion rates.
IFP School launched two MOOCs – “Sustainable Mobility” and “Oil&Gas” – which saw unusally high completion rates.
In this paper we analyze the results obtained within these two MOOCs. Our goal is to identify the factors that made such completion rates possible and to understand how these key issues help to produce a succesful MOOC. By this analysis, we are able to give some tips in terms of video recording, interactive assignment design such as Serious Game or Mini-games and participant mentoring to promote motivation. Applying these tips when designing a MOOC will minimize the chance of participant withdrawal and thus lead to high completion rates.

Keywords

MOOC, Videos, Completion rates, Gamification, Serious Game

1 Introduction

IFP School is an engineering school that offers applied graduate programs, providing students and young professionals with education in the fields of energy which meets the needs of industry and the demands of society with particular emphasis on sustainable development and innovation.

With the aim of improving notoriety and to produce innovate teaching methods, IFP School launched two MOOCs in the last year. The surprisingly high completion rates made us wonder what factors contributed to this successful experience. With the data available today it is impossible to scientifically prove why our completion rates are higher than the average. However, the empirical analysis that has been done in this paper helps us to understand some of the factors that impact motivation. In particular, the impact of the use of a serious game and mini games in the completion rate will be discussed, as well as the video format, duration and pace.

2 Definitions

2.1 Completion rate

Since there are several definitions, it is important to clearly define the completion rate considered in this paper:

$$Completion\ rate = \frac{number\ of\ participants\ awarded\ a\ certificate}{total\ number\ of\ participants\ enrolled}$$

2.2 Mini-games and Serious games

A mini-game (figure 1) is a disguised quiz. In other words, questions are asked through a colorful interface that makes the participants feel they are actually playing a game. Participants need to drag-and-drop the correct answers into the right boxes.

A serious game (figure 2) is much more sophisticated than a mini-game. The learner acts as a player first by selecting an avatar and then by playing a succession of sequences which form a continuous game. The interface might be the same as the mini games but behind a serious game, there is a real and complete story with, sometimes, a real complex simulation, such as a refinery or an engine test bench, where participants are asked to find the right answer by playing with the different parameters available to optimize a solution.

Figure 1 : Mini-games views

Figure 2 : Serious-Game – Refinery and Engine bench test simulators

3 The two IFP School MOOCs

3.1 The MOOC on Sustainable Mobility

IFP School launched its first MOOC in November 2014 called “Sustainable Mobility: Technical and environmental challenges for the automotive sector”. This MOOC was taught in English over a 4-week period. When building this MOOC it was important to challenge the current teaching practices to improve interaction and to develop an environment where the students can experiment and practice the skills learnt from the lessons. A Serious Game was designed and it was implemented over a three week period inside the MOOC. In addition to the Serious Game, the participants worked on peer-to-peer assignments.

3.2 The MOOC on Oil&Gas

IFP School’s second MOOC was launched on May 2015. This MOOC called “Oil & Gas: from exploration to distribution” was conceived with the support of TOTAL and in partnership with IFP Training. Again, this MOOC was taught in English with subtitles in French over a 4-week period. The course is not only the first of its kind, but also innovates by bringing together three key players with interrelated interests. IFP School developed the course, IFP Training coordinated the project and Total, one of the main companies interested by education in this field, provided financial support, content and expertise. Two main innovative elements were implemented inside this second MOOC: 2 interactive videos and 15 mini-games to evaluate the participant’s progression.

Table 1 presents the characteristics of each MOOC in terms of courses (videos) and assignments (quizzes, games, peer-to-peer assignments). Each week, forums were opened to discuss the different questions asked on the courses. In addition, an “open forum” was also proposed in order to promote exchange between different participants.

Table 1: IFP School MOOC characteristics

	Videos	Forums	Serious Game	Mini Game	Quizzes	Peer-to-peer
Sustainable Mobility	28	11	3	-	3	1
Oil&Gas	31	10	-	15	1	-

As a first observation we notice that we use a high number of discussion forums compared to the number of videos. The maximum participation obtained in one forum was 12% in the Sustainable Mobility MOOC and 16% in the Oil&Gas MOOC with a minimum of 1% participation in both. Aware of this low participation rate, forums will be reduced and will focused on discussing specific issues for the following sessions.

Table 2 presents the data regarding each MOOC: total number of participants enrolled the median age, male/female ratio and finally the completion rate.

Table 2: IFP School MOOC data’s

	Total enrolled	Median Age	Male/ Female	Completion Rate
Sustainable Mobility	3099	25 y	77% - 23%	31%
Oil&Gas	21840	27 y	75% - 25%	28%

4 How to improve motivation and completion rates in a MOOC

4.1 Goal definition and intended audience

MOOCs, by definition, are open to everyone. However, defining the goal and the intended audience has a major impact on the way the MOOC is built. It seems obvious that a MOOC designed for teenagers should not be built in the same way as a MOOC designed for retired people. Every choice must be in accordance with the goals: the videos, the quizzes, the duration, marketing and communication operations… Even if anyone can enroll, adapting the MOOC to your target population helps to improve the completion rate.

In our two cases our primary goal was to attract young students to the fields of energy and transport, and to improve the recruitment of excellent students from all over the world. From this clear goal, the following choices were made:

- The choice of English as the language: to reach out to international students.
- The 4-week duration: a short period so that students would stay connected.
- Assignments design: The use of mini-games and a serious game for validation.
- The format of the videos.

4.2 Assignments design

As mentioned previously, as an applied engineering school it was important for us to improve interaction and to develop an environment where the students can experiment and practice the skills learnt from the lessons. The mini games and serious games were first developed to address this issue. Looking now at the outstanding completion rates, it is reasonable to ask ourselves if the use of this model helped achieve such results. For this purpose we asked the following question "What did you think of the serious games?" 53% of participants say that the serious game helped improve their comprehension and 43% say that the serious game improved their motivation (other possible answers were "They were not interesting" or "I did not use them"). Since these two populations are mutually exclusive, it means that for 96% of the participants surveyed, the serious game had a positive impact in the learning process. To go further, a comparative analysis was done. The global grade and the degree of satisfaction were compared. It appears that, the learners who found that the serious game was the most interesting activity obtained a better global score in the MOOC. It is then possible to conclude that the serious game is a real motivation tool.

With this previous experience, the initial and final survey for the Oil and Gas MOOC was adapted. Table 3 shows the answers to the question: Would you rather be evaluated by a quiz or a mini-game? It shows the answers before and after the MOOC: 83% of the participants prefer the mini-games at the end of the MOOC. Much research has shown the benefits of games in teaching. It is our believe that it also has an impact on the learner's motivation and therefore in the completion rates

Table 3: Would you rather be evaluated by a quiz or a mini-game? Comparison of answers.

	Before MOOC	After MOOC
QUIZ	30%	15%
MINI-GAMES	46%	83%
Do not know	24%	1%

4.3 Video Format

We studied the data from the 2 MOOCs concerning the impact of the video type and duration on the participants' motivation and involvement. A similar study on videos produced for the MIT MOOC (GUO) showed that the shorter the videos, the higher the involvement. In total, for the two MOOCs, we have produced 59 videos with duration times between 4 and 17 minutes. To compare all these videos, we define the Viewing Rate (VR): It is the ratio between the average viewing time over the total length of a video.

4.3.1 Video duration

Figure 3 gives for each video of the "Sustainable Mobility" MOOC (blue circle) and the "Oil&Gas" MOOC (green triangle), the Viewing Rates (VR) obtained from YouTube as a function of the video duration. We can easily conclude that the duration of the video has a direct impact on the VR. In figure 4, we have divided all the videos into 3 groups: a first group of videos with a duration less than 6 minutes with a VR higher than 80%, a second group with a duration between 6 and 12 minutes with an average VR of 77% and a last group with all the videos having a duration higher than 12 minutes with a VR of 66% and lower.

The Viewing Rate decreases rapidly for videos with a duration longer than 12 minutes. In conclusion, to maintain students' involvement during a video it is better to divide the courses into short sequences (typically 6 minutes). In all cases, it is better to never record videos with a total duration longer than 12 minutes to limit participant dropout.

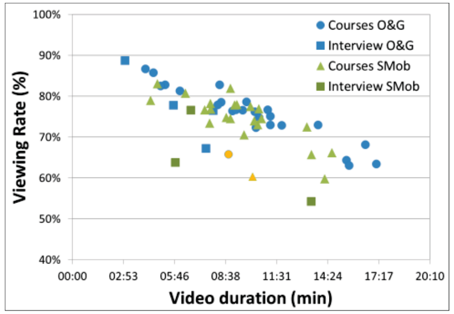

Figure 3 : Impact of video types on viewing rate (VR)

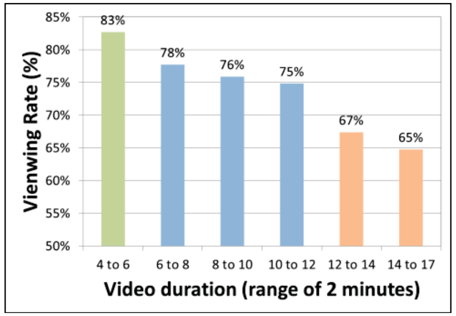

Figure 4 : Impact of video duration on viewing rate (VR)

4.3.2 Video type

In the MOOCs we had two types of videos. First, the classic courses with a professor giving his lecture in a window in the top left corner of the video. In this format, the teacher explains the slides shown one by one all along the video The second type was videos containing interviews of experts as complementary information related to the subject of the course.

In figure 3, the squares are the points for interview videos. This figure shows that the classical course types have a higher viewing rate (VR) compared to the interviews of experts. This difference is even bigger as the duration increases. In conclusion, to control the dropout rate, it is better to limit experts' interviews to short sequences, for instance, less than 6 minutes.

Finally for figure 3, we can also observe the drop-out effect of the first video of a MOOC (yellow points). The VR of the first video of a MOOC is considerably lower than the others. This could be explained by the idea that at the beginning of a MOOC

some participants are enrolled just to "have a look" with no real personal objective to follow the MOOC.

4.3.3 Video speaking pace

We define the speaking pace as the number of words said during the video by the professor divided by the total duration of the video. The reading rate depends on each professor's manner of speaking and varies between 110 and 170 words per minute, with an average of 140 words per minute. Unlike the conclusions of the GUO study, we did not observe any correlation between the reading rate and the Viewing Rate (VR).

5 Conclusions

IFP School launched two MOOCs last year and the completion rates obtained by both MOOCs were impressively high (around 30%) compared to the available average completion rate data. The data available was used to determine the different student profiles and their degree of satisfaction in order to identify the main parameters that help improving the completion rate. With the information available, it is extremely difficult to produce a scientific demonstration to identify the key parameters that improve completion rate. A true comparison would be to re-edit the MOOC without a serious game and compare the completion rates from both experiences (with and without serious game) to isolate the impact of the serious games on the completion rates. Nonetheless, motivation is a key factor to increase the completion rates and many research before has shown how games improve motivation.

Throughout this empirical analysis the factors contributing to improve the completion rate were analyzed and described:

1. Defining a clear goal and the target population helps build a MOOC that will satisfy the needs and characteristics of the main group of participants.
2. Using games as a form of evaluation creates a fun environment and improves the learner's motivation.

3. It is important to limit the video duration to a maximum of 12 min, the ideal being between 6 and 12 min. The speaking pace showed no impact on the viewing rate.

The question people are asking now is : how can we motivate people more? Even though MOOCs are changing the whole learning approach, they remain fairly unknown to the general population. In our two experiences, more than 80% of the participants were doing a MOOC for the first time. This population is not used to learning through a MOOC. Another possible way to motivate them would be to mentor them. The idea is to show participants how they should learn with a MOOC and to give them some support if needed. For this purpose four mentor profiles can be identify with four different roles: overall program tutor, module tutors, technical support tutor and peer tutors. This tutorial system will be introduced this in the future sessions.

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How MOOCs Are Impacting Campus at the Technische Universität München

Anna KRUSE & Elvira SCHULZE

Medienzentrum, Technische Universität München,
anna.kruse@tum.de, elvira.schulze@tum.de

Abstract

Given the investment of time and resources that a MOOC requires, one of the most pressing challenges facing MOOCs today is the question of on-campus integration. How can institutions of higher education bring their investment in MOOCs back to campus, enriching matriculated students' learning? And how might students on campus participate in MOOCs in a way that benefits both their own learning and global registrants' learning, establishing a cycle of reciprocal value? The Technische Universität München (TUM) has been working toward a solution to this challenge, and this paper explores both the context of TUM's interest in deepening the curricular integration of MOOC materials and specific cases of blending MOOCs and the on-campus experience at TUM.

Keywords

MOOCs, Flipped Classroom

1 Introduction

For many universities, the Technische Universität München (TUM) included, MOOCs (Massive Open Online Courses) pose a special opportunity to advance those universities' missions and play an important part in the advancement of knowledge and intellectual curiosity worldwide. With five individual MOOCs and two MOOC reruns now successfully completed, we at TUM continue to find MOOCs a valuable means of outreach and a gratifying contribution to make to learners around the world.

Being two years and thousands of hours deep into the production of MOOCs, however, has made it impossible for those of us at TUM entrusted with MOOCs to ignore the extensive resources required to prepare and run a successful MOOC. Given this reality, MOOCs cannot, then, simply fade away after being run, nor would we want them to – the potential for continued learning and engagement is too enticing to be ignored. In an effort to see MOOCs less as a bounded approach and more as a highly-connected node in a network of learning scenarios, we have intensified our quest to find the most effective and seamless ways to bring the instructional material produced for MOOCs back into the on-campus experience.

But by no means is TUM a newcomer to supporting digital tools and methods in teaching and learning. As a University of Excellence in Germany, TUM has been awarded funding from the government for a variety of exciting "future concepts," and looking toward the future with regards to teaching and learning has long been a part of TUM's institutional strategy. Now that we have a critical mass of experience behind us, we are taking the opportunity to reflect on our needs and goals as an institution, and identify how MOOCs can fill those needs and advance those goals. As we set for ourselves an aim to harness the best of digital technologies for our students (deepening our impact) while also benefiting learners throughout the world (widening our impact), we see MOOCs as a truly valuable part of this strategy.

2 Flipping the Classroom with MOOCs

The "flipped classroom" model – synonymous with the "inverted classroom" model – is a form of blended learning in which learners engage with the content of a course at

home through such methods and resources as instructional videos, podcasts, and interactive elements, combined with tasks and assessments. When the students meet with the instructor during the in-person class period, he or she can clarify common questions and can use the time to discuss and to solve problems (cf. LAGE, PLATT & TREGLIA, 2000; BERGMANN & SAMS, 2012). Thus, learning is personalized because learners can work with the course materials according to their own needs and at their own pace.

"Flipping the classroom" is one of the ways we have connected the instructional content of our MOOCs to our on-campus classrooms. Two of our MOOCs, *Einführung in Computer Vision* and *Autonomous Navigation for Flying Robots*, illustrate two different ways we have flipped the classroom using MOOCs. One model sees an instructor repurposing the modularized material that he had produced for his MOOC in his classroom after the MOOC had run. In the other model, an instructor invites students matriculated at TUM to participate live in his MOOC and take a rigorous in-person exam in order to receive credits for their participation.

2.1 On-campus engagement using MOOC media

TUM's first MOOC, *Einführung in Computer Vision*, offered in 2014, is a living example of how a MOOC can continue to generate waves of positive impact. Based on a foundational class in the Elektro- and Informationstechnik program, Professor Martin Kleinsteuber's *Einführung in Computer Vision*, which was offered as a German-language course, attracted over 17,000 learners when it first ran in January and February 2014. Kleinsteuber offered the course again in 2015, with 28% of registrants during that re-run indicating that they had never before heard of TUM. As an introduction to the university for many potential students around the globe, its reach was wide and impression positive.

Kleinsteuber did not stop with the MOOC, however. He blended the materials he had produced for the MOOC into his on-campus classroom, offering the next local iteration of *Einführung in Computer Vision* as a "flipped classroom" experience. His blended course saw enrollments double from the last time he had offered the course on campus, pre-MOOC. Kleinsteuber has since continued to investigate the impact of using material produced for a MOOC in his classroom, and analysis of relevant data is ongoing.

In the interest of sharing the results of his experiences more widely, Kleinsteuber recounted his experience building a MOOC with colleagues at TUM through conversations and a formal presentation. In his presentation, he pointed to the time required to build a MOOC, the dramatic difference between lecturing to a camera and teaching students, and complex production logistics as the biggest challenges that he faced in producing a MOOC. Despite these development and production challenges, however, Kleinsteuber pointed to the MOOC as a rewarding and positive experience.

3.1 On-campus engagement during a live MOOC

Dr. Jürgen Sturm's and Professor Daniel Cremers' course "Autonomous Navigation for Flying Robots", TUM's first offering on edX, looks at how quadcopters, programmed to operate autonomously, can serve such purposes as remote monitoring and visual inspection of construction sites. The course, offered in English, ran in 2014 with excellent participation figures – over 21,000 learners registered – and the course team offered the course again in 2015 with a similarly enthusiastic reception.

Following the first run of the MOOC, Sturm and Cremers took a creative next step that brought its impact back to the TUM campus. Students across the university were invited to participate in the course when it was offered the second time (in 2015), and those who finished the MOOC, which they participated in asynchronously, received 2 ECTS (European Credit and Transfer Accumulation System) credit points after successfully passing an oral examination that Sturm held. Seventeen TUM students successfully passed and earned TUM credit.[1]

[1] To learn more about the course's on-campus offering, please visit https://vision.in.tum.de/teaching/ss2015/autonavx

3 Student Professional Development

3.1 Instructional contributions to QEMx

Students participating in course development for a MOOC gain useful experience both in their content area, in pedagogy, and in the "soft skills" that will serve them well in the workplace. One such example of students participating in the development of a MOOC at TUM comes from Professor Holly Ott's and Professor Martin Grunow's *Quality Engineering and Management* course (QEMx). At TUM, students in the Informatics master's degree program are required to complete an interdisciplinary project (IDP) that applies their Informatics knowledge to the context of another discipline. TUM has been working to facilitate productive confluences between students' IDP projects and ongoing projects in other areas, including MOOCs. For Ott's and Grunow's QEMx MOOC, eight students made significant contributions to the course as part of their IDP projects. The eight Informatics students worked in pairs, each producing a major piece of the MOOC: one pair completed a case study project that used hiking boot manufacturing steps to lend an applied perspective to the DMAIC quality management cycle, one team completed a Statistical Process Control (SPC) study on helmet manufacturing, another team provided data correlation exercises, and the final group used programming languages and online libraries to build statistical simulation exercises. These projects were all incorporated into the instructional sequence of the QEMx MOOC. The students publicly presented their work at the end of the semester, completing an intense, applied cross-over work experience that will help prepare them for their future careers.

3.2 Serving as teaching assistants during MOOCs

Students serving as teaching assistants (TAs) are at the frontline of a MOOC. They must be ready to take on any number of unexpected questions from learners around the world in a thoughtful and engaging way, using excellent judgment and diplomacy. Given the diversity of these expectations, the experiences that MOOC TAs gain from serving as mentors and instructors in a MOOC are valuable for their professional development. At TUM, at least one TA, and in the case of one course 3 TAs, has been active on the discussion board while each course is live. Questions that student TAs field range from content-related questions to questions about course logistics and larger philosophical questions about the value of the subject and more. One student who served as a TA for a MOOC at TUM noted that responding to students' often-creative questions triggered him to productively revisit the concepts in question. TAs must exercise a good deal of professional judgment as they respond to the questions, answering with care and escalating issues that they cannot resolve to the course instructor, as well as learn to explain succinctly and both diagnose and target misunderstandings.

4 The Credits Question

MOOCs and other technology-enhanced learning strategies afford a different kind of credentialing measurement, competency- or mastery-based, which stands in direct competition to the traditional method of time-based measurement (also known as "seat time") coupled with a minimum standard of performance. In fact, PIPER (2010, cited in GRAHAM, WOODFIELD & HARRISON, 2012) notes that validating the importance of mastery-based learning, such as that demonstrated through MOOCs, is one of the major policy challenges that we are currently facing, and to embed MOOCs in our university structures, it is a critical one.

As this paper has already mentioned, TUM has awarded ECTS credits to TUM-matriculated students who participated in Sturm's and Cremers' *Autonomous Navigation for Flying Robots* MOOC and successfully passed an oral examination. The on-campus oral examination was a critical element in TUM's ability to award the credits, since only an in-person examination would allow the verification of identity and content acquisition at a level sufficient for formal recognition. Participating in the MOOC and completing the examination was judged to meet the standard for 2 ECTS credits,

which according to ECTS standards entails 50-60 hours of engagement with the content.[2]

As a part of its Academic English courses, the TUM Language Center offers students the option to participate in a "Guided English Self-Study" with an online course or a MOOC.[3] Students choose an English MOOC related to their course of study, and then they work with an English instructor to formulate a plan that involves 30 hours of language-related work to supplement the online course work. This work might include summaries of lectures, drafts of homework assignments, exercises tailored to their own needs, and use of online learning resources. Students participating in a self-study receive regular written feedback on the texts they submit and meet with the instructor several times over the semester to monitor their progress and get individual feedback. If students have successful completed the self-study sequence, they earn 2 ECTS credits. We find this pilot to be not only successful but also a truly creative way to blend MOOCs into the on-campus experience.[4]

5 Next Steps

Since MOOCs open up new teaching experiences, we believe that MOOCs in the context of blended learning scenarios, including flipped classroom arrangements, have potential that we should not underestimate. In order for this potential to fully develop, we see it as the task of institutions of higher education, and particularly their e-learning

[2] Please visit the ECTS handbook (http://ec.europa.eu/education/ects/users-guide/assets/ects_users-_guide_web.pdf) for more information on ECTS credits. The calculation for credits based on effort is available on page 10 under „Workload".

[3] For more information on the TUM Sprachenzentrum's Guided English Self-Study option featuring MOOCs, please visit http://www.sprachenzentrum.tum.de/academic-english-cluster/.

[4] The Sprachenzentrum's English Guided Self-Study featured in the October 2014 edition of *Language Learning & Technology*. The issue is available at http://llt.msu.edu/issues/october2014/emerging.pdf.

centers and teaching and learning centers, to teach instructional staff about didactic principles that inform the use of digital media – including open educational resources, such as MOOCs – and train them on the use of teaching and learning tools and web applications in higher education.

In addition, universities and other higher educational institutions should continue thinking about whether and how what students learn in MOOCs can be formally recognized as part of their personal learning outcomes.

6 Concluding Thoughts

Over the past two years, we have been gratified to see how many creative ideas for making MOOCs long-lived have circulated on campus. Each MOOC is valuable both as a "package" of course content carefully created and curated and as a collection of discrete, modular instructional elements that could potentially be reused in different ways. We are also pleased to have the opportunity to support our students as they learn English using MOOCs as both content and language instruction. Perhaps because of their visibility and impact globally, we have found that MOOCs inspire excitement and fresh ideas at the university, and as we have described in this paper, TUM's work with MOOCs has allowed both instructors and students involved in developing MOOCs to deepen their experience with instructional design and pedagogical principles for online learning. We have already seen MOOCs make a difference through flipped classroom scenarios using MOOC material, helping prepare students for their professional careers, and connecting MOOCs more firmly to campus through credits. We look forward to seeing the transformative potential of MOOCs continue to unfold.

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When a University MOOC become a professional training product

Leslie HUIN, Yann BERGHEAUD, Alexandra CODINA & Eric DISSON

University Jean Moulin Lyon 3 – France

Abstract

The course “Introduction to business process mapping” was the first experiment of MOOC at the University Jean Moulin Lyon (France). This MOOC welcomed 7,500 participants. The rate which was really interesting was the 90% of professional participants due to the topic of the MOOC.
Regarding the feedbacks of participants and the fact that some companies have contacted us to include our MOOC in their training plan, we felt the great potential of adjusting this learning system to meet some organizations’ expectations.
Thus, this paper focuses on the description of a dedicated system to respond to this target and to enhance the use of a MOOC by companies. We propose two complementary offers, specifically dedicated to professionals : a blended MOOC format mixing the online course with a face-to-face support and a recognized University Degree (UD). The blended-MOOC has already been experienced in our own institution during the 2015 session.

Keywords

MOOC, blended-MOOC, Professionnal training, Continuing education, Tutoring,

1 Introduction

In January 2015, Jean Moulin University (Lyon – France) opened its first MOOC. A motivated team of teachers wanted to experience the design and animation of this kind of learning system. At an institutional level, there wasn't any strategical objective. Initially, this first go was just to prove the ability of the University to produce a MOOC which could compete in the current landscape. We didn't think about any Return On Investment (ROI) as we just wanted to jump on the MOOC bandwagon like many other institutions at this time.

This MOOC welcomed 7,500 participants (a very satisfactory number for a French MOOC) but about only half of them were really active. This was an unexpected number as we didn't make any communication around the MOOC, focusing primarily on the content. However, the rate which was really interesting for us was the 90% of professional participants, including 77% of professional in activity. Only 6.5% of learners were students. That is definitely not a proportion we are used to.

This can be explained by the topic of the MOOC: Introduction to business process mapping. We proposed an initiation to business process management to help organizations to improve efficiency and quality, and also a method and a formalism to draw those processes. Thus, it allowed participants to learn knowledge but also to acquire skills making the MOOC practical and directly applicable. Participants had the choice to obtain the level 1 certificate by answering quizzes to verify acquired knowledge, but also to obtain the level 2 certificate by adding a group project evaluated by peers.

90% of the participants had a professional interest in the short or medium term, and therefore a real operational concern. We don't know if subscriptions were individual or corporate initiatives. We only know that about 25% of the participants did the MOOC during their working time. We also measured an average satisfaction score of 8.7 out of 10. According to these figures, we have thought about adapted offers and opportunities for organizations which will be discussed in the next sections.

2 Two complementary offers

Regarding the feedback of participants and the fact that some companies have contacted us to include our MOOC in their training plan, we felt the great potential of adjusting this learning system to meet some organizations' expectations. Thus, we propose two complementary offers, specifically dedicated to professionals, for the 2016 iteration:

1. A blended MOOC format: a blended MOOC format mixes the online course with a face-to-face support. In this scenario, learners follow the same learning path like the regular MOOC participants but they also have an individual support and sessions with a teacher to assist in their progress. This premium service can also be completed by a customization of the group project theme which can be adapted to the stakes of the organization.
2. A recognized University Degree (UD): The University will propose in 2016 a UD based on the completion of this MOOC and another one. This will include verified exams and individual tutoring. This goes beyond the usual verified MOOC certificate earned online. We keep the traditional evaluation mode. Only the course contents are delivered online. So there is a real recognition of training by an official university degree. Organizations are ensured a certain level of learning and learners are valued by a diploma.

Although the MOOC course access remains free, those two specific offers have a cost regarding the extra-services. This will allow the University to find a return on investment (ROI) and a viable economic model. For the time being, some organizations have already expressed their interest and signed for a partnership.

3 Opportunities for organizations

Mixing the *massive open* with the *individual private* makes MOOCs more suitable for organization training needs. Some of those opportunities are discuss below.

3.1 Accessing preconceived training

When a MOOC is designed by a University, it is proposed to organizations as a preconceived training system. This means that the MOOC landscape offers an on-shelves catalog of training modules. The design cost is not imputed to the organizations. Thus, the MOOC can be seen as a turnkey solution. We are not going to enter into the debate of user licenses. Most of the MOOCs' content are open and can be freely used in a non-commercial context. However, the boundary between a non-commercial and a non-profit use is really thin and can raise some issues which are out of the scope of this paper. We just advise organizations to contact the MOOC owners if they want to use the MOOC in a corporate plan to be sure they do not violate the license.

Being preconceived is one of the main advantages of MOOC for organization but also one of the major limitations. Indeed, training created for thousands of scattered learners with various profiles may not be adapted for peculiar expectations. Moreover, we know well the problems of persistence observed in MOOCs learners' behavior. This can be problematic because high stakes training must be effective.

3.2 Aligning the MOOC on specifics needs

Organizations typically expect their internal training to meet their expectations. With only using a MOOC, this may not be possible. By adding face-to-face meeting and adapted group projects to the organization, we reduce the gap between the original module and the operational needs of the organization. The main content remains generic but learners can make the connection between their learning and their own practice field.

3.3 Helping the persistence of the learners

It is notorious that learners' persistence is very difficult (CLOW & DOUG, 2013; COFFRIN et al., 2014; KIZILCEC et al., 2013). Achieving a MOOC requires a lot of individual skills like self-organization, self-motivation and self-determination (RYAN & DECI, 2000). Thus, not everybody is able to complete a course. However, like in other learning system, it is possible to add some mechanisms to improve the learner persistence. Some can be built in the MOOC and some can be set alongside. This is the case when you propose a blended system. By taking the individual out of the mass, you improve the learning experience of the participant. Tutor can check its progress, strengthen motivation and propose individual remedial actions if needed. As MOOCs are not suitable for everyone, this support system can federate more learners among those who do not have the required initial skills.

4 Experiment of the blended-MOOC

The blended MOOC offer has been commercially formalized for the 2016 session of the MOOC. However, we have already experienced this system in our own institution during the 2015 session.

4.1 Objectives of the blended system

Our University has initiated a plan to manage its processes in order to add some quality and efficiency to the various services. To do so, the administrative staff must be sensitive to this issue and must be able to interpret and build processes models. So, it was decided to include the MOOC into the training plan. For this first experiment, people were encouraged (not appointed) to register to this training. This is actually a very important fact: the registration was an individual initiative, not compulsory and not rewarded by any kind of promotion. The motivation of the participants was to learn new knowledge and skills which will be useful in their own work and also at an institutional level. Being part of the first MOOC of the University and of an innovative training format was also source of motivation for some of the participants.

They had the choice to follow the level 1 or the level 2 (even if they were encouraged to go as further as they could). The expected work effort was about 3–4 hours per week and this amount of time was released by the head of service to participants in the course.

The participants had to follow the lessons online like any other learners, following the same pace. They had the same MOOC animation and received the same newsletters.

However, we added two weekly face-to-face sessions to help the participants to do the exercises and answer questions regarding the content. It was also a good opportunity to help them to stay on track and to encourage their good progression. These sessions were not mandatory. We can compare them to office hours during which a teacher was available to learners. This way, we keep the flexibility of the learning system by letting the participants organize their own progression. Alongside, using the quizzes results, we were able to adapt messages regarding individual behavior.

On top of that, during the group project phase, the participants of the University had a specific system. The group project themes were found according to the needs of the University in order to initiate real work. Also, the peer evaluation was done only among the University staff and a teacher's verification was performed. The evaluation was exactly the same but realized in a private environment.

4.2 Some encouraging early results

110 individuals registered for this first iteration. However, only 49 started the course. We have a 55% of no-shows. The analysis gave two reasons for this. Firstly, there has been a kind of excitement in relation to novelty. Registrations were opened to all. Even people not really concerned with the subject had registered to participate in this institutional event. Secondly, we met with our administrative teams the same problems as with traditional participants: time management and organization. Many had not been able to find the time required for their learning. Among the remaining 49 persons, 29 achieved Level 2 certification, or 59%. However, we can be more precise.

Only 39 got committed in the course, having participating in activities and having benefited from the blended system. 10 got involved only in the week 0 which consisted in presenting the course and understanding the platform. Thus, we agree to present a success rate of 74% (29 over 39).

Beyond individual success, it is important to underline the great advantage of group projects for the institution. 14 projects were made and constitute a working basis for the mission of process management at the University.

4.3 Lessons learned

The University has decided to renew the MOOC to strengthen the training plan regarding process management. However, during the 2016 session, we will experiment some adjustments. Indeed, adding face-to-face sessions and individual monitoring does not eliminate all the difficulties encountered in MOOC. Fortunately, thanks to this first iteration, we have seen the challenges and we can capitalize for the next one. Our tutors will be more empathetic and will implement a more relevant and effective motivational strategy.

We also suggest a pre-MOOC support to help learners to define their organization and their motivation. This consists in a personalized awareness and tools to facilitate their learning and engagement. We hope to reduce the no-show rate without including any obligations.

5 Conclusion

The course "Introduction to business process mapping" was the first experiment of MOOC at the University Jean Moulin Lyon (France). Despite the prolific literature on MOOCs and different feedbacks, we did not really know what to expect. The MOOC encountered a great success among professionals. Therefore, we discovered a strong opportunity for the University. Indeed, it reinforces its role at the heart of continuing education and not just the initial training.

On top on that, targeting the professionals allows us to propose offers with paid premium services. We found our return on investment. However, we must be clear-sighted. This economic model will not be applicable to all topics. Practical and professional oriented courses suit better to the model. Maybe we should not think about the profitability of a single MOOC but about the whole picture. A cost effective MOOC can help to finance c*itizens MOOCs*, which can also be part of the ethic mission of Universities.

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MOOCS as an Opportunity to Foster International Collaboration between Universities: MOOCs for Teachers

Paola CORTI[1], Manuela MILANI[2] & Susanna SANCASSANI[1]

[1] Politecnico di Milano, METID Service, paola.corti@polimi.it, susanna.sancassani@polimi.it

[2] Università degli Studi di Milano, CTU, manuela.milani@unimi.it

Abstract

Polimi Open Knowledge (POK), the MOOCs portal developed by Politecnico di Milano, offers a new series of courses: MOOCs for Teachers, developed in an international partnership and focused on pedagogical innovation.
This paper describes the design path of these MOOCs, a successful collaborative design experience which involves experts at international level and testifies the possibility to design collaboratively, in multiple settings, with professionals with different profiles and belonging to different universities.

Keywords

POK, MOOCs for Teachers, international collaborative design, international testimonials, academic internationalization

1 Polimi Open Knowledge

Politecnico di Milano (Polimi) is one of the main Polytechnic University in Italy. It offers degrees in Engineering, Architecture, and Design. Polimi Open Knowledge – POK (www.pok.polimi.it) is the MOOCs platform designed by METID (the service of Politecnico di Milano, devoted to e-learning and e-collaboration http://www.metid.polimi.it) on the basis of Open edX.

Politecnico di Milano in 2014 defined a specific strategy for MOOC development, whose aim is to "bridge the gaps" in the following areas: #1 transitions of students' career; #2 teaching innovation; #3 academic social responsibility.

To this end, Politecnico di Milano has been developing a series of MOOCs in the above-mentioned areas:

area 1. To support the main transitions in students' career. That is, from high school to university, in order to improve and consolidate their STEM skills before starting courses at Politecnico di Milano (e.g. MOOCs in pre-calculus and physics); from Bachelor of Science to Master of Science, aligning students' skills to the Master of Science of Politecnico di Milano, if they come from another university (e.g. MOOC in financial and management accounting); from university to employment, raising awareness about critical soft skills in a professional (e.g. MOOCs in Conflict Management, Change Management, Working in Multidisciplinary Teams)

area 2. to support teaching innovation in both higher education institutions and schools, a series of "MOOCs for Teachers" is under development in collaboration with the French UNIT consortium [Université Numérique Ingénierie et Technologie, http://www.unit.eu, from now on, UNIT in the text]; topics entail among others: flipped classroom, use of OERs, active learning

area 3. to open up the expertise of Politecnico di Milano for the benefit of a general audience, promoting conscious citizenship in compliance with the third mission of universities (e.g. MOOC about the relation between science and astronomy, Bet on Math MOOC about maths and gambling)

MOOCs are available in Italian and/or in English.

Polimi Open Knowledge – POK initiative has the multilayer objective of sharing knowledge, as it develops MOOCs to:

- meet a diversity of learners' needs: university students and staff, but also learners at a global scale, maximizing the impact of the education and service missions of the university;
- support new forms of teaching and learning and their integration to enhance curricular education at Politecnico di Milano.

In other words, MOOCs are designed to be both an educational opportunity and a lever for teaching and learning innovation in the MOOCs for Teachers series. The scenario proposed for them promotes the sharing of knowledge between experts during the design phase, and this is the main focus of this experience paper.

Very synthetically, here are the most relevant numbers about POK platform from June 2014, to November 2015, before we enter the main topic.

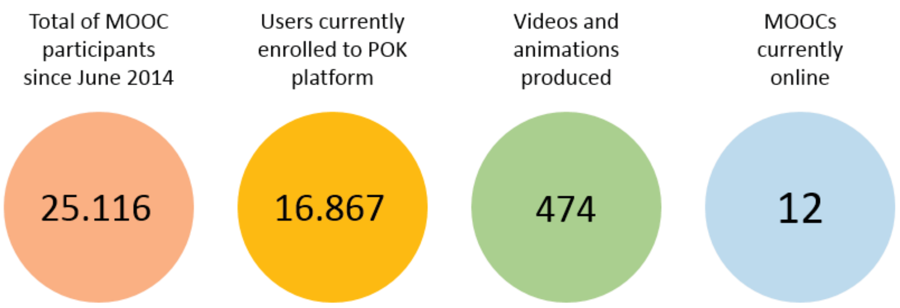

Figure 1: POK in numbers (June 2014 – Nov 2015)

2 MOOCs for Teachers and collaborative design

MOOCs in general may represent a chance to foster collaboration between teachers and instructional designers, coming from different countries and different cultures. At academic level, MOOCs are considered an innovation in teaching and learning practices in themselves.

MOOCs for Teachers series represents an example of effective international collaboration during the design phase.

Since the very generation of the series, METID strongly believed in the opportunity to involve other Universities, in order to discuss and design the pedagogical approach to be transversally applied in all the MOOCs of this series and to share ideas and approaches with professionals and experts coming from other academic contexts. Politecnico di Milano thus invited UNIT consortium to join the project in order to work together at different levels, choosing between the mere endorsement of the project in itself, or a participation in the collection of digital contents, or the design of the MOOCs in themselves, as preferred. The development and implementation of contents is kept in house, in order to avoid, at this first level of collaborative experience, to put too many variables on the table. In the first face-to-face meeting, all participants from both sides (METID and UNIT) made proposals about the management of the partnership in itself, in order to set few shared boundaries. They also put the basis for future steps toward openness of contents, and about the methodological approach to be adopted in the design of these MOOCs, in order to contribute in a sustainable way according to the capacity and the desired involvement of each partner.

Through some online and face-to-face meetings, Polimi and UNIT reached the following expected results:

- to sign a Memorandum of Understanding between the partners, open to sharing and reusing contents in an OER perspective;
- to define a common strategy about the development of contents' structure, according to partners' different competencies;

- to share a pedagogical perspective, consistent with both the target users and the innovative approaches to be focused, starting from experiences (coming from participants themselves and collected from testimonials by the staff involved in the MOOC design) in order to build knowledge and to enable practical didactical design skills. The most consistent approach with this attitude was suggested to be Kolb's Learning Cycle, according to pedagogical experts from L'École des Mines de Nantes, so the whole series is build according to Kolb's learning Cycle approach (KOLB, 1984). Kolb provides one of the most useful descriptive models referred to the adult learning process, inspired by the work of Kurt Lewin. According to Kolb, there are four stages in learning, which flow from each other: Concrete Experience – new or a reinterpretation of existing experience – is followed by Reflection on the experience itself. Afterwards, comes the Abstract Conceptualisation, that is the derivation of general rules describing the experience, or the application of known theories to it; Hence, comes the construction of ways to modifying the next occurrence of the experience (Active Experimentation), leading in turn to the next Concrete Experience.
- to design in parallel different parts of the MOOCs sections, according to the effort each institution could sustain and to the specific competences possessed.

This is the short story of the first MOOC under construction, about flipped classroom, which will be online before Christmas Eve 2015.

1. A panel of seven teachers from Politecnico di Milano took part to a focus group in order to let them raise innovation needs and effective and motivating learning experiences; all the suggestions collected were used to start the discussion about the subject matter of the MOOCs of this series.
2. The design team started proposing a set of objectives, elaborated through a face-to-face brainstorming activity, which involved Politecnico di Milano, L'École des Mines de Nantes, l'Université de Lorraine.
3. Partners discussed whether to propose an active path to participants or to offer the choice between a quick, informative path and a more active approach, according to each participant's attitude and availability.

4. Partners shared the perceptions of criticalities specific to each group of possible target users (teachers in high schools, academic teachers, professional learning teachers, etc.).
5. Partners agreed about letting them free to choose their own path: the informative path will require only a final test, while the active path will propose different activities to support reflection, deep understanding, sharing of experiences and their evaluation, reconstruction of meaning, sharing of ideas, and much more.
6. Partners started working on the design of the first MOOC of the series, and this is the focus of the following activities because is the most advanced experience in this field, for us: the MOOC on flipped classroom.
7. Partners shared a common design scheme in which, for each general objective, specific learning objectives are defined and activities are described to be suggested in order to achieve them. This scheme is built online and updated each time design team focuses on a specific section of the course, and adds or modifies slightly something; in this way all the team is always aware of what happens also in parts of the course they are not directly working on.
8. Partners invited some international testimonials who already experienced this pedagogical approach, and asked them to record videos in order to tell the story of their flipping experiences, step by step, through a set of questions selected according to Kolb's learning Cycle approach. Preferably, the design team asked to experts who teach STEM subjects, since our first target are Polytechnic's teachers. At the moment we have recorded video interviews from Penn State University (USA), École Polytechnique Fédérale de Lausanne (CH), Leiden University (N); University of Sheffield (UK), École des Ponts ParisTech (F) and Politecnico di Milano (IT).
9. In the design team partners had the chance to embrace an international expert in the field, Ariane Dumont[1], who collaborates in order to build the theoretical parts of the course, with a strong practical attitude; the design team and Professor Dumont are sharing everything: sources, materials, papers, documents used for the preparation of the lessons, ideas, and doubts. It is a real collaborative design activity, which in METID experience is not so usual, nor so easy in an academic scenario.
10. The final revision of all storyboards involves the whole team in asynchronous activities, in order to check consistency of all parts and implement the best option for each choice.

[1] Ariane Dumont is Professor – Responsable of Pedagogical Service, Conseil d'Administration International de l'Association Internationale de Pédagogie Universitaire – section Suisse AIPU-CH, and General Secretary at Swiss Faculty Development Network – SFDN.ch

3 Conclusions

MOOCs experiences have been studied from different perspectives in these years, and it seemed quite improbable to identify in our POK production an experience, which could be considered relevant as something innovative. Thinking about the MOOCs for Teachers series, on the contrary, the international collaborative approach adopted for the design immediately appeared us as something relevant to be shared and, with due adaptations, to be reused in other academic contexts, if suitable. It is an ongoing meaningful experience, since it allows the international team of instructional designers and teachers, with their specific experiences in different contexts and cultures, to work together and reciprocally enhance the chances to train-on-the-job. MOOCs are, from this perspective, a concrete "educational resource", also for the design team in itself, since it fosters teachers and instructional designers to rethink their role in this specific context, their contribution to the design activities and their ability to learn from each other while reaching a better-shared result. Thus, this is not only a shared design experience: it becomes a reciprocal teaching experience, which is a high objective in the evolution of our academic scenario, and is consistent with the growing need of internationalization of our Universities. We look forward continuing this activity in the next year, in order to enhance as much as possible our attitude to effective innovative design.

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Classroom Hollywood: Using Popular Entertainment to Engage New MOOC Audiences

Katie BRADFORD[1] & Melissa LOBLE[2]

[1] University of Wisconsin, Stout & Canvas Network, katie@instructure.com

[2] University of California, Irvine & Canvas Network, mloble@instructure.com

Abstract

Can learning be more meaningful and engaging in the context of popular entertainment? Can we use this context to attract new audiences to MOOCs? This paper presents the experience of offering a multidisciplinary MOOC on academic topics such as public health, disease modeling, and weaponry physics from within the context of the popular television show *The Walking Dead*. The article describes the process of building relationships with television networks and academic institutions, as well as the process of designing and building a course of this nature. Finally, the paper explores how this course and other courses like it have successfully engaged new audiences and atypical MOOC participants.

Keywords

Edutainment, Popular Entertainment

1 Introduction

In October 2013, the MOOC platform Canvas Network hosted the course "Society, Science, Survival: Lessons from AMC's *The Walking Dead*". The course was developed by faculty and staff at University of California, Irvine (UCI) and sponsored by AMC Network, the creator of the hugely popular television show *The Walking Dead*. The course coincided with the Season 4 premiere of the television show, which attracted over 16 million viewers (BUSINESS WIRE, 2013). The course itself attracted over 65,000 enrollments over the eight weeks that the course took place (SAARINEN, 2014).

Following the success of "Society, Science, and Survival," Canvas Network has partnered with other organizations to offer what were termed "edutainment courses," or MOOCs that combine academic topics with popular entertainment to make the subject matter more engaging. Table 1 lists edutainment courses hosted on Canvas Network.

Table 1: Edutainment Courses Offered on Canvas Network

Course Title	**Organizations Involved**
Society, Science, Survival: Lessons from AMC's *The Walking Dead*	University of California, Irvine, AMC Network
Gender Through Comic Books	Ball State University, Various experts in the field
TCM Presents Into the Darkness: Investigating Film Noir	Ball State University, Turner Classic Movies
Fight or Die: The Science Behind FX's *The Strain*	University of California, Irvine, FX Network

The initial idea for the project arose from a need to find new and innovative ways to use MOOCs to provide valuable educational opportunities to new audiences. It has been established that MOOC participants are typically well-educated adults, and that reaching alternative audiences has been difficult (CARTER, 2013). Thus, the Canvas Network MOOC platform formulated an idea to offer an academic course based on topics related to *The Walking Dead*, theorizing that pairing popular entertainment with academic content may provide a unique educational opportunity (S. Washington, personal communication, September 10, 2015). From that kernel of an idea, Canvas Network established a relationship with AMC Network, who signed on to the idea early in the process. Finally, Canvas Network interviewed and worked with universities to find a good candidate to build the course, and eventually settled on UCI as the academic content provider.

This paper describes the process of offering this first edutainment course, as well as the results and lessons learned from the experience.

2 Building Relationships

One of the primary obstacles in building an edutainment course like "Society, Science, and Survival" is the need to build relationships with the organizations that will be involved in the project. In the case of this course, the MOOC platform Canvas Network worked with a public relations agency to connect with AMC Network about sponsoring a MOOC. Because the involvement of the television network was necessary to offer a course on *The Walking Dead* that included footage from the television show, the facilitators at Canvas Network wanted to establish this relationship first. The Canvas Network team believed that footage from the television show was an integral aspect of providing the edutainment experience. In the end, AMC's vice president of promotions, Theresa Bayer, agreed to participate in the project because there was "a growing appetite for engagement with 'The Walking Dead'" (UNIVERSITY OF CALIFORNIA, IRVINE, 2013).

After the partnership between the MOOC platform and the television network was coordinated, Canvas Network sought out a team from an academic institution that could provide content for the course and design the course effectively. After interviewing several candidates, Canvas Network ultimately settled on UCI because Canvas Network already had an established relationship with this academic institution and because the faculty had experience teaching MOOCs. The university recruited four faculty members in various disciplines to provide a multidisciplinary learning experience in the MOOC. These faculty members already had experience teaching MOOCs, teaching with popular topics, or both (2013). The multidisciplinary approach was used as a way to draw a diverse student audience.

3 Preparing the Course

3.1 Creating a Course Outline

Because it is so challenging to recruit sponsors and facilitators for this type of course, the course outline was designed after faculty from UCI had been recruited to teach the course. The course topics, outlined in Table 2, were chosen to both highlight the expertise of the faculty members, as well as feature academic content related to *The Walking Dead*. Each faculty members involved in the course led 1-3 modules.

Table 2: Outline of Course Topics and Schedule

Week	**Dates (2013)**	**Module Topics**
1	Oct. 14-20	Foundation of Survival
2	Oct. 21-27	Public Health and Infectious Diseases
3	Oct. 28-Nov. 3	Deconstructing Society
4	Nov. 4-10	Social Identity and Survival of the Fittest
5	Nov. 11-17	Modeling a Zombie Outbreak
6	Nov. 18-24	Thriving on a Post-Apocalyptic Diet
7	Nov. 25-Dec. 1	New Materials and the Science of Damage Control
8	Dec. 2-8	The Science of Hope

3.2 Developing Course Materials

Canvas Network facilitated a relationship between UCI and the AMC Network such that UCI faculty and staff were permitted to use video clips from *The Walking Dead* to enhance their course materials. The course development team also had access to several cast members from the show for interviews on topics related to the course content. Therefore, in addition to filming lectures and panels with the course faculty, the team filmed interviews with actors from the television show. These interviews, which were available in the course and nowhere else, helped with recruitment among enthusiastic fans of the show.

Course modules were structured such that the module introduction page included objectives and an introductory interview with cast members on the module topic. The module then delved into the academic topics using lecture video and readings, and occasionally included clips from the television show that demonstrated the principles under discussion. In order to earn the badge associated with each module, participants were required to pass a quiz that tested the academic concepts in the module. Surveyed respondents in the course reported that the lecture videos were the single most valuable resources in the course, with a mean rating of 4.63 out of 5, whereas video clips from the show and exclusive actor interviews were rated at 4.24 and 3.98, respectively.

The UCI team that developed the course was composed of a project manager, four faculty members, a videographer, several instructional designers, and several teaching assistants. The entirety of course development took place over a two-month period in the Canvas Network platform.

3.3 Marketing Efforts

For all the involved parties, press coverage and marketing was one of the perceived benefits of being a part of the project. In fact, improving university branding is one of the primary reasons that universities invest time and resources into offering MOOCs (HAYWOOD, WOODGATE & DEWHURST, 2015). Canvas Network, AMC Network, and UCI collaborated with a public relations agency to bring positive attention to the course so that this goal could be met. Partnering with the television network proved especially fruitful because the course received tremendous spikes in enrollment numbers each time AMC Network advertised the course on social media. The single largest source for enrollments came from two separate posts on the official AMC Blog, which resulted in 16,537 enrollments, or approximately 25% of enrollments (AMC, 2008). This statistic demonstrates how the involvement of the television network was essential for generating interest and enrollments for the course.

In the press, the course was described as "a new breed of MOOC fusing popular culture with academic topics," and the teams involved saw the course as a chance "to shake up what was going on in the MOOC world" (BROOKMAN, 2013). By the launch date of the course on October 14, 2013, 53,550 participants had enrolled in the course. An additional 12,012 participants enrolled over the duration of the live course. These large enrollment numbers are attributed to the substantial media coverage, as

well as the enormous popularity of the television show, which had 16.1 million viewers at the time the course launched (2013).

4 Results and Lessons Learned

4.1 Results: New Audiences Reached

Among the reasons for offering "Science, Society, Survival: Lesson's from AMC's *The Walking Dead*" was the desire to experiment with how MOOCs can be used to push the envelope in education. How can we best use MOOCs to educate more people? How do we reach new audiences?

Participants were surveyed at the end of the course to gather information about their experiences and to collect their feedback. Through this survey, Canvas Network learned that 59% of the participants had never taken an online course before (see **Figure 1**), and 83% had never taken a MOOC before (INSTRUCTURE, 2014). This statistic was surprising, considering 83% of MOOC students have a post-secondary degree (CHRISTIANSEN, STEINMETZ, ALCORN, BENNETT, WOODS & EMANUEL, 2013). This result suggests that combining popular entertainment with academic subjects can help reach new audiences, rather than the typical, highly educated MOOC student. This non-traditional audience also indicated (over 90% of respondents) that they learned something new about a subject they would not have otherwise considered studying. This result may show that edutainment-style courses can not only attract a different audience, but these courses can also be used to teach subjects that are less interesting or less well-known to the MOOC participant.

5. Prior to this course, how many online courses (including MOOCs - Massive Open Online Courses) have you taken? (Select one response)

#	Answer	Bar	Response	%
1	0		867	59%
2	1-2		273	18%
3	3-4		128	9%
4	5+		214	14%
	Total		1,482	

Statistic	Value
Min Value	1
Max Value	4
Mean	1.79
Variance	1.21
Standard Deviation	1.10
Total Responses	1,482

Figure 1: Qualtrics Survey Responses, Online Courses

Additionally, 60% of survey respondents indicated that they were a bigger fan of the show after taking the course. This statistic is useful in making the case with popular entertainment entities, like television networks, that MOOCs are a viable fan engagement strategy.

4.2 Lessons Learned: More Research Needed

It seems clear that there is a great deal of potential for educating new audiences by combining academic topics and popular entertainment. As new edutainment courses are developed, course facilitators should consider what audiences must be reached, and then choose entertainment that appeals to that audience. Additionally, it would be useful to determine what types of popular entertainment attract MOOC students, as perhaps popular book series, movies, or other pop culture icons may be able to attract unique audiences as well.

If MOOC facilitators can reach unique audiences through edutainment courses, then more research is needed to determine how these courses can be used to meaningfully educate these audiences. Can edutainment be paired with credentialing or training? What value can these courses add to the lives of the participants? Many questions remain unanswered on the subject, but initial results indicate that these questions are worth pursuing.

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Ensuring Self-Regulated Learning Outcomes with a MOOC & CLIL Project in K-12

Inge DE WAARD[1], Mieke ANCKAERT[2], Bjorn VANDEWAETERE[2] & Kathy DEMEULENAERE[2]

[1] The Open University, Milton Keynes, United Kingdom, Inge.deWaard@open.ac.uk

[2] GUSCO Kortrijk, Kortrijk, Belgium, {Mieke.Anckaert, Bjorn.Vandewaetere, Kathy.Demeulenaere}@guldensporencollege.be

Abstract

This paper shares the current status and methods of an ongoing high school project using MOOCs embedded in K-12 classes. The project follows the Self-Regulated Learning journey of 5th grade secondary students enrolled in a one year (2015 – 2016) class combining MOOC and Content and Language Integrated Learning (CLIL). In this weekly, two-hour class the 16-17 year old students are increasingly guided towards autonomously choosing and learning MOOCs. The project has two complementary approaches: firstly the practical teaching/learning approach which is rolled out by the teachers at GUSCO school in Kortrijk – Belgium, secondly a research approach which enables a step-by-step evaluation of self-regulated learning (focus on self-efficacy and motivation). This paper describes the three main steps of the teaching/learning approach, and shares research instruments and methods to ensure evidence-based outcomes at the end of this ongoing K-12 project.

Keywords

CLIL, MOOC, K12, High School, Self-Regulated Learning, Language Learning

1 Background

Educators in the 21st century increasingly argue for the importance of information and communication technology (ICT) literacy and ask how it can be acquired formally and informally for students' effective participation in this highly technology-dependent society (LAU & YUEN, 2014; DE WAARD et al., 2014). One of the ways to answer this demand is to integrate MOOCs in existing pedagogies. Massive Open Online Courses (MOOCs) have been used in various ways often in the form of a flipped class-room, to complement traditional classroom teaching through integration of a whole course or specific parts of a course both in K-12 and in higher education" (LIU & CAVANAUGH, 2012, p. 1). As such contents of a live or an archived MOOC can be integrated into an K-12 course (BRUFF, FISHER, MCEWEN & SMITH, 2013), especially as research showed that teacher presence in online secondary school courses positively affected student outcomes (LIU & CAVANAUGH, 2012).

Establishing how student's progress through an educational system (in this case MOOCs) is a prerequisite for educational planning and decision making is important for learning. The teachers can provide a scaffolded improvement of their student's Self-Regulated Learning (SRL) skills. However, in order for upper secondary students to be able to quickly pick up the content and interaction opportunities provided in MOOCs, their digital skills need to be brought up to speed. Additionally, measures are needed to under-stand the benefits or risks that may result from exposing upper-secondary students to MOOC participation.

2 Situating the project

2.1 Project description

This project is part of an initiative taken by the GUSCO Kortrijk (Belgium). The target population of this project consists of upper secondary school students who are volunteering to follow Content and Language Integrated Learning (CLIL) by engaging in MOOCs. CLIL refers to teaching subjects such as science, history and geography to students through a foreign language. In order to do this GUSCO Kortrijk became an

official CLIL school which offers opportunities for students to follow different classes in non-Dutch languages (Dutch being the mother tongue of most students). For this project English and French are the chosen languages for CLIL education.

Three MOOC-CLIL courses were set up: two in English, one if French. The MOOC-CLIL courses are part of what is called 'vrije ruimte', a course providing innovative new learning techniques to the students. By using this course space, the teachers are more open in terms of the content that is used during the project, as the 'vrije ruimte' is not part of the mandatory course curriculum. The focus is on language use and learning to learn (in online environments) by choosing topics/content of interest.

The upper secondary students in this pilot project are enrolled in curricula that normally result in college or university entrance. By combining CLIL with a range of external (i.e. not self-developed) MOOCs, the teachers hope to enhance SRL skills and critical thinking in a blended learning environment (MOOC and classroom).

2.2 Three step approach

The pilot project runs throughout the 2015–2016 academic year, with a frequency of two hours per week. The project consists of three phases:

1. a GroupMOOC phase
2. a OwnMOOC phase
3. a PrepMOOC phase.

3.2.1 GroupMOOC

In the initial stage all the students will follow a trajectory set out by the teachers that allows the students to explore different MOOC platforms, and be introduced to the different learning activities and media options that are present in MOOCs. A Group-MOOC was chosen by the teachers and offered to the students: 'The Rise of Superheroes and their impact on Pop Culture'[1]. This MOOC was offered on the EdX platform

[1] Link to 'The Rise of Superheroes and Their Impact on Pop Culture':

and started on 12 August 2015, allowing the teachers to explore the MOOC and select parts of that MOOC to work on during the MOOC-CLIL classes.

During the GroupMOOC stage the students were divided in groups of three students each. In this stage the flipped classroom approach was used in order to let the students look at certain parts of the GroupMOOC and then perform activities (e.g. debate, discussion, analysing and selecting content) in class. During the GroupMOOC phase the teachers still offered a strong support vis-à-vis the students. This strong support was planned in order to increase their digital literacy (e.g. critical thinking), increase their spoken and written language skills (to ensure a useful basis before launching into a MOOC on a personal basis), and to explore the main features of the MOOC activities in a safe classroom environment. It also coincides with Bandura's observational learning theory, where students acquire self-regulative functions from observing models. The resulting self-efficacy provides the student with the confidence to attempt to perform the observed behaviour, hence increasing successful results (GRUSEC, 1992).

3.2.2 OwnMOOC

During this phase the students follow a MOOC of their own choosing. During OwnMOOC the learners have to self-regulate their MOOC learning. The teacher becomes a guide on the side, and is not necessarily following any of the MOOCs chosen by the students. A broad MOOC selection is provided by the teachers. This selection offers MOOCs focusing on diverse topics, and being part of three selected English MOOC platforms (EdX[2], FutureLearn[3], Coursera[4]) and a French MOOC and education selection (FUN[5], FranceTVEducation[6]). At that point the teachers will no longer proactively point the students towards what to do, the actions undertaken by the students become their own responsibility. In order to increase the intrinsic motivation of the students, they are given more freedom in choosing which MOOC they follow.

3.2.1 PrepMOOC

In the final phase the students are asked to build a project that combines all they have seen, this is the so called PrepMOOC phase (e.g. what is a MOOC, which language activities were used during the year). This final project will be used to inform future students about the project in order to scale up the project for the following academic years. In this phase the students will make a MOOC facsimile: movie, syllabus, questions or other interactions within their LMS (i.e. Smartschool). To add another layer of reflection, digital literacy, as well as increase their understanding of MOOCs (e.g. production aspects, decisions to be made).

3 Evaluation

Throughout the year three types of evaluation are planned and organised. Two evaluations are related to class-related interactions (the student logbook and an adapted grading scale), and one evaluation is investigating the overall effect of the class on the student's SRL (the self-regulated learning questionnaire).

3.1 The student logbook

The student logbook is kept on a weekly basis. The students are asked to fill in their own digital logbook during the last 5 minutes of the 2 hour class. The logbook is kept on the school's Learning Management System (i.e. Smartschool). The students are asked to briefly describe what they did, and to provide feedback on the lesson itself.

3.2 The adapted SAM-scale

The setup of the MOOC-CLIL class demands that the students are evaluated on language use, digital literacy and (online) learning skills that are important to a MOOC setting. In order to evaluate and grade the participating students an existing policy in-

[2] Link to EdX.

[3] Link to FutureLearn.

[4] Link to Coursera.

[5] Link to FUN.

[6] Link to FranceTVEducation.

strument for evaluating educational skills and attitudes was adapted. This adaptation produced the 'Scale for Attitude and skills Measurement' (In Dutch: 'Schaal voor Attitude en vaardigheden Meting) or SAM-scale to enable the teachers to grade the progress of the students throughout the year. The SAM-scale[7] consists of 10 criteria embracing language use, digital literacy and learning to learn.

3.3 Self-Regulated Learning Questionnaire

This project is not only a practical roll out of integrating MOOCs into K-12, it also wants to investigate how the guided exposure to MOOCs – that are offered in a different language then the mother tongue – increase or decreases self-efficacy , motivation and digital literacy in K-12 students.

Research has shown that self-efficacy and motivation are key components of self-regulated learning success (ZIMMERMAN, 1990; SCHUNK & ZIMMERMAN, 2012; WANG, SCHWAB, FENN & CHANG, 2013). Self-efficacy is defined as "beliefs in one's capabilities to organize and execute courses of action required to produce given attainments" (BANDURA, 1997, p. 3) and is part of the self-regulation process.

Due to the novelty of the project, potential challenges were mapped:

- MOOC complexity might adhere students from learning,
- the fact that the content of the course is delivered in a foreign language might be a barrier for engaging in active participation in the MOOC,
- in general the age and educational levels of those participating in MOOCs are higher than those of secondary students – as such this might be felt as a barrier for participation,
- cultural differences expressed through language might affect the participation level of the students.

[7] Link to SAM-scale.

To enable tracking self-efficacy and motivation for the whole project, as well as for each separate phase, a SRL-instrument[8] was set up. The instrument was based on adapted questions put into sub-groups, following the grouping as suggested in PINTRICH, SMITH, GARCIA & MCKEACHIE (1991).

The participating students who agreed to be part of the study and who signed the informed consent document are requested to fill in the survey on three different occasions during the academic year (never interfering with their exam periods): at the beginning of the academic year, half way (i.e. at the end of the GroupMOOC phase), and at the end of the OwnMOOC phase. Additionally there will be two one-on-one interview moments with those students. The semi-structured one-on-one interviews are organised after the 2nd and 3rd survey request, building on the answers of the survey.

4 Conclusions

With this paper the focus lies on the instruments and set-up of a MOOC-based project integrated in K-12 classes. The combination of planning a new project, and embedding evaluation inside of the project from the start seems promising. The project is ongoing. By simply rolling out this project, an additional interest was created within the teacher corps. The participating teachers have engaged in a voluntary type of continued professional development, as they were exploring MOOCs, are exploring new pedagogical approaches as the class progresses, and they reflect on the feedback from students in combination with their own conclusions. The first logbook feedback from the students was already positive in terms of course approach, and the fact that they could learn new content online from non-school related courses.

[8] Link to SRL instrument.

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Differences and Commonalities – A comparative report of video styles and course descriptions on edX, Coursera, Futurelearn and Iversity

Jeanine REUTEMANN

University of Applied Sciences and Arts Northwestern Switzerland, Institute Aesthetic Practice and Theory, jeanine.reutemann@fhnw.ch

Abstract

This paper reports a comparative overview of MOOC courses from edX, Coursera, Futurelearn and Iversity. The sample covers courses published between September 2014 and January 2015 and the comparison focuses on different video styles as well as course descriptions on the platforms.
Based upon this data set of MOOCs (N=449) this study shows noteworthy facts about the state of MOOC production. *Talking head* is the most common video style overall on all four MOOC platforms (87%), followed by or in combination with *Presentation slides* (38%).
The courses on the European platforms Futurelearn and Iversity show a highly significant difference in the amount of work effort per week description compare to the US platforms edX and Coursera. In addition, Futurelearn has the shortest course week duration compare to the other platforms. A number of further points are reported below.

Keywords

Video style, talking head, MOOC platforms, edX, Coursera, Iversity, Futurelearn

1 Introduction

edX, Coursera, Futurelearn and Iversity are four of todays leading platforms for MOOC courses. Whereas edX and Coursera are US based, Futurelearn and Iversity are located in Europe. Each platform has its strengths and weaknesses but all of them display various university courses from all over the world. Almost every course on these platforms uses video as a form of knowledge communication. Video as a *time based media* offers unique ways for online teaching (LOVISCACH, 2013). Previous research suggested, that using short videos as a media for knowledge communication offers comparable learning results with traditional lectures (PROBER & HEALTH, 2012; GLANCE, FORESEY & RILEY, 2013). But students also seem to interact differently with course video material, depending on the video style (KIM et al., 2014). Previous studies already highlighted different typologies of video styles (GUO, KIM & RUBIN, 2014) or video interactions (KIM et al., 2014). HANSCH et al. 2015 provide a guideline of the pro and contras of different video styles (HANSCH, MCCONACHIE, SCHMIDT, HILLERS, NEWMAN & SCHILDHAUER, 2015). Whereas these studies give a good overview of different video styles with the pro and contra, a more detailed analysis from the perspective of average use of certain video styles over several MOOC platforms are still missing. Therefore, this research article asks the following research questions: Is there a significant difference of video styles and course descriptions between edX, Coursera, Futurelearn or Iversity? What are the overall most common video styles on these platforms? As far as known, no previous work has compared MOOC course videos from different MOOC platforms regarding to video styles and course description.

2 Method

Between September 2014–January 2015, all open accessible video courses on the platforms Coursera, edX, Iversity and Futurelearn with an intro and lecture video have been collected. For all courses, the intro video and one example of a regular lecture have been analysed. 60 courses were excluded, as they had either no intro video or third week video. A total of 448 MOOC courses from all scientific disciplines have been coded on criterions based on media specific characteristics such as video style (more details see below). The intro and the first content lecture video of the third week (excluding *introduction to the week* videos) were coded for the evaluation. The third week was chosen as a representative week for the content-focused part of the MOOC, as at this point the introduction is typically over and the closing talk has not yet started. The report in this paper focuses on a cross-platform comparison.

Each video was manually evaluated for binary core variables. The core variables are based on previous research studies with video style definitions (e.g. GUO et al., 2014; HANSCH et al., 2015). The elements were coded using 1 if the video contains an element and 0 if the element is absent. Only variables which can readily be captured as yes or no were considered in the evaluation. After the first round, 25 courses were randomly selected and re-evaluated, verifying the robustness of the evaluation method. A simple descriptive statistic of the sample is presented using averages, resp. percentages of the courses scoring a one on a binary variable. For the non-binary variables (duration, number of educators and announced effort per week), the averages are listed. Additionally, the number of different universities, countries and disciplines are counted. To further make qualitative sense of the dataset, a series of interviews with experts from MOOC platforms was conducted.

3 Data Sample & Results

3.1 MOOC course description on platforms

Table 1: Comparison of course descriptions on different platforms

Course Description Intro Page	All 448	edX	Coursera	Futurelearn	Iversity
1a) Nr. of MOOC courses	448	136	222	68	22
1b) Nr. of Different Universities	160	41	73	26	20
1c) Nr. of Different Countries	35	15	24	6	6
1d) Avg. Course Weeks	7.95	9.1	7.92	5.21	9.95
1e) Avg. weekly effort	5.1	6.1	5.2	3.2	3.2
1f) Avg. Intro Video (min/sec)	2.25	2.21	2.29	2.11	2.40

For the full data set and variables explanation from Table 1 & 2 please see this link: http://www.audiovisualresearch.org/moocs/differences-commonalities/.

Coursera shows the widest variety in different universities und countries. edX has the highest variety of scientific disciplines (49), although Coursera offers more courses than edX (edX 136 courses, Coursera 222). Futurelearn, with a lot less courses (68) than Coursera, offers an equal variety of disciplines (Futurelearn 24, Coursera 23). Iversity presents a vast variety of courses from different universities (20) considering that only 22 courses are offered. Courses on Futurelearn and Iversity describe significant less effort of work per week average than the ones on edX and Coursera. At the same time, Futurelearn has with 5.21 weeks the shortest average week duration while Iversity with 9.95 weeks, the longest.

3.2 Video styles in MOOCs

Table 2: Comparison of video course styles

MOOC Lecture Video	All 448	edX	Coursera	Futurelearn	Iversity
2a) Avg. Lecture (min/sec)	10.26	9.49	12.36	5.40	6.03
2b) Classroom with students	7%	12%	7%	0%	0%
2c) Classroom without students	6%	7%	4%	10%	14%
2d) Pr. Slides with speaker	33%	26%	46%	3%	36%
2e) Pr. Slides without speaker	38%	30%	48%	22%	27%
2f) Computer screen	29%	33%	32%	9%	27%
2g) Green screen	26%	35%	25%	10%	22%
2h) Talking head	74%	78%	68%	81%	91%
2i) Animation	20%	19%	21%	19%	18%
2j) Outdoor/unrelated content	10%	9%	5%	31%	5%
2k) On location/related content	20%	22%	20%	22%	9%
2l) Webcam capture	8%	7%	12%	0%	9%

The most common used video style overall the platforms is with 74% *Talking head*. The highest use of a *Talking head* can be found on Iversity with 91%, whereas Coursera has with still 68% the least. A high contrast between the video styles on edX (26%), Coursera (46%) and Iversity (36%) compared to Futurelearn (3%) also is in *Slides with a visible speaker.* Moreover, the Futurelearn platform also demonstrate a contrast with the rare use of *Green screen and Webcam capture (0%)*. On the contrary, it has a notably higher average percentage regarding *Outdoor (unrelated content)*. Iversity shows the most use of *Classroom without students* and in contrast the least use of shots *On location (related content)* with 9%, whereas the other three platforms are all around 20%. The video style *Classroom with students* is only used by edX and Coursera. The only variable which all courses on the four platforms have almost in common is the average use of *Animation*.

4 Discussion

4.1 MOOC course description on platforms (Table 1)

edX and Coursera, both launched in early 2012, a bit earlier than Futurelearn (end of 2012) and Iversity (end of 2013). This could be one reason why the European platforms Futurelearn and Iversity offer less courses than the US platforms. But still, Futurelearn offers as much diversity of the disciplines as Coursera. One reason for the vast variety of disciplines on the Iversity platform can be that the Stifterverband Germany started 2013 an initial funding to finance ten MOOC productions (IVERSITY, 2015). MOOCs in many different universities and disciplines received this funding. This could explain the low number of courses per university on Iversity (22 courses from 20 different universities). The video implementation on Iversity is only marginally different from Coursera and EdX, which is in contrast to what Lara Ruppertz, Director of Didactics and Course Development at Iversity stated in an expert interview (2015): „We don't want to have standardized courses, where a professor is recorded in a lecture hall or in a studio and we create a video library." One striking point in the data set is that Futurelearn and Iversity have a significant difference within the weekly amounts of work compare to edX and Coursera. This point seems to differ widely between the European and the US platforms. Furthermore, the weekly amounts of effort are not replaced by longer course durations. To the contrary, the courses on Futurelearn also have the smallest weekly amounts of effort also with 5.21 the shortest time span of the course duration. Iversity, on the other hand has with 9.95 a slightly longer duration than edX and Coursera. In traditional academia, hours of effort and weekly durations of

courses are counted for achievements and ECTS points. Following, if the weekly effort of the Futurelearn and Iversity courses is much lower, does this mean that the value of a certificate is worth less compare to a certificate on edX or Coursera? This point should be considered carefully for future decisions about course requirements, weekly durations, the demand of effort and possible certificate standards.

4.2 Video styles in lecture videos (Table 2)

The *Talking head* is by far the most regularly used video style, rightly followed in combination with *Presentation slides*. Usually there is a montage between a *Talking head* and a *Presentation slide*. GUO et al. (2014) already highlighted in their study the problems of the visual changes (*visual transitions*) and the rewinding back to the presentation, when the speaker appears. Yet, in this paper this is exactly the most common used combination. The reason for this could be, that while this data set covers the period of September 14–January 15, GUO et al. (2014) published their article as the courses have already been produced. HANSCH et al. (2015) give additional attention to the point, that a *Talking head* can evoke monotony. They propose to use multiple camera angles and edit it afterwards. One problematical point can be that the image of the speaker *jumps* from one angle to the other, as the framing is to similar. This event increases when a speaker stands in front of a *monochromatic surrounding space* (e.g. white, black) as the similarity of the background evokes a stronger attention focus compare to natural background with different colour nuances. Both video styles, *Slides with speaker*, or *Slides without speaker* are as already mentioned another dominant video style. One could speculate, that the overall dominant use of video styles with *slides* is somehow a logical result, as this seems to by an analogy to the most common and equally known teaching materials of todays academic knowledge transfer.

It is striking, that some variables appear more often within a sole platform compare to the others. Futurelearn is again, as before an outlier in various ways. As an example, edX, Coursera and Iversity use the video style of *Slides with a visible speaker* quiet frequently. Coursera especially, with 46%. In contrast, only 3% of the lectures videos on Futurelearn make use of this video style. On the one hand, Futurelearn has the highest use of *Off-Screen Speaker and Outdoor (unrelated content)* – which can all be de-

scribed as rather more time consuming production styles. On the other hand, within the video style *Green screen*, which is rather time consuming to produce too, Futurelearn shows the lowest average. Interestingly, edX and Coursera are the sole platforms that make use of the video style *classroom with students*. In an expert interview with Nigel Smith (Head of Content, Futurelearn) and Lara Ruppertz (Iversity) both highlighted, that they try to closely work with the MOOC producers together to improve the way videos are created for the courses. Nigel Smith stated (2015): "When we encourage partners to produce videos, for all of the different steps that you can deliver as part of a Futurelearn course we offer quiet a lot of guidance. […] For an instant, with our partners we always ask to see sample video before the course starts. We always try to see material and we provide feedback and guidance on how it might be improved."
Clayton Hainsworth, Operations and Production Manager from the Media Team at edX stated on guidance for video production (2015): "The video production part of this is not something that we actively go out and make an assessment of, but we will often provide feedback. What we actually find is, that this feedback is often very much appreciated." Coursera is as far as known the only platform not to offer any video production advice but leaving it fully to the universities or organisations themselves. Coursera was also the only platform that was not readily available for expert interviews and Pauline Vorms from Coursera wrote in an email (2015), that they don't have dedicated personal responsible for video consulting or production advice. This could be the reason, why the MOOC videos on Coursera show the highest percentages within rather simple presentation styles e.g. *Slides without speaker (*48%), *Slides with speaker* (46%) or the use of *Webcam capture*.

5 Further Thoughts

MOOC platforms themselves are not responsible for the video production as the universities decide what and how they produce. Some platforms give advice and consult universities regarding video production. These platform consultants can influence the production and discuss and reflect with the university producers about their own style.

Further, it can be assumed that when universities decide to produce for a specific platform, they will also use the existing production styles as guidance. Or they decide for

this or another platform because they are enthusiastic about the offered course quality. An example for that is the *khan academy* with their own "khan-style". So, if more courses use *Slides* on one platform, it seems likely that other producers follow these course examples. This report shows only some insights into the frequency of video style production overall different platforms. Some variables, e.g. *Slides, Talking head*, duration of the lecture have been identified to differ significantly between platforms. Only a small number of variables have been presented to compare video styles and course descriptions on the platforms. Further steps should include a deeper analysis of video differences on platforms with further variables such as correlations of video styles and scientific disciplines. While we currently do not have sufficient data, it would be interesting to correlate the video styles with drop out rates. We would highly welcome access to such data and are happy to share our data set with interested parties. More comprehensive insights about the perception of different video styles could be an interesting and necessary perspective on the further development of MOOC courses.

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How MOOCs can be used as an instrument of scientific research

Claudia ZIMMERMANN[1], Michael KOPP[2] & Martin EBNER[3]

[1] University of Graz, Department of Sociology, claudia.zimmermann@uni-graz.at

[2] University of Graz, Academy of New Media and Knowledge Transfer, michael.kopp@uni-graz.at

[3] Graz University of Technology, Educational Technology, martin.ebner@tugraz.at

Abstract

Massive Open Online Courses (MOOCs) are an increasingly important phenomenon in the world of technology-enhanced learning. This development opens many opportunities for interdisciplinary interaction, not only for the purpose of researching MOOCs themselves, but for integrating them into various research settings. In this publication, we adress the question of how MOCCs can be used as instruments in scientific research. Our suggestions are illustrated on the example of the “Dr. Internet” project, which allowed us to gain practical experience in this area.

Keywords

Case study, experiences, Higher Education, Dr. Internet

1 Introduction

During recent years, MOOCs have been established as a rather substantial form of knowledge transfer in various academic fields. However, their didactic potential as well as their profitability is still being called into question. Therefore, MOOCs are an interesting object of continuous scientific investigation. This research usually focuses on how MOOCs may support lecturers and students, how they enhance technology-based teaching and learning and how much effort it takes to produce and to offer a MOOC. High numbers of participants produce copious amounts of data, which are routinely collected and analyzed. Previous research mostly deals with demographic issues (NEUBÖCK et al., 2015), (rather low) completion rates (KHALIL & EBNER, 2014) or the didactic value provided by MOOCs (LACKNER et al., 2014).

In all these cases, MOOCs themselves are the objects of research. While there are certainly many inherent aspects to MOOCs that warrant further investigation, they continue to play an increasingly important role in higher education (KOPP et al., 2014). Hence, they should not only receive consideration as targets of scientific research, but also as potential tools to be integrated in a variety of research designs to the avail of several academic disciplines. In this context, the following research question is the most apparent: How can we use MOOCs as an instrument of scientific research and what are the benefits and drawbacks of integrating MOOCs in a specific research setting? This paper describes the first case (at least in Austria) where a MOOC is part of a comprehensive, multi-disciplinary scientific research project. More precisely, this particular MOOC supports the investigation of people's behavior regarding Internet use to find diagnoses for diverse disease patterns.

Unfortunately, the MOOC "Dr. Internet – determining diseases with the help of Internet searches" is scheduled to start after the submission deadline for this paper. Therefore, the authors will primarily describe the objectives and the structure of the MOOC as well as its relevance for the chosen research setting, finishing off with a preview of the expected results (which will be available when the summit takes place).

2 "Dr. Internet"-project: Description and objectives

The "Dr. Internet"-project focuses strongly on online searching for health-related information. The aim of the project is to investigate how the increasingly common practice of using the Internet to answer medical questions affects the doctor-patient relationship, and what benefits and risks are associated with this behavior. Recent experiences of general practitioners show that more and more patients visit their doctor's office with previously acquired medical knowledge, obtained from online sources like popular websites, patients' forums etc. The acquired information can be extensive, but has often been found to be inconsistent and difficult to evaluate (BENIGERI & PLUYE, 2003). Possible negative consequences include unsettled patients and overwhelmed doctors: First, Internet searches might lead patients to under- or overestimate the severity of their perceived illness. Second, some patients may only consult with their physician to get a confirmation of the self-diagnosis they have already attained with the help of the Internet, and it can prove difficult for doctors to convince them of a differing diagnosis.

Therefore, it is important to raise awareness for a more balanced and critical approach to online health information. The "Dr. Internet" project is providing a MOOC that includes six different medical case studies, all of which will be assessed and diagnosed by the participants. These case studies are presented in the form of short videos in which a patient describes or exhibits various symptoms. After watching the video, the participants are encouraged to make full use of the Internet in order to find possible diagnoses, and to discuss their assumptions with other participants in the forum of the MOOC. A special quiz format is used to gather data on the participants' diagnosing preferences and to provide feedback on medical opinions about the subject (which will be described in more detail in chapter 3).

An experienced general practitioner designed the medical case studies for the MOOC. In addition, each module includes a video, where this doctor explains which one of the suggested diseases he believes to be the most likely one and how he came to this conclusion, as well as what to do if these symptoms were to occur in real life.

The design of the MOOC thus enables participants to question their search behavior on the Internet and evaluate their skills in the context of determining diseases. Simultaneously, the participants increase their knowledge about certain disease symptoms and receive useful instructions on what to do (e.g. searching on the Internet versus consulting a doctor) when particular symptoms occur.

The MOOC is available on the first and only Austrian MOOC-platform called "iMooX". In contrast to many other platforms, all course materials on "iMooX" are so called Open Educational Resources (OER). This means that all videos are licensed under a Creative-Commons-License and may be accessed and used by anybody who is interested in using them (as long as this is not done for commercial purposes). Moreover, all materials stay available after the initial MOOC and the research project have finished, so that future participants may still benefit from the course experience.

3 MOOCs as tools of research – a case study

The description of this case study is intended to illustrate some of the opportunities and challenges of using MOOCs as a research instrument. The "Dr. Internet" research project was contrived to integrate the MOOC within an already elaborate research design, which uses a triangulation of traditional qualitative and quantitative research methods in order to build a multifaceted database. We will first give an overview of how the MOOC is involved on various levels of data generation, followed by a preview of the expected results. Finally, we will briefly discuss the particular qualities of MOOCs in a research setting and offer a few preliminary conclusions.

3.1 The "Dr. Internet" MOOC as part of a research design

The first and most traditional axis of analysis is the accumulated data that is generated solely from the participants' activity on the MOOC itself. In addition to person-level variables like video completion, number of "clicks", number of threads read and posting activity in the forum etc., there is a short compulsory questionnaire which participants have to fill out during the first week of the MOOC. Questions include but are not limited to the individual health situation, any experience of researching symptoms online and the perceived trustworthiness of medical information on the Internet. There is also a qualitative arm of analysis that will focus on the MOOC's forum, with the aim not just to observe and analyze the postings, but also to start discussion threads and provide stimuli for debate.

The second level uses data that is generated both by the MOOC users as well as by an outside comparison group that is researched before the start of the MOOC. As with most MOOCs, there are quizzes to be completed as part of each medical case. However, contrary to most conventional quizzes that are constructed to test the participant's acquired knowledge and therefore serve as an indicator of learning. The quizzes of the "Dr. Internet" MOOC are better described as polls: for each medical case, the participants are asked to assess the likelihood of eight potential diagnoses that the patient in the video could be suffering from. This likelihood is rated on a four-part scale (comprising the categories unlikely, little likely, more likely, very likely) and can only be submitted once per participant. While there is no direct feedback on whether or not the likelihood estimations are correct, the participants are not only able to see the average results of all users who have already submitted their choices, but also the average ratings of a similar survey conducted among trained physicians.

The research activity on the third level can be seen as a complimentary exploration of one of the main research questions of the Dr. Internet project, which is focused on changes in the doctor-patient-relationship due to the increase of medical information available on the Internet. Therefore, both sides need to be heard and appropriate research tools have to be employed in order to provide sufficient material. Most of the subjects will be recruited through a pyramid scheme of contacting general practitioners, asking them for interviews as well as permission to approach their patients, who will be prompted to fill out a questionnaire. In order to highlight potential differences in this population and the Internet users who participate in the MOOC, there will also be several interviews with participants of the MOOC, which will roughly follow the same outline as the questionnaire. An online version of said questionnaire will also be made available to the MOOC users at a later stage of the course, but its completion will be optional.

3.2 Preview of the expected results

Starting in the last week of October 2015, the "Dr. Internet" MOOC will last for six weeks. After course completion, the analysis of data collected through or in addition to the MOOC should allow for a more profound illustration of the following aspects:

- Information on the course participants and their previous experiences with online searches for medical information. While the sample is obviously not representative of the general population, the sample size is still quite substantial (expected N=400) and relatively conclusive with regard to the target population (internet users who search for medical information online). The compulsory questionnaire as well as the forum discussions will yield data on the sociodemographic background of the course participants, their perceived physical condition, their experiences with online searches for diagnosing purposes and their interactions with medical personnel regarding their findings.
- Cross analysis of participants' characteristics and their course activities. One reason for including the compulsory questionnaire was to be able to find out more about who performs well on the diagnosing test. Additionally, we will be able to do a cross-sectional data analysis with regard to the users' personal characteristics and several relevant course parameters (forum posts etc.).
- Comparison of diagnosing preferences of course participants and physicians. The previously conducted survey among doctors used the same videos that the MOOC users will get to see as part of the course. We are thus collecting data that will allow us to compare the diagnosing preferences of doctors and laypeople (who are encouraged to use the Internet). This kind of comparison is not only highly relevant to the main research question of the project, but also an innovative way of administering the same test for two very different and hard-to-reach populations.

3.3 Benefits and drawback of MOOCs as research tools

As demonstrated on the example of the Dr. Internet MOOC, there is a lot of potential with regard to the incorporation of MOOCs into larger and multi-level research designs. The advantages are relatively clear: MOOCs provide a simple and convenient way of collecting data, and they feature innovative options of presenting materials and tasks or administer tests on a large scale, which can all be pertinent to many research settings. They allow for both observation and engagement of participants, who might be more inclined to put some effort into their tasks if they feel like they receive an interesting learning experience in return. Compared to standardized questionnaires that are administered online, MOOCs make it easier to test (or question) the same sample of participants more than once. Further possible applications of these technical opportunities also include the large area of social intervention research, where there is a wide range of conceivable interventions that could be delivered and tested online.

The disadvantages include the focus on a tech-savvy and Internet-affine population, where several important characteristics might be different from the general population. Thus, there are some research areas that are more suited to use MOOCs than others (like the "Dr. Internet" project, where the phenomenon under consideration was closely tied to Internet use in and of itself). There are also a few general characteristics of MOOCs that are detrimental to some research designs, for example the low completion rate and an overall declining frequency of activities of most course users. This is a problem for most experimental settings, where a high attrition rate severely compromises the comparability of outcomes in different groups. While some incentives that are used in traditional research settings might also prove useful here (like monetary compensation or course credits for students), it is likely that new ways of encouraging ongoing participation will have to be developed and tested.

Finally, there is the slightly ambivalent aspect of data generated through MOOCs: while they usually produce massive amounts of data, a meaningful analysis is not always possible, since "big data sets do not, by virtue of their size, inherently possess answers to interesting questions." (REICH, 2015) Perhaps more so than with other research tools, the instrumentation of MOOCs should always go hand in hand with a clearly structured research design and a set of realistic research questions, with full consideration of the above limitations. Additionally, the incorporation of MOOCs into complex research designs requires a high degree of coordination on an interdisciplinary level, though some might argue that this could also constitute an advantage.

4 Conclusion

The case study of the "Dr. Internet" project demonstrates one promising approach to the question of how MOOCs can be integrated in larger research settings, and the preliminary experiences are all but favorable. More insights and actual results are sure to be available at the time of the EMOOCs 2016.

Overall, a wide range of possibilities with regard to MOOCs as research tools is yet to be explored, which no doubt will lead to the development of more recommendations as well as best practice examples. We can, however, already conclude that the instrumental use of MOOCs in scientific research will give rise to new ways of collecting and analyzing data that shows every indication of being a useful addition to the existing array of scientific methods.

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A Model to Evaluate Mandarin Learning MOOCs

Estella Y. M. CHEN[1], Huei-yi LAI[2], Jing ZHANG[2] & Hongchen WU[3]

[1] University of Southern California, estella@mandarinx.com

[2] Columbia University Teachers College, hl2786@tc.columbia.edu, jingzhang@mandarinx.com

[3] The State University of New York at Stony Brook, hongchen0926@gmail.com

Abstract

In this paper, we explore the potential factors to sustain learners' engagement in Massive Open Online Courses (MOOCs). We use as a case study an edX class, a basic Mandarin Chinese course that aims at bridging the gap between cultures by facilitating the communication process, to investigate learners' persistence behavior. By comparing learners who chose to receive a verified certificate with those not to receive one, we explore whether course content, homework or exam could be influential on learners' course completion behavior. The analysis indicates significant predictors of completing the course.

Keywords

Massive Open Online Course, Open learning, E-learning, Online learning, persistence

1 Introduction

Mass Open Online Courses (MOOCs), as a promising venue, for researchers and practitioners to understand learning from different facets, is also initiative's core missions. edX and Coursera have developed platforms that track learners' click stream as they use instructional resources, complete assessments, and engage in social communication. The data provides potential indicators of what contributes to learners' engagement and persistence and what defers their success. However, even with all the potentials for equitable opportunities of lifelong learning, one of the concerns of MOOCs to date is their low course completion rate, which averages less than 10% (BRESLOW, PRITCHARD, DEBOER, STUMP, HO & SEATON, 2013). We want to understand more about what might cause stop out, regarding the course content complexity, instruction design, or user experience design. Given MandarinX on edX as one of the highest enrollment rate Mandarin learning platform, we would use the data drawn from MandarinX to explore the potential factors to sustain learners' engagement or stop out.

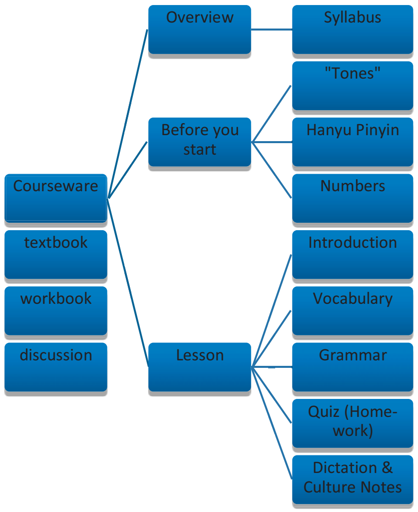

Figure 1: MandarinX: MX101x Chinese Language: Learn Basic Mandarin

2 Related Work

Researchers have strived to propose the possibility to classify learners in order to improve course completion rate (KIZILCEC, PIECH, & SCHNEIDER, 2013, April). A distinguishing trajectory of engagement defined by the authors is the learners who stay engaged through the course without taking assessments. The study (JORDAN, 2014) indicates that the average MOOCs course is found to enroll around 43,000 students, 6.5% of whom complete the course. Completion rates are consistent across time, university rank, and total enrollment, but negatively correlated with course length (JORDAN, 2014). Even with the numerous data and at a finer grain than have ever been generated, there are still many challenges posed to understand the factors to facilitate the online learning by sustain learners' motivation. Specifically, the more diverse prior knowledge learners have before they come to class, and the reasons they enroll the course or other evaluations can be valuable to course developer, designers, and instructors. By understanding the factors contributing to the stop out rate, the strategies provided by a past study (ANGELINO, WILLIAMS & NATVIG, 2007) may provide us an insight to adjust or minor revise the learning platform for improving learning experience.

Furthermore, Mandarin learning as a tool for communication with others has attained great popularity. The emerging interest in learning Mandarin might be either due to economic considerations, or personal interest in Chinese history and culture (SHIH, CHEN & LI, 2013). However, the obstacles for learning Mandarin as a second language are not only the four tones, the multitude of characters but also the influence by the learner's native language. Prior research has shown language is a powerful tool in shaping thought about abstract domains, so that one's native language plays an important role in shaping habitual thought (BORODITSKY, 2001). With the diverse MOOCs learners' background, that is, with different native languages, along with varied purposes for learning Mandarin, it is worthwhile to explore the users' learning pattern to understand what instruction design can be improved for future MOOCs course design.

3 Data and Exploratory Analysis

3.1 MandarinX

MandarinX is aiming to introduce basic spoken Mandarin phrases and vocabulary for everyday life for beginners. According to the exit course survey, 38% of learners reported to be new to Chinese before enrolling in the course, while only 8% of them demonstrated their ability to communicate with Chinese speakers in daily life. When asked about their purpose of learning Chinese, 65% of the respondents indicated their curiosity about language while one-third of them learn Chinese for travel or working. Overall, respondents of the exit course survey demonstrated relative high satisfaction with course content (86%) and instructor (94%) with rating 4 or 5 in a five-level Likert scale questionnaire.

3.2 Course Completion Rate

It is still a topic of debate to define what's so-called success, or course completion, in MOOCs. Learners in MOOCs do not necessarily adhere to the old traditional expectation, centered assessments or certification completion or likewise. Learners are categorized as completing, auditing, disengaging and sampling groups, which represent completed the majority of assessments offered in class, did assessments infrequently, did assessments as the beginning of the course but then have a marked decrease in engagement, and watched video lectures for only one or two assessment periods (KIZILCEC, PIECH & SCHNEIDER, 2013). In this paper, in order to investigate what might cause the stop out, we used the grade distribution to track any specific session point for learners' attribution of class.

The policy for getting a certificate for this course is to get a final score higher than 80. There were two types of certificates, a verified certificate or an honor code certificate. Students needed to purchase for the verified certificate while the honor code certificate was free. Among 41653 students who registered this course, 225 purchased the verified certificate. That means, their aim was to finish the course and get a grade above 80. In the end**, 1389** students got the certificate. Among them 145 got verified certificate and

1244 got honor code certificates. The completion rate among verified students was 145/225=64%. The completion rate among honor code students was 1244/(41653-225)=3%. It can be seen students who bought a certificate was 20 times more likely to succeed in taking the course than those honor code students.

MEYER (2012) reported that the dropout rates of MOOCs offered by Stanford, MIT, and UC Berkeley were 80-95%. Thus, it would be useful to improve the retention rates of MOOCs by finding out why and what stage student students drop out of courses. Given an overview of potential business models proposed by a current MOOC provider, with edX proposed certification as the only factor in the model, rather adding secure assessment, employee recruitment, etc., we consider course completion rate to be tightened with this particular indicator (YUAN, POWELL & CETIS, 2013). Verified certificate is signed up for once users log in to the course. At that point, benefits are listed, an instructor-signed certificate with the institution's logo is generated, a certificate is shareable on one's resume. This all provides motivation to complete the course and support the edX non-profit mission.

Table 1: Grade Distribution (count of learners with X grade)

X grade (0~1)	X = 0	$0<X<0.8$	$0.8 \leq X<1$	1	TOTAL
HW1	36833	1511	54	3255	41653
HW2	38929	784	34	1906	41653
HW3	39625	356	39	1633	41653
HW4	39859	254	21	1519	41653
HW5	39948	407	15	1283	41654
HW6	39994	239	8	1412	41653
Final Exam	40162	157	906	428	41653

3.2.1 Homework Completion Rate

The homework (a.k.a. quiz) on MandarinX is after introduction, vocabulary, and grammar. The main theme includes drag and drop in translation and tone, multiple choices in grammar and dialogue, basically in five components. Learners are allowed to have 10 attempts in the homework. In the beginning of the course, around 11.6% of users attempted to submit the homework; however, there was a decreasing trend in that by the end of the homework assignment, only 4% of enrollers attempted the homework. Interestingly, the course progress for student is provided by a graph on the course website, with the time intervals of HW01-06, HW average, Final and Total. Specifically, there is a decreasing trend from homework 1 to 2 with a 43% decrease, from homework 2 to 3 with 25.5% decrease, from homework 3 to 4 with 11.5% decrease, from homework 4 to 5 with 4.9% decrease, and from homework 5 to 6 with 2.7% decrease. The most significant dropout occurred during homework 1 through 3. The content of homework (quizzes) includes translation, grammar, dialogue, and tone and listening, using drag and drop, multiple choices and text input problem types. However, the total score for each quiz ranged from 18 to 28, which might not able to provide learners a consistent expectation.

3.2.2 Final Exam Completion Rate

After six consecutive weeks of learning, the final exam had a 7-day open window for completion. If an individual gets a score above of the total of 80%, he or she will be able to earn a verified or an honor code certificate, and no certificate can be given after the final week. The data shows that 1389 learners, which occupy 3.3% of the population, got a score above of the total of 80%. The data reveals an interesting finding that those who purchased the verified certificate (1389 people and 145 verified certificate) are mostly likely the ones who got a score above of the total of 80%. From the last quiz (quiz 6) to the final exam, there still existed 10% decrease rate. The final exam only allows 2 submissions, but the quizzes allow 10 submissions in maximum. Other than that, at least three times more problems are included in the final exam that might possibly infer learners' willingness to attempt it. The difficulty of the final exam might be quite equitable to quizzes. Also, the time learners need to devote to studying throughout the course as well completing increasing amount of problem sets could be decisive for their final exam attempts. However, for those have purchased the verified certificate in the very beginning of the class, since the final exam is determinant for their certificate, those purchasers would be more likely to work hard on completing the final exam.

3.3 Exit Course Survey

A 22-item exit course survey questionnaire is posted under course info on website, newsletter via email, and final exam. Designed as a voluntary survey, users are encouraged to answer the questionnaire for our course future improvement. With a 2.3% response rate, we asked learners' self-reported improvement in listening, speaking, vocabulary and grammar. The responses showed at least 30% improvement in general, with the largest improvement in vocabulary (54%). Overall, 72% of respondents are satisfied with the textbook, workbook and quiz. Though 46% of them hold a more neutral attitude toward TA feedback, this may bdue to their lack of participation in the TA activity. Also, respondents demonstrated quite positively toward the overall rating of the course (84%) as well as the instructor (93%). An interesting trend is observed when asked if getting additional assistance during learning will make them more willing to purchase a verified certificate, the overall proportion is 5%, if given feedback from the staff on the audio recordings; 6%, if join online tutoring sessions; 7% if join an exclusive discussion group with other verified students. We suspect the potential to provide peer discussion or tutoring can be helpful to maintain learners' external motivation, given the data.

4 Conclusion

One of the powerful promises of MOOCs is their prevalence, along with their free and world-class education. The preliminary analysis in this study indicates the possibility that what sustains learners to be engaged all through the session can be the purchased certificate, as known as an extrinsic motivation. For learners who may not have the time/score pressure, they might learn at their own pace, rather than complete all the course assignments. With the self-pace module released, it would be interesting and worthwhile investigating the difference as compared with the current module. Using the data drawn from the online learning platform will allow researchers and designers across the MOOC space to develop more optimal approaches to meet the MOOCs learners' need in the future.

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'MOOC' as a platform for social learning, research and social change in dementia

David ROBERTSHAW[1] & Ainslea CROSS[2]

[1] Academic Lead for Nursing, Health and Social Care, University of Derby Online Learning, University of Derby, D.Robertshaw@Derby.ac.uk

[2] Academic Lead for Health Psychology, University of Derby Online Learning, University of Derby, A.Cross1@Derby.ac.uk

Abstract

Dementia is a complex syndrome affecting brain functioning. During 2015 we ran a MOOC on Dementia aiming to use the platform as a vehicle for social change encouraging discussion and dialogue around the subject. Over 3000 learners participated in discussion forums encouraing social learning and interaction. This paper presents our experience of running the course and how we have used the MOOCto address two health care research questions.

Keywords

Dementia, Social learning, Social change, Impact, Research

1 Background

Dementia is a complex syndrome which affects brain function. It relates to an irreversible loss of cognitive ability and memory with a significant decline in behaviour, social and emotional capacity (KITWOOD, 1997; DE BELLIS, et al. 2008; WORLD HEALTH ORGANISATION (WHO), 2012). Although often seen as such, Dementia is not a normal part of ageing and many people who have a diagnosis are able to continue a positive quality of life, live in the community and maintain their independence. Dementia is a progressive disease and can reduce a person's ability to undertake normal daily activities which can lead to dependence on family memebrs and carers. Dementia is becoming a significant public health issue, and there are associted demands on health and social care systems (DE BELLIS et al., 2008).

The World Health Organisations estimates that number of new cases of dementia each year worldwide is nearly 8 million, meaning as many as one new case every four seconds. The number of people with dementia is expected to nearly double every 20 years, to 65.7 million in 2030 and 115.4 million in 2050.

During 2015, we ran a Massive Open Online Course (MOOC) on Dementia entitled 'Bridging the Dementia Divide' which attracted 3,070 learners from a wide variety of professions, backgrounds and locations. We chose to run our course on dementia due to its importance in culture, society and its effects on the future of civilisation with the hope that the course might become a vehicle for social change and stimulate dialogue around the subject. This paper presents our approach to the MOOC, considers its impact and also presents two research projects that have arisen as a result of the MOOC.

2 Our MOOC

'Bridging the Dementia Divide' ran for six weeks in duration with associated learning activities. As a MOOC, the course involved some aspects from an accredited University-level course delivered through online distance learning. The course sought to provide a higher education experience to participants who might not be able to access this mode of learning. We also hoped that the course would provide a platform for peer

engagement and social learning; participants in the course varied significantly from nurses to occupational therapists to members of the public.

Activities were designed to encourage a reflective, person centred-approach to dementia and ask participants to consider their own experiences of dementia. For example, one of the initial questions asked participants to share their own experience of dementia and many of the responses were detailed and personal, demonstrating real insight into dementia.

There was a strong focus on quality, and each week had identified content and learning outcomes. The table below outlines the first three weeks of the course and their associated activities.

Unit	**Unit title, theme and indicative content**	**Unit learning outcomes** (visible to learners)	**Indicative activities may include**
1	**Introduction to dementia** What is dementia and why is it important? Indicative content: Types of dementia History of dementia care How the brain changes with ageing How the brain changes with ageing	Learners will demonstrate a critical understanding of dementia, challenging its myths and stereotypes.	In the discussion boards, introduce yourself. Outline your reasons for undertaking this course; do you have personal experience of dementia? Write a short reflection on the challenges facing society in meeting the health and social needs of people with dementia. Remember to be reflective in your thoughts; use an example to illustrate how this directly applies to your situation. Formative Quiz

2	**Communication and Compassion** Why is effective communication important and how can you show compassion? Indicative content: Compassion as a concept Models and principles of compassion Compassion in dementia care Communication techniques	Learners will evaluate the main theoretical perspectives applicable to the study of 'compassion' in care. Learners will demonstrate a critical awareness of enhanced communication skills to enable them to better communicate with people with dementia.	Share a website related to communication or compassion, which could be a government organisation or charity, from your own context. Create a mindmap [support and definition will be given] of techniques you could use to help carers of people with dementia to communicate their needs. Share your mindmap on the discussion board. You could create your mindmap digitally or draw it on a piece of paper and then photograph the image with your smart phone or scan it. Formative Quiz
3	**Independence, control and quality of life** How can you help the person living with dementia to maintain independence, control and a good quality of life Indicative content: Self-determination and the maintenance of independence Ethical and legal challenges to enabling and respecting self-determination Ethical theories Consent and capacity	Learners will discuss techniques to defend independence, control and quality of life within the context of dementia, evaluating relevant ethical and legal frameworks.	What ethics and values apply to you? Are ethical principles universal? Share your thoughts on the discussion board. Review Jacques' comments on paternalism and consider whether paternalism in some form or another is inevitable in dementia care. Discuss this in the discussion board. Reflect on the views expressed regarding euthanasia, particularly as applied to those with dementia. Share your thoughts as a group about the implications for those in need of ongoing care for dementia. [Optional activity] Formative Quiz

3 Impact

Throughout and after the course we have obtained valued student feedback through the MOOC discussion boards. We hope to include both feedback and student-generated content in future iterations of the course. Some general comments from students include:

> *"The content and the activities. Well written authoritative textual content and an impressive array of found and newly developed videos often featuring excellent stories of practice from carers and practitioners on the dementia frontline."*
>
> *"The course was well planned, easy to navigate with high quality content."*
>
> *"The ease of use, the availability, the content. It was excellent!"*
>
> *Students found the content to be scientific and academic, but at the same time accessible:*
>
> *"The content of the course covers the whole topic of dementia from scientific until end of life. I love it."*
>
> *"The Course was really scientific with each tutor replying and engaging with us and our questions having studied them first. The most amazing Course I have ever attended and I have to say I will miss such an engagement with specialists like the ones from the University of Derby."*

In terms of wider impact, this remains to be observed, but there is some early evidence that the course has had real impact externally:

> *"I've already signed up to volunteer with a few dementia patients overseas. Having gained the pre-requisite knowledge, I'll be able to identify more easily signs of dementia in a client since I'm working at the community level, assist families and educate them about the condition as well as advocate for a national dementia policy in my country."*

"I am now a member of a dementia focus group and attending workshops and seminars. Also able to add this topic to my education courses"

"I may volunteer as a dementia friend"

Students were awarded badges for completion of units and 67.75% of participants received at least one badge. We were able to demonstrate a retention rate of 35.48% which is considerably higher than rates on other platforms which have generally been reported between 5-8% (HO et al., 2014). Videos in the MOOC, which consisted of ten interviews with subject specialist in fields related to dementia, were viewed nearly 12,000 times on You Tube.

4 Using MOOCs for Research

The main purpose of this submission is to outline our experiences of using the MOOC for research purposes and demonstrating the potential for extracting qualitative research data on important health and social care research questions. We see MOOCs as acting as a platform for social change, and as such, proposed two exploratory qualitative research questions.

Data was extracted from two MOOC discussion board activities, which comprised of 1695 MOOC discussion board posts. The data was analysed using the Framework Analysis approach (RICHIE & LEWIS, 2003), which involved categorizing the data into themes and organizing the themes into charts to explore the findings across all of the participants' MOOC discussion board posts.

Experiences of Dementia

The first research question aimed to explore participants' individual experiences of dementia. It focused on exploring the variation in clinical experiences of treating and managing dementia, as well as considering wider health care and resourcing influences. It also considered personal accounts of dementia, looking at carer experiences and the role of social support.

Integrated Care

The second research question aimed to explore MOOC participants' definitions of Integrated Care for Dementia, as well as their perceptions of its strengths and weaknesses. The data suggested that Integrated Care for dementia should be patient-centred and holistic, involving a multidisciplinary team of health and social care practitioners, as well as the patient, the family and the wider community. The establishment of Integrated Care for dementia was overall viewed positively, although it was recognized that it presents challenges such as role conflict, lack of funding and often poor coordination of care. Enablers for Integrated Care included the introduction of shared communication and IT systems to allow information continuity and assigning an appropriately qualified care coordinator for each patient to ensure the patient's care plan is implemented effectively.

Conclusions

MOOCs provide opportunities for social change through their potential for internet mediated research. Our experiences of using MOOC discussion board posts as qualitative research demonstrate their effectiveness in providing research data that can improve our understanding of real world health and social care issues.

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An Analysis of Different MOOC Environments from the Students' Perspective

Vlad MIHAESCU, Diana ANDONE & Radu VASIU

Politehnica University Timisoara, Romania
{vlad.mihaescu, diana.andone, radu.vasiu}@cm.upt.ro

Abstract

Observing a lack of research regarding the impact and integration of MOOC technologies over Romanian higher education, this paper points out key findings of a pilot developed with Master students from a Romanian technical university, who attended MOOC courses. The students' previous experience was in web technologies, usability and interaction and they followed some MOOCs as part of their courses. Students were asked to analyse the platforms and courses from instructional, technology, usability and design. The final report pointed out a series of advantages, problems and suggestions. Our results are going to be helpful for creating guidelines for future tutors involved in MOOC education and for creating the first Romanian MOOC platform.

Keywords

MOOCs, Higher Education, MOOC integration, Romanian education

1 Introduction

One of the most debated topics inside the education area over the last years has been the positive or negative influence of MOOCs or Massive Open Online Courses. One cannot argue of the general impact this new (or not?) technologies has had on education as a whole and higher education in particular. One of its main pillars on which it supports is usefulness is the proposition of solving everything that is fundamentally wrong with education, from our opinion: lack of access, lack of attractiveness, too expensive, resistant to progress and elitist approach.

Started in a connectivist manner in 2008 (SIEMENS & DOWNES, 2008) MOOCs gained momentum in 2011 and 2012 as American platforms Coursera and Udacity became extremely trendy in the scholar community (DANIEL, 2012; PAPPANO, 2012). Other ventures followed, and soon MOOC was a main topic both for research and for gossip.

Even if there are different problems regarding retention (DANIEL, 2012; GEE, 2012; MEYER, 2012), accreditation issues (OPEN CULTURE, 2013) or lack of openness (MARTINEZ, 2014; NKUYUBWATSI, 2013), MOOCs bring a great promise for the democratization of education.

In Europe there are a lot of good practices offered either by European MOOC platforms such as FutureLearn (United Kingdom), iversity (Germany), MiriadaX (Spain), FUN (France) or EMMA (the European multilingual MOOC) just to name a few, or they can take the form of successful collaborations with other platforms such as the case of LouvainX (Belgium university on edX platform). However, looking on Europe's map, it is very difficult to find anything related to MOOCs in its Eastern part. This is something that we are planning to change as Romania is doing strong research into how it could integrate MOOCs in its higher education (MIHAESCU, VASIU & ANDONE, 2014; VASIU, 2014; VASIU & ANDONE, 2014).

2 Study Case of MOOC Integration in UPT

2.1 Premise

Our study case involved students enrolled in the MSc Program of Multimedia Technologies who attended two different credit-based courses: Multimedia Technologies and Instructional Technologies. The main objective of our study was to understand how the integration of MOOCs into traditional higher education would influence the students' perception over eLearning and MOOCs.

The courses are part of the traditional higher education Master of Science in Multimedia, the student cohort being between 23-28 years old, 60% of them male students, all with high-level ICT skills. This setting allows a rare opportunity to investigate if students' perception of using MOOCs in higher education is changing and if MOOCs can increase students' learning. The study ran for 9 months, and involved 34 students at Master level with each student attending between 2-5 MOOCs.

2.2 Methodology

During both courses several tools and methods were used as an organic evolution from the initial objective of including just one of the MOOCs in the course:

- Both courses used as learning support the university online learning environment CVUPT – Campus Virtual UPT https://cv.upt.ro/.
- The tutor indicated relevant topics and courses to the students, but left the choice of the right course to the students. This was based on previous studies that indicate students' strong desire for control over their learning environments (ANDONE, DRON, PEMBERTON & BOYNE, 2007).
- Students communicated the selected course to the class. This was done in a dedicated blog in CVUPT.

- Selected topics from the MOOCs course were discussed during in-class hours. Topics were selected by tutor and students to fit in with each weekly learning goal.
- Multimedia materials and videos were discussed during in-class hours.
- A wiki tool in CVUPT was used by students to contribute with course content (embedded links and comments) on topics relevant to every week's goal.
- Blogs in CVUPT were used by students to comment on and analyse the course, their experience and 'what they learned'.
- Each student submitted a final evaluation report of his experience in MOOCs, following the topics: the technical environment, the platform usability, quality of learning materials, activities performed and communication tools.
- Students completed an online evaluation questionnaire.
- Students attended a written exam related to the course topics (35% of test questions were related to topics learned from the MOOCs).

Results from the evaluation reports, online surveys and a general evaluation of their exam are presented in this paper.

2.3 Results

During their final report students raised some issues regarding the usability or the functionality of different MOOC platforms. We integrated the summarized results here as an exhaustive list of each platform's features and a pinpoint of their specificity.

Advantages reported by students:

- The platform is adaptive and the student can follow the course from mobile devices (iversity) (Coursera);
- The percentage of completion is helpful for self-administering the learning process (iversity);
- The progress bar (Udacity) was mentioned by more than one student;
- The option to jump straight to the quiz if you already know a section (Udacity) (Coursera);

- The very well-structured syllabus (Udacity);
- Learning at one's own pace (Udacity); – mentioned by more than one student
- All courses are openly accessible, without start or end dates (Udacity);
- Powerful accent on pedagogy (Udacity);
- Asynchronous courses are very much favored by students, as they can study anytime and anywhere (Udacity) (Saylor) (Coursera);
- Large quantity of courses to choose from (Coursera);
- Much information offered in individual courses (Coursera);
- Many videos have a subtitle option for English and other languages (Coursera);
- Almost all courses offer a certificate (Coursera);
- All courses have a short introduction or presentation video (Coursera);
- Interactive way of learning (Coursera);
- Learning in a relaxed environment (Coursera);
- Involvement of specialists (Coursera) (Udacity);
- No commercials (FutureLearn);
- For a user it is extremely useful to see the rank of the course (from 0 to 5) and reviews about the course written by other peers (Udemy);
- It is a very good method to gain new knowledge, having access to information in a structured way (EdX);
- Accessibility, flexibility, comfort (Saylor); – mentioned by more than one student;
- Splitting the course into modules helped the information to be assimilated in a progressive way (open2study).

Problems reported by students:

- The forum is too complex in the current context, with too many layers of information (Coursera);
- Technical issues during tests (Coursera);
- Lack of a gradebook (Coursera); – mentioned by more than one student

- Lack of motivation, as tests are not sufficient for testing one's knowledge; game-like activities would help (Coursera);
- Difficult requirements (Coursera);
- Not all courses are open for enrollment (Coursera);
- Peer-grading is not reliable (Coursera);
- Deadlines are hard to fulfill (Coursera);
- Lack of motivation of the teacher (Coursera);
- No information about the abilities gained (Coursera);
- No search feature inside the lesson (Coursera);
- The lack of a synchronous communication activity, where students could communicate instantly (Coursera);
- Lack of detailed explanation and lack of examples (Udemy);
- Few free course (Udemy); – mentioned by more than one student
- The course could be separated in two (beginner and advanced) (Udemy);
- Accessing the course could be challenging for an IT beginner, as some video plug-ins are required to be installed (Udemy);
- There is some blur in the videos (Udemy);
- Lack of interactivity (Udemy);
- An error that was observed is a shift of the text in the case of an older browser version use (Udemy);
- The lack of a final exam could leave the student with the false impression that he understood and gained all the knowledge that the course offered (Udemy);
- Errors and bugs during tests (Udacity) (Saylor);
- Lack of explanations for some lessons (Udacity);
- Lack of text material (FutureLearn) (Saylor);
- Disappointment for not being able to visualize a course that starts in the future (FutureLearn);
- No possibility to solve an assignment if the deadline expired (Iversity);
- Few courses (Iversity);
- Description for course in English, but course in German (Iversity);
- Lack of option for choosing the level of the student (Udacity);

- No visualization of changes during the feedback about the code (Udacity);
- No feedback in the discussion section (Udacity);
- No certification for non-paying students (Udacity);
- It could encourage procrastination (Udacity);
- As exams are unsupervised, cheating comes into discussion (Udacity);
- Some courses require knowledge gained in previous Udacity courses;
- The lack of a tutorial for the use of the platform (Saylor);
- Difficulties in usability (Saylor);
- Not professional enough (Saylor);
- Videos that are too long – one hour (Saylor);
- Too much content and bad structure (Saylor).

3 Conclusions

We have seen objective opinions of our students, opinions that help us into developing a first Romanian MOOC platform. It is clear for us that the most important focus in developing a platform for Romanian students should be the video lecture section. The quality of the videos and the facilities offered by the video player (downloading, speed modifying, transcript, etc.) were highlighted as vital. The platform should be easy to use and access with clear explanations about how it works. The students' progress has to be clearly visible through a progress bar and through periodical self-testing. Interactivity and being adaptive are also two key factors that emerged from our study. What we should be careful when building this platform is the construction of the forum tool as this seemed to frustrate many of the students on different platforms.

After conducting various experiments and surveys we are left with enough conclusions and good practices required to build a first Romanian platform, which remains to be tested by experts and students for our future directions of research.

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Carpe Diem: a new day for flexible MOOC design

Leonie MEIJERINK, Janine KIERS & Danika MARQUIS

Delft University of Technology, Extension school, l.meijerink@tudelft.nl

Abstract

Is there one approach to course design that can be recommended in engineering education? At Delft University of Technology (TU Delft), we designed and developed 25 MOOCs, and our experience and expertise in course design is advancing.
One of the frequently used approaches for supporting course teams was inspired by the Carpe Diem approach (Salmon 2014). This paper discusses the experience of TU Delft in implementing this methodology in an engineering setting in MOOCs. The reason for choosing the Carpe Diem approach is that it is simple to use, supports constructive alignment and is a team based approach. In the approach a more activity-based design of MOOCs is promoted through developing e-tivities. In this article the experiences of e-learning developers are described in supporting ten course teams (5 online courses and 5 MOOCs) using the Carpe Diem approach. Two main challenges in supporting course teams are highlighted;

I. How to introduce course teams to the value of the methodology and
II. How to ensure that the specific characteristics of a MOOC are embedded in the design.

For both challenges a range of 'proposed solutions' is suggested based on the experiences of the e-learning developers. This results in lessons learned that can be applied by anyone who would like to make use of the Carpe Diem approach for flexible MOOC design. This paper argues that the Carpe Diem approach needs to be used in an interative and flexible way, taking into account the diversity of the course teams and course leaders as well as the special characteristics of a MOOC.

Keywords

MOOC, Gilly Salmon, design, Carpe Diem

1 Carpe Diem Approach: characteristics and implementation

1.1 Introduction

In 2013, Delft University of Technology (DUT) reshaped its vision for education, announcing its intention to educate the world and improve the quality of campus education through the development of Massive Open Online Courses (MOOCs), online courses, professional education courses and blended courses. Lecturers were encouraged to participate and were offered extensive support on the design and delivery of online courses. The course design approach that TU Delft has gained experience with is Gilly SALMON's Carpe Diem approach (2014). While the main principles of this approach were implemented in all course designs, the particulars have been adapted to the context of specific courses and their course teams. This paper summarizes the lessons learned from using this approach, and it suggests solutions to the specific challenges that course teams face.

1.2 What is the Carpe Diem Approach?

Carpe Diem[1] is a team-based approach to the design of online learning, with the following strengths:

[1] Carpe Diem is based on original research by Prof Gilly Salmon at the Universities of Glasgow Caledonian, Bournemouth and Anglia Ruskin. It was developed further at the Universities of Leicester, Southern Queensland, Northampton, Swinburne and Western Australia.

- The focus on the e-tivities (online activities for students), and aligning these with learning objectives and assessment.
- Designing 'with the end in mind': considering what the student should be able to do after finishing the course.
- The approach includes scaffolding the course structure in five stages[2] for the student experience: 1) access and motivation, 2) online socialisation, 3) information exchange, 4) knowledge construction and 5) development.

Elements of the Carpe Diem (CD) approach were used for the design of five MOOCs and five online and blended courses. The approach was, however, adjusted and used for every course in a different way, depending on the course team and type of course.

1.3 Why use the approach?

The Carpe Diem (CD) approach was implemented to support course teams for the following reasons:

Firstly, the simplicity of the approach appealed. The principle of constructive alignment[3] used in the approach is easy to explain. In particular, the concept of constructive alignment is familiar to lecturers that participated in the training 'Basic Qualification Education', a professional development programme offered at TU Delft.

Secondly, the approach makes the course design (the learning objectives, learning activities and assessment) explicit on a time line. This structures the course and clearly relates objectives with the e-tivities. This systematic approach is especially effective when working with course teams that consist of multiple teachers from different faculties or even different institutions. It facilitates the collaboration and distribution of tasks, while ensuring the overall coherence of the course. In addition, one of the core principles of CD is 'Design once, use multiple times'. The design can be re-used and adapted easily when integrating an advance level of the MOOC into campus education.

[2] SALMON (2013, p. 15-35)

[3] BIGGS & TANG (2007, p. 54, 55)

1.4 Implementation

The Carpe Diem approach was integrated in various stages of course design. Some course teams started designing the course content, after which they reconciled their initial design to match with the Carpe Diem approach through one or more workshops. Other teams started with a Carpe Diem workshop and build up their course from there. Ideally these Carpe Diem workshops, based on the model of Gilly Salmon, should include the following steps:

1. Visualise/write a blueprint
2. Design a storyboard
3. Make a prototype
4. Check reality
5. Review and Adjust
6. Make an Action Plan

In reality, time constraints did not allow all course teams to have multiple workshops, and course teams work in very diverse ways. Instead, the e-learning developer first identified, together with the course team, which steps to focus on. It was observed that step 2 was frequently the most important and most appreciated step. Other steps were usually integrated within the regular 'advice' sessions between the course coordinator and e-learning developer. In this paper, an analysis is made on the value of the different steps in the design and development of five MOOCs. Also our experience in designing five other, not massive, online courses is used in order to come up with proposals on achieving flexibility in the integration of the Carpe Diem approach.

2 Supporting course teams in engineering education – challenges and proposed solutions

As with many universities, TU Delft's lecturers are highly qualified specialists and researchers within the fields of engineering, science and design. Research and passing on specialist knowledge therefore are the primary aims of lecturers. TU Delft's support services aim to strengthen lecturers skills to implement a 'didactical shell' with a focus on promoting active learning methods. By offering a dedicated e-learning developer who provides didactical support througout all the stages of the design, development, delivery and evaluation of MOOCs, lecturers learn how they can implement these didactical principles whilst developing and teaching their courses. For some lecturers this requires a mind-shift in their teaching practices from a more frontal approach when teaching on campus, towards a more student-driven approach to online teaching and learning, where expectations and needs of students are given a more prominent position in the design of the course. Therefore, the e-learning developer's intention is encourage course teams to consider more student-centered an active learning approaches in an efficient way.

The Carpe Diem workshops were implemented to facilitate and structure the course design process of five MOOCs and five online courses (see figure 1). This paper focuses on the design of the MOOCs, and uses the design of online courses as a reference.

During the design stage of the courses, two main challenges were identified:

1. How to introduce course teams to the value of the methodology, e.g. the importance of allocating some time with the entire course team to the various steps of the Carpe Diem approach.
2. The design of a MOOC differs significantly from the design of a regular course, and it has some specific characteristics, which need to be embedded in the design of the course.

Course	**Work-shop**	**Blue print**	**Story board**	**Proto-type**	**Check reality**	**Adjust review**	**Action Plan**
MOOCs							
Circular Economy	2	V	V	V	V	V	V
Sustainable urban development	1		V	V		V	V
Building with Nature	2		V	V	V	V	
Complex Project Management in engineering education*	1	v	v				
Visualizing the unimaginable*	1	v	v				
Online / Blended Courses							
Mathematics blended	4	v	v	v	V	V	V
Advanced Embodiment Design blended*	1	v	v				
Online Master classes*	2	v	v	v			
Coastal Engineering*	1		v				
Railway Engineering*	1	v	v	v	V		

*in progress: follow up sessions are planned

Figure 1: Overview of use of Carpe Diem used in MOOCs and blended/online courses at TU Delft

Below some of the experiences of working with the course teams are described, followed by proposals to adapt and implement the CD Approach for flexible MOOC design.

2.1 Challenge I: How to introduce the value of the CD approach to course teams?

A difference was observed between the different 'types' of courses and course teams. For the course teams with more visually oriented course materials, which is common for the design oriented faculties (Industrial Design and Architecture), the introduction of story boards to 'design the course' were an immediate success. It was even needed at some times to limit all the creative ideas that were brought up in this phase.

Three of the online and blended courses and one MOOC that implemented the Carpe Diem Approach came from more science and engineering oriented departments (e.g. Mathematics and Civil Engineering). These course teams benefitted from an introduction to the value of the methodology in a more gradual way. For example initially this led to discussions on why this particular approach had been chosen. Later the e-learning developer observed that a better way of introducing the approach was to not provide an elaborate instruction to the CD approach. Instead the e-learning developer gradually brought in the components of the approach. An example of this is that the e-learning developer would write down whenever 'objectives', 'e-tivities' or 'assessment' were discussed and then placed them on the table as would be done in the story board, without specifically mentioning the team was now developing a story board. Where relevant, the e-learning developer would hand out 'tip sheets' such as an overview of verbs to use for objectives (Bloom) or the five stages of Gilly Salmon. The same was done for the blue print stage where the questions related to the 'mission statement' were asked without mentioning we were developing a 'blue print'. The hand-out of words that describe the look and feel of a course from the Carpe Diem guidebook would be brought in whenever it fitted the discussion.

One of the course leaders from the Department of Architechture preferred to start with the 'prototype' phase before making the full story board. He explained: "*As an archi-*

tect I am used to dealing with complex processes and to take big steps in order to fill in the empty spaces. An architect wants to visualise right away what the product will look like. That is why I requested access to the edX platform from the beginning". After he had worked on the prototype in the platform he was ready to develop the story board. He reflected in the course team meeting that he was aware of the dangers of having to completely reorganise or change the protoype, but he needed it anyway to be able to picture what the course would look like.

Based on the above experiences, the following 'proposed solutions' are made for using a flexible CD approach to MOOC design. These are both affirmations of the intentions of the 'authors' of the CD approach, as well as adaptations to the CD approach:

Proposed solution: Prepare with course coordinator and agree on team involvement

Being flexible when preparing the Carpe Diem workshops with the Course leader/coordinator is important. The e-learning developer meets the course leader and discuss the order in which the approach will be used. For example: start the design from scratch with the whole course team or share a prepared design with the course team? This deviates from one of the strengths of the CD approach to work from the beginning as a team. The course leader may also want to first start the design process individually. In this case, the e-learning developer strongly advisedthat s/he should be ready to receive new ideas and suggestions from the course team which could lead to a change in the course design, as well as the health warning that this way of working could potentially be less time efficient.

Proposed solution: start implementation

It appeared an effective approach was to avoid too much explanation of the methodology and to just start doing it. The course teams then soon realized that the visualisation of the storyboard helped them in their discussions about the design of the course.

Proposed solution: focus on higher learning levels

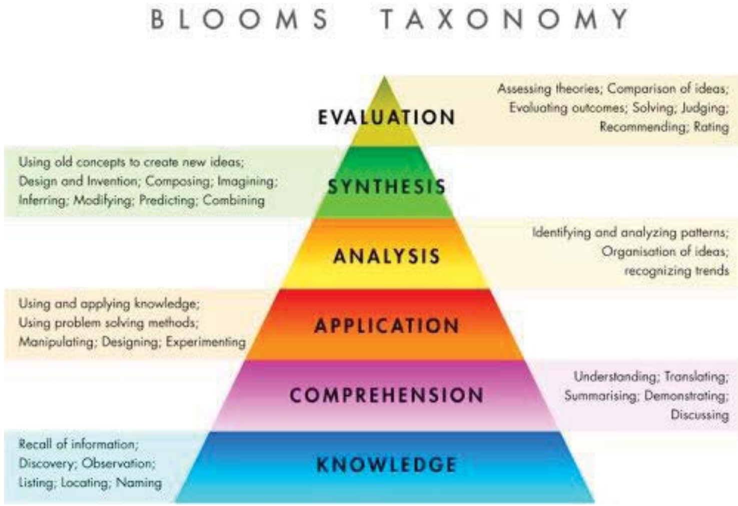

Figure 2: Bloom's taxonomy in ALFORD, HERBERT & FRAGENHEIM, 2006

One of the most convincing arguments for the value of the CD approach was to address the 'level' of learning objectives (figure 2)[4].

Emphasizing that reaching the required course quality involved targeting higher learning objectives rather than merely including more content for students to 'understand'. Most lecturers were convinced that TU Delft courses need to be of a certain quality that reaches further than lower level learning. The 'higher level verbs' then automatically lead to more active learning methods.

[4] ALFORD, HERBERT & FRANGENHEIM (2006)

Proposed solution: demonstrate benefits

The benefits of this approach were further viewed when debates based on the visualised storyboard began within the course teams. The visualisation of the objectives, activities and assessment positioned on a weekly time line, usually immediately starts a debate. The essence of Salmon's carpe diem approach is to 'seize the day' and thus whatever is designed during the workshops can be put to immediate use. At the end of the workshops, we have always received positive remarks of the course team where they felt they could move on and put whatever is on the storyboard into practice. Also course teams found that examples of story boards from other courses inspired them a lot.

Proposed solution: save time later

Because lecturers are busy primarily with research activities, there is often less time to focus on education and workshops. However, we have now experienced on multiple occasions that course teams keep referring back to the design made in the initial storyboarding workshop. The e-learning developer refers to these experiences and gives health warnings on the risk that much more time will be needed later and if insufficient time is spent on the design of the story board. Also there is experience that excessive course materials were developed which later did not fit the course design. For one of the MOOCs, the course leader later reflected *'I am so happy we at least have the story board to refer to, but I wish we would have been able to free up more time than just half a day to establish a more refined story board. That would have saved us a lot of time.'*

Challenge II: Design a MOOC, not a regular course

The nature of MOOCs requires a different approach to course design. In MOOCs, we see a broader variety in motivation and prior knowledge of the audience. Also the means of delivery is different compared to the courses teachers are used to developing. In the design of a MOOC lecturers need to:

a. adapt to a more flexible way of supporting students
b. ensure the course is inclusive.

Lecturers will need to have more realistic expectations of their students' capacities and motivation for studying.

Proposed solution: Create awareness in the blueprint stage, make teachers MOOC-savvy

Awareness can be created in many different ways, but it does take time to understand the nature of MOOCs. An important moment in which to create this awareness at TU Delft is during our regular 'On-Boarding' days, where e-learning developers and the online course team share their experiences of developing MOOCs. Right from the beginning, the message is that MOOCs are much more than just video clips and quiz questions, and the Carpe Diem approach automatically leads to a more 'activity-based' approach to the MOOC.

During the Carpe Diem approach, special attention is given in the 'Blueprint' stage to the following questions: Who is your target group, what is most relevant for them? Is this what *you* would like to share with students, or what *students* want to get out of the course? What is the benefit for students to do this 'voluntarily'? We also share edX insights to lecturers of the courses, in which demographic characteristics of the learner population are provided. The more experiences we gather, the more convincing we can be in explaining why some online methods work and others don't. More importantly, it helps to invite fellow lecturers to share their MOOC-experiences and underline the difference of creating a MOOC compared to regular education.

Proposed solution: Bring in the idea of inclusiveness in the first phases of Salmon's scaffolding

Lecturers of campus-based courses, are not used to addressing socialization aspects. The importance of the 'welcoming' or 'online socialisation' stages in a course are not part of their normal routine. Therefore the five stage model of Gilly SALMON[5] is provided as hand-out and discussed during the 'storyboard' stage. The course teams are guided towards freeing up time in the first weeks to the welcoming and online socialization stages, rather than filling the first two weeks with a lot of content. This welcoming in a MOOC is typically done in the introduction on the world map, where the learner can introduce themselves and share an example from their own context on the topic of the course. Also we advocate opening a 'welcome week' or start the course with a teaser.

3 Lessons learnt

Concluding from this article we have suggested a number of proposed solutions that have helped us to implement the CD Approach in a flexible way. There are a few aspects that we have observed that appear to be distinctive for a succesful and efficient course design process, which are recurring in most of the propals. The following are guiding questions that we use as e-learning developers to provide flexible support in the design of a MOOC:

1. What type of course team are you working with?

While limited, our data suggests that the more 'visually oriented' the course teams are (in our case usually from industrial design and architecture), the less explanation is required when you introduce a 'story board' activity. Whereas, the more 'engineering' departments are helped by talking through the storyboard, and then seeing it gradually appear. These teams are also helped by sharing a lot of 'practical' examples to inspire new ideas.

2. Who is the course coordinator/ leader?

Depending on the preference of the coordinator, it usually works well to agree on the order in which to follow the steps and whether to bring them in gradually, or in a structured way using a formal workshop setting. Course teams have indicated that they appreciate flexibility in the way the steps are implemented.

3. Who is the target group of the MOOC?

It is extremely important to focus on the interest of the target audience from the beginning.

The emphasize should not be on what the professor wants to share with the world, but awareness needs to be raised on when it is challenging and interesting for a student to voluntarily decide to follow a MOOC.

4. What is the nature of a MOOC?

The special 'nature' of a MOOC needs to be integrated in the CD approach. Foremost in teachers' mind should be: "what makes a MOOC different from a regular course" and "how do you motivate massive crowds to stay in the course and conduct the activities". Consideration needs to be given to the five stage model of Gilly Salmon, especially related to the welcoming and online socialization stages.

In conclusions, based on our experiences of supporting course teams in the use of the Carpe Diem approach it was observed that many of the key principle of this approach are upheld and valuable for supporting course teams, such as: bringing in the idea of scaffolding, making constructive alignment explicit and saving time later. However, it was also observed that it is very important not to be stuck to the order of the stages of the CD Approach and to adjust the order and extent to which the stages are being implemented to the needs of the course team and specifically the course leader. Finally, awareness needs to be raised in the course team to understand the specific nature of a MOOC, specifically the consideration for who the learners are and what their learning needs are. The experiences in using the CD Approach have led to a deeper appreciation of the complexities of designing a good MOOC, which can be used by other teams who intend to use the CD approach to support course teams.

More research on experiences at different universities into different design approaches, as well as the CD approach in particular, could help gain valuable insights in order to make the process of the design of a MOOC more efficient and of higher quality.

[5] Taken on 1-12-2015 from: http://www.gillysalmon.com/five-stage-model.html

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Classifying the IRISH 101 LMOOC

Mairéad NIC GIOLLA MHICHÍL, Mark BROWN,
Eamon COSTELLOE, Enda DONLON, Collette KIRWAN,
Clare GORMLEY & Colm Ó CIARDÚBHÁIN

Dublin City University,
{mairead.nicgiollamhichil, mark.brown, eamon.costelloe, enda.donlon, clare.gormley, colette.kirwan, colm.ociardubhain}@dcu.ie

Abstract

The number of language learning MOOCs or LMOOCs within the wider MOOC field is considerably smaller than in other disciplinary areas. Many language educators believe that the reason for this lies with the necessity to have both knowledge and skills to engage actively in language learning. Further to this the isssue of "M" or massive in a language learning context holds negative connontations for language educators. This paper provides a contextual overview of LMOOCs and updates the findings of previous research. Chinese is becoming more prevalent, with LMOOCs for Spanish and for English being the most popular across the platforms within the study. Beginner language learnes are the most popular target audience, however, many English language MOOCs cater for more nuanced langauge learning contexts and domains. As part of this paper and to illustrate the complexities and issues facing the development of an LMOOC, the Irish 101 LMOOC is classified using CONOLE's (2014) proposed classification of elearning and MOOC environments

Keywords

Language Learning, Theory to Practice

1 Introduction and Context

Computer Assisted Language Learning (CALL) has long held both theoretically and empirically that technology can and does support the language learning process (ZHAO, 2003; TAYLOR, 2006; SAGARRA & ZAPATA, 2008; TAYLOR, 2009; YUN, 2011; GRGUROVIC et al., 2013). However, the integration of CALL within traditional practice of language learning remains at best side-lined (CHAPELLE, 2009). Therefore, it is perhaps not surprising that as an area language learning has remained steadfastly slower to engage with the potential of MOOCs as a means by which a language can be learned. SOKOLIK (2014) likens the growth and development of Language MOOCs (LMOOC) as being "neonatal" in the context of the wider MOOC field. BÁRCENA & MARTÍN-MONJE (2014) describe the field as being at the very earliest stages of development, their analysis in 2014, although limited to the major MOOC platforms and MOOC listing sites, reveals 26 LMOOCs with English and Spanish oriented LMOOCS predominating. A review in 2015 conducted by this research team of the current offering of LMOOCs based on the methodology of BÁRCENA & MARTÍN-MONJE (2014), demonstrates a notable increase in the provision of LMOOCs to 46. Along with English and Spanish, Chinese is emerging as an increasingly popular language with small numbers of non-major languages such as Frisian and Valencian within the sample. The majority of LMOOCs target beginner language learners, with a limited number of LMOOCs aiming their courses at intermediate learners, with some English LMOOCs directed at the use of English in different domains such as business. Within this sample there is wide divergence with respect to the length of each course and also in terms of the expected workload that would-be learners are expected to engage in. Based on the description by providers of their courses the approach to language learning advocated within the majority of the LMOOCs could credibly be aligned with an XMOOC approach (MORRIS & LAMBE, 2014). However, within some LMOOC descriptions forms of structured and facilitated collaborative engagement by learners is described. Many different and diverse conceptualisations of language learning exist and the evolution of the field of CALL demonstrates a shift both in the use and purpose of technology within the discipline and in the context of specific learning approaches (BAX, 2003; BLIN, 2015). Learning a language is in the

main an active practice, facilitated by knowledge of the language and the development of specific language competencies and skills (BÁRCENA & MARTÍN-MONJE, 2014). The pedagogical challenge that this presents to the developers of LMOOCs is not to be underestimated or simply delineated between the broad categorization of XMOOC v CMOOC. Rather the challenge is to develop a LMOOC which meaningfully integrates CALL within a language learner's learning process (GARRET, 2009). This paper continues to consider these issues and others in terms of the ongoing development of the Irish 101 LMOOC.

2 Classifying Irish 101

Irish 101, a LMOOC is in development by Dublin City University (DCU). The project is led by academic staff from FIONTAR, an Irish-medium interdisciplinary School and the National Institute of Digital Learning in DCU. The LMOOC and research into the MOOC is supported by the Irish Government as Ireland engages in a significant national commemorative programme during 2016. It is envisaged that the LMOOC will go live in first half of 2016. The LMOOC will last three weeks with 25 hours of workload equating to 1ECTS. The LMOOC is aimed at ab initio language learners or those learners with no prior experience of learning the Irish language. The LMOOC is being developed on the basis of learners achieving specific learning outcomes as described by the Council of Europe (2001) in the Common European Framework for References (CEFR) for language learning. An important feature of the learning outcomes is to support oral language production, developing oral language skills is an area which has been least developed in online language learning environments (Appel, Santanach and Jager 2012). This review of LMOOCs conducted as part of this paper corroborates this finding within the sample of LMOOCs. To structure the discussion on the development of the Irish 101 LMOOC, CONOLE's (2014) twelve dimensional classification of MOOCs is used. This classification prompts an exploration and evaluation of the technical, pedagogical and institutional aspects and limitations influencing the MOOC's design and implementation to date and will hopefully inform others venturing into the LMOOC space.

Open

The selection of the institution's MOOC platform has been a concurrent process to the design and development of the LMOOC. The process of the selection has been inherently complex with varying institutional and ideological issues associated with the process. An example of this was the aspiration related to the contexts of an open development philosophy and also from our development team that the platform could provide a multi-lingual experience. MOOC developer teams within Higher Education Institutions may not always play such a central role in the selection process but being party to this process has facilitated end-developers concerns being discussed and reviewed as part of the decision making process. The LMOOC will be hosted on a bespoke MOOC platform on a pilot basis. However, the platform is in itself is new and is undergoing iterative development parallel to that of the LMOOC visualizing the structure and design of the MOOC in an evolving design context has been challenging. To overcome this issue the team developed the Irish 101 course in the institutional LMS to aid in low-fidelity design process. The platform will link to social media supported by the University, through DCU's Google Apps. Open source tools may also be integrated into this platform to facilitate synchronous oral communication.

Massive

The number of participants within the LMOOC is based on prospective learner demand but this number is limited to the available resources of the project and the required technical capacity. Agreeing this measure with the platform provider was an important step i.e. learner registrations versus active participants. Size within language courses is always an issue, with smaller classes being the preferred option particularly when it is considered that 8-20 participants are viewed as an adequate class-based size in this area (YI, 2008; BLYTH, 2010).

Diverse

The LMOOC should attract a potential homogenous population of language learners with a specific interest in the Irish culture and language. Target learners are linked to the Irish diaspora in areas such as Northern America, the United Kingdom, Australia

and New Zealand. Designing learning objects goes beyond geographic region but also considers diversity in learning styles. Each learning object, task and resource, therefore, is being developed and designed from the perspective of engagement of student-content, student-student and student to facilitator interaction.

Multimedia

The LMOOC integrates bespoke learning objects created using specific software by the pedagogical team. The LMOOC includes SCORM objects and learning resources, by doing this it is aims to maintain learners within the platform. Learning objects do make use of multimedia but have limited interactivity functionality. The level of interactivity has to be managed as the computing demands of the potential cohort of learners may stress the platform. The LMOOC incorporates open source tools and social media to support synchronous and asynchronous communication using text-based and digital media.

Communication

Learners will use both social media and discussion forums to interact. Discussion forums will not be thematically threaded to facilitate engagement and navigation. Facilitators use feedforward strategies and respond to a limited range of learners' comments. The use of video is important in this context not only for peer-to-peer collaboration but as a tool to allow reflection on areas such as pronunciation. Technically, ensuring that both audio and video uploads can be handled is an important issue and a restriction on files sizes for upload is currently being considered.

Collaboration

Pedagogical tasks are designed to facilitate peer-collaboration within the MOOC. As learners will have limited language proficiency this collaboration is aimed at promoting both social interactions in the target language. Tasks are designed to build on learners' engagement with learning objects and to prompt them to engage with each other.

Reflection

Reflection on learning is included to a limited degree as part of the task based approach where learners can comment on the open blog within the LMOOC. Further to this learners can post video reflections etc. using You Tube particularly to reflect on socio-linguistic learning objects evaluating their prior knowledge of Irish, and Ireland with the formal learning objects and also with the comments of their fellow peers.

Learning pathway

This issue is one of the most significant for language learning, particularly when learners with little or no language proficiency are taken into account. The pedagogical designers have emphasized the need to sign post and provide learners with a basis by which they can start to engage in meaningful yet simple dialogue with peers.

Quality Assurance

The design and content of learning objects is subject to a formal content and technical review process. Furthermore, the LMOOC benchmarked with the CEFR applies bespoke learning outcomes aimed at the ab initio language learner. The MOOC is subject to rigorous usability testing, where both platform and pedagogical learning objects are formally reviewed by a sample representative of final learners.

Certification

The MOOC has at present no certification due to the early stages of development of the platform. However, the pedagogical designers aim to implement a badge system to design into the MOOC persuasion strategies to encourage engagement and participation this will be tracked and issued based on participation. The notion of self-badging as a means to promote engagement is currently also being considered.

Formal Learning

At present there are no formal links between the LMOOC and a formal educational offering, however, it is envisaged in the future that the LMOOC will form the basis of Accredited Prior Learning for an online degree in the Irish language.

Autonomy

The nature of language learning requires both knowledge and skills, therefore in an effort to balance one against the other learners will be guided through learning objects and will engage in formative assessments. The discussion forum design promotes light-touch moderation and tutors will feedback on a limited number of posts. Learners will be able to practice language in the social media element of the LMOOC with minimal facilitation by tutors and therefore have a greater degree of autonomy to collaborate and engage with each other.

3 Conclusion

As language learning MOOCs continue to develop the basis by which language acquisition is supported within LMOOCs needs continuing empirical and theoretical investigation. This paper provides contextual background to the development of LMOOCs it also outlines many of the design, implementation and peadgogical issues using CONOLE's (2014) classification of MOOCs as an organising and reflective tool by one LMOOC development team.

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Guidelines for Evaluating the Teaching and Learning in MOOCs: a TU Delft approach

Danika MARQUIS, Janine KIERS & Leonie MEIJERINK

Delft University of Technology, d.e.marquis@tudelft.nl

Abstract

What does it mean to qualify as a 'successful' MOOC? This question haunts policy makers and educators alike, and is at the core of the continued development and funding for Massive Open Online Courses. Because MOOCs can serve many purposes, their value lies in more than just their short-term educational role. A 'successful' MOOC can do more than just teach; it can provide institutional brand recognition, address global challenges, improve the quality of campus education, and generate data for educational research. In this paper, we examine the methods and tools TU Delft uses to evaluate the teaching and learning within its own MOOCs in particular. Recommendations are provided for the use of a set of qualitatitve tools in addition to the more common quantitative tools used to evaluate the 'success' of a MOOC.

Keywords

Evaluating MOOCs, teaching and learning, constructivism

1 A Teaching and Learning Approach

1.1 An Introduction

Because of the global, massive and free nature of Massive Open Online Courses (in which approximately 30 000 students register, but only approximately 5% complete a course), traditional methods for evaluating education, which examine retention rates and utilize student surveys, do not adequately address MOOC quality for several reasons (ADAMOPULOS, 2013; WANG, 2013; KHALIL et al., 2014). At present, there is insufficient data linked to why students discontinue MOOCs, since completion rates for evaluative surveys are significantly lower for MOOCs than for traditional courses. In addition, it is speculated that unlike in traditional education, attrition rates are higher in MOOCs for a variety of reasons, beyond dissatifaction with the course content.

At Delft University of Technology, we developed an alternative method for examining the success of a MOOC from a teaching and learning perspective. Our main aim in evaluating our courses is not necessarily to improve retention rates, but to improve our teaching and learning through encouraging reflexive practice in our staff members – a goal that can translate to improved teaching in both online and offline courses. Our approach to evaluation draws on a combination of qualitative and quantitative data from several teaching and learning stakeholders, including teachers, learners, e-learning developers[1] and community managers. In our institution, MOOCs are seldom created by a single individual, but rather a team of lecturers, student assistants, occassionally industry partners and instructional designers working in collaboration. In this paper, we will discuss our multi-tiered approach, noting how we collect data from each of the teaching and learning stakeholders. We will further examine the role reflexive practice by staff members and effect on reruns or other (online or campus) courses.

[1] At TU Delft, e-learning developers are pedagogical experts, who support course teams with the design and execution of their online courses.

1.2 Students as Primary stakeholders

TU Delft online students' opinions are canvased in several different ways. First, we utilize standard pre- and post-course surveys. While surveys are included in all of our 25 existing MOOCs, at present, only 11 of these course questionnaires have been analyzed. The surveys include several standardized questions, related to participant demographics and expectations, and then additional course-specific questions, which the lecturers provide. The latter information gives individual course teams the opportunity to evaluate specific areas within their own teaching and content. A section on student expectations and perceived quality are depicted in report from all surveyed MOOCs in the image below:

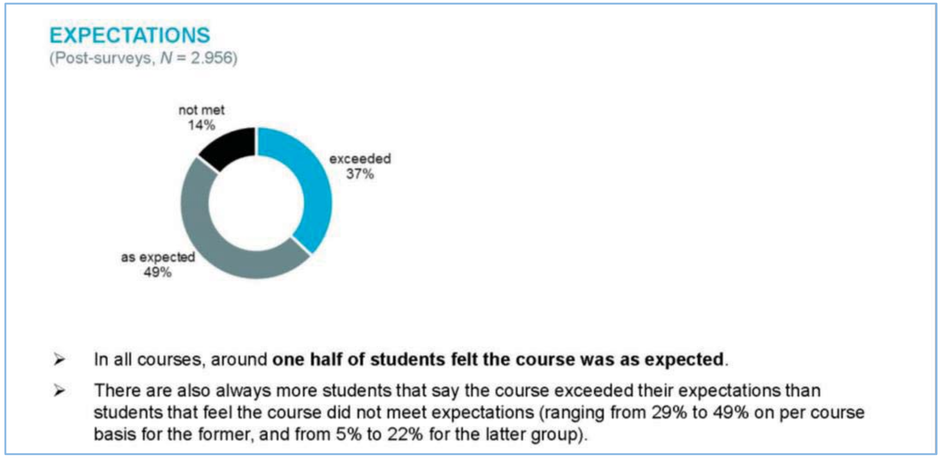

Figure 1: TUDelft MOOC Survey Report – Graph on student expectations

Figure 3: TUDelft MOOC Survey Report –
Likert scale on students' rating of MOOC quality

However, we don't solely rely on these surveys, because of several key limitations. First, because of their voluntary nature, while approximately 10% of students fill out the pre-course survey[2], less than 1% of students complete the post-course survey (around 6,900 students of 608,000 participants in 2015). In addition, our current analytical data shows that the end-of-course surveys are predominently (approximately 85%) completed by students who have successfully finished the course (TOPOLOVEC, 2015), and thus give us less information about why students drop-out[3] and whether this is related to the course design and/or support.

To counter this, and to enable timely reaction by the course team, we have designed a concise mid-course survey, but this is only effective in courses that run for longer than 6 weeks due to 'survey fatigue' (PORTER et al., 2004).

Thus, we concluded that it is essential to include additional means of reviewing student experiences and results. In addition to quantitative research methods, including big data analyses using learning analytics on student participation and results, we recommend the uses of qualitative research strategies to develop a holistic image of both staff and student experiences.

[2] Based on October 2015 data from TU Delft data analytics team

[3] Only 6% of post-course surveys submitted by reported drop-outs

1.3 Recommendation 1: Analyse MOOC fora

A particularly rich source of qualitative data comes from the MOOC fora, which provide course staff and students with a wealth of information. Beyond their role in creating an online learning community for socialising, discussion fora are a crucial space for staff to 'gauge the temperature' of their course and to gather feedback on their students' experiences. In our experience, the fora are a crucial source of timely student feedback, and generally provide the first notification of when and where course design fails to meet the students' expectations and levels of competence. While we acknowledge that it is impossible to create a course that is suitable for everyone, the fora are a good place to gauge how widespread a course design issue may be, and whether our actual audience have the same reactions to content as our target audience. In many cases, the fora help us identify when a further feedback video is required or if quiz questions need additional explanations or revision in future courses.

Several qualitative research methods have been employed to examine fora; including: sentiment mining (WEN et al., 2014), thematic content analysis and discourse analysis (GUARDIA et al., 2013; DOWELL et al., 2015). In particular, discourse analysis has been applied effectively to examine tacit learning that occurs through conversation (ZIEGLAR et al., 2015). As a long term in-depth strategy, discourse analyses and qualitative content analyses of forum posts can yield a wealth of information. But they are time-consuming analytical tools and may not reach the course teams in time to contribute to course improvements. Because of this, a more effective short-term strategy is the inclusion of the community managers in the evaluation process.

1.4 Recommendation 2: Make use of Community Managers

Community managers (usually student assistants) are essential to course evaluations, since they are at the coalface between course design and the actual student experience. Prior to each course, community managers are trained in best practices in community management. Beyond the basics of community management and fora organisation, the training includes instructions on keeping a report or journal of weekly course issues and solutions. In this weekly journal, community managers are instructed to include the following information:

- The top 2 issues students had each week
- How they solved them at the time
- What could have been done to prevent them (clearer video explanations, etc.)
- What would they change for the next course
- The top 3 course items that worked well in that week and should be kept
- What additional training / support they think someone in their position should have before
- starting to e-moderate a course?

Community managers are empowered to fix or escalate problems during the course's run, but the journals also help us to track issues for the reruns. At the end of the course, the community manager/s' reports are coallated and included in the review. If necessary, the e-learning developer also conducts interviews with the course team. This approach has been particularly helpful during the running of the MOOC, as it helps staff to track design and delivery issues with relative ease (especially if the fora are clearly laid out and easy to navigate).

1.5 Recommendation 3: Reflect with teachers and course designers

Teaching and learning is evaluated in several different ways. Prior to the course, teachers are asked to consider their course design through our Online Learning Experience (OLE) tool developed by JORGE et al. (2015), which aids teams in identifying and rating their progress in 8 key areas, such as diversity, flexibility, inclusivity and supportive course designs. This tool further facilitates institutional learning by enabling the identification of more general learning points to improve education.

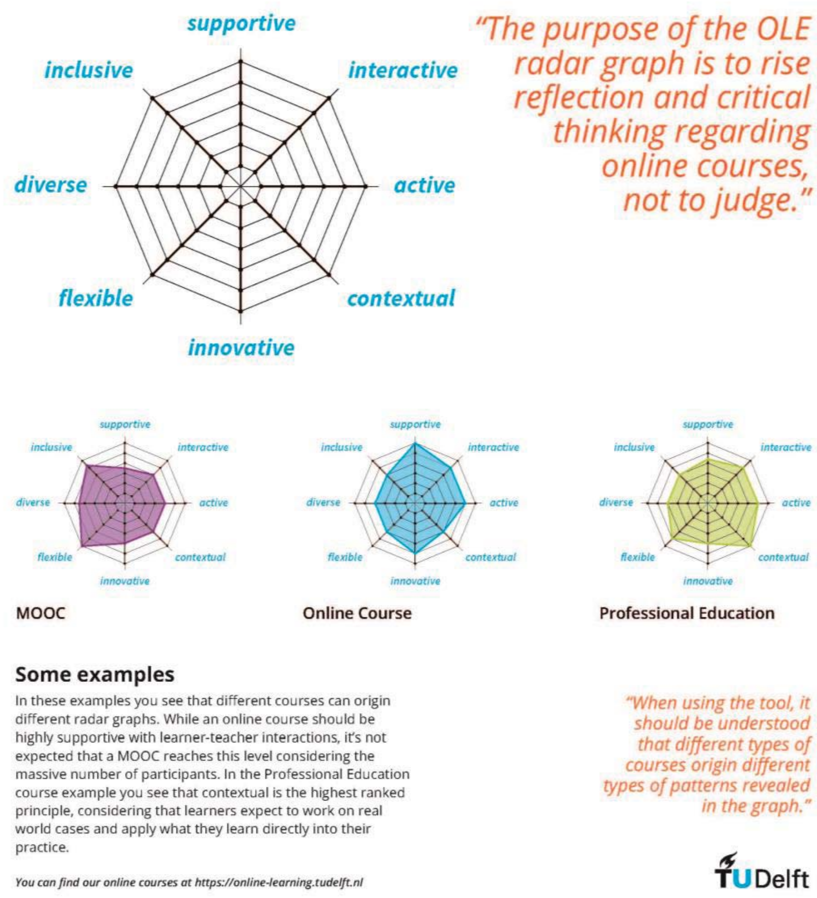

Figure 3: Online Learning Tool poster

The purpose of the tool is not to score 10 points on each scale, but for the course team to realistically assess which aspects of course design require greater attention. For instance, while an online Msc course may attempt to provide the same level of teacher-to-learner support as their on-campus equivalent, it is unneccessary (and arguably impossible) for a MOOC teacher to provide the same level individualised support. However, MOOCs should ideally strive to be more inclusive and flexible than online MSc and Bsc courses.

This tool, which was developed by TUDelft's Extension School, serves as a basis for the course design and is returned to after the course has wrapped up. During this evaluation, course teams (namely teaching staff) and their e-learning developers are asked to reconsider and rerank their course design based on their experiences and the student and community managers' feedback. For example, if a teacher aimed to create a highly contextual or authentic course, but received feedback that their course examples and activities did not relate real-world applications, then this would be an area of focus and redesign for the rerun.

Self-assessment for the teachers is an essential part of the evaluation. This reflexive approach to teaching and learning is core to our understanding of evaluation. While quality assurance is important, our model of evaluation is aligned with a learning model as opposed to a 'policing' model:

> In contrast to the policing model, the learning model has very different assumptions about what constitutes good teaching and good course design. In the learning model, good is understood as relative and context-dependent because of the factors which themselves constitute that context (BOUGHEY, 2001, p. 19)

The purpose of returning to the OLE tool and reevaluating and reranking a MOOC is to enable teachers to reconceptualise their design and learn through this experience.

2 Analysed Courses – some preliminary findings

For 11 TUDelft MOOCs, reports including detailed survey information and data analytics have already been produced and delivered to the course teams. In 3 of those

courses, the course teams have also been interviewed by the elearning developer and asked to work with the OLE tool (above) to rerank themselves. This exercise has provided a talking point for key areas of improvement.

Since the OLE tool for designing and evaluating our MOOCs was only introduced in May this year, these first rounds of evaluation with the e-learning developers helped us gradually fine-tune the tool's 8 key criteria. In particular, in the initial draft, 4 of the 8 criteria were too similar to be adequately individually assessed, such as flexibility and diversity:

> ***Flexible***
> The concept of flexible pedagogy can be perceived in a broader sense, meaning more than simply being able to study independent of time restraints or location. As KIRKPATRICK (2011) argues, "students expect and need greater convenience and flexibility – in their choice of materials, their pace and timing, and their ways of learning" (p.19). In this way, flexibility is also about offering students the possibility to choose the educational resource format that will help them learn in a more effective way. In some courses, it may also be possible to select between different learning activities and topics to study, depending on the learning goals.
>
> ***Diverse***
> Diverse learning and cognitive styles are more adequately supported when learners can choose between different content formats (OZ & WHITE, 1993; CROSBY & STELOVSKY, 1995; YAVERBAUM et al., 1997; DAUGHERTY & FUNKE, 1998). Students will be challenged with different types of learning activities, which can be collaborative or individual, depending on their learning goals, in order to improve retention and performance, while motivating to learn (KOLB, 1984; CASSIDY, 2004).
>
> At another level, diverse groups of learners enrolled in our courses are enriched with different perspectives and ideas, contributing to a culturally-rich learning experience where integrity, respect and inclusion are fostered (in JORGE et al., 2015).

These were later revised as:

> ***Flexibility***
> "Course schedule considers learner's needs in terms of workload and deadlines. All important dates are communicated in the first week of the course or even before its start. Course is based on asynchronous communication, with synchronous moments (when existent) clearly announced in the beginning of the course, taking in account learner's needs.
>
> Learners can explore the course content in a non-linear way and complete the required tasks, managing their time individually according to the course schedule. Learning units have a minimum length of 1 week.
>
> ***Diversity***
> Learners carry out different types of learning activities throughout the course, both individual and collaborative. Learners are assessed using a variety of forms of assessment, both formative and summative, aligned with the learning objectives and activities.
>
> Course provides a diversity of high quality educational resources (video, audio, text, hypertext, images, graphics) throughout the course to enhance learners' knowledge (in JORGE, 2015).

In addition, the earlier version of the tool was more cumbersome to use. However, OLE tool has now developed into a tool that can easily be filled in by the course team, using scalable indicators on a spreadsheet.

In one example of a MOOC evaluation using the OLE tool, the following discussion points were considered:

> ***Active:*** While the course team understood the value of active learning, in practice "the MOOC learners were mostly asked to watch video and answer quiz questions". More practical elements, such as the worldmap, however, were received with greater enthusiam. The recommendation to the course team is below:
>
> "In a MOOC it is important to ensure the 'level' of the course builds up gradually to get students active and to keep them active. The number of active students usually stabilizes after week 2. This means for the rerun it would be advisable to check if the level of the first two weeks is not too high and that it gradually builds up" (MEIJERINK, 2015).
>
> ***Contextual:*** The MOOC drew on several authentic or contextual examples, ensuring that videos were shot in different and relevant locations. In addition, exercises were clearly linked to the learners' own situation.
>
> ***Supportive:***
> "Over 70% of students felt the instructor cared about their learning experience and felt they belonged in the course, which means a majority of students felt sufficiently supported.The majority of students (61%) that filled in the survey indicate they felt the course team supported them well on the forum. This is quite a nice achievement, as a sense of presence was created, whilst the majority of students have never received individual support." (MEIJERINK, 2015)

This last item is an example how we combine the use of quantitative and qualitative data. By starting to use the OLE Tool through these first three MOOCs, we have now generated a fairly stable tool that we will start using systematically in the design and evaluation of all our MOOCs.

In the follow up interviews, course teams discussed their perceptions of the course design and delivery, noted key improvements and worked with the surveys, forum reports and student assistant's reports to restructure their course for the next rerun. At present, one of the courses, Calc101x has already begun their next rerun based on the evaluation report's recommentations.

3 Conclusion

Online education is an exciting space for innovative teachers. MOOCs open up new audiences, new content needs and new teaching practices for those teachers who are bold enough to take the chance. The high student numbers also allow better evaluation of the student experience. Our stance on how to evaluate MOOCs is that one of the key areas of evaluation should focus on improving teaching and learning, in addition to evaluating a course to improve the course itself. The evaluations should be used to identify more general learning points on effective teaching that can be used to improve online and residential education. When teachers experiment with new teaching techniques in MOOCs, and evaluate their practices, this can have a weighty impact on how they teach both online and on campus.

At TUDelft, we have found that a combination of qualitative (surveys, fora analysis, staff journals and interview) and quantitative methods (data analytics and qualitative survey data) that take into account the different stakeholders. This combination helps provide a multifaceted and holistic evaluation of the teaching and learning quality of MOOCs.

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Visualising the MOOC experience: a dynamic MOOC dashboard built through institutional collaboration

Manuel LEON[2], Ruth COBOS[1], Kate DICKENS[2], Su WHITE[2] & Hugh DAVIS[2]

[1] **University Autonoma of Madrid, Spain, ruth.cobos@uam.es**

[2] **University of Southampton,**
{ml4c08, kate.dickens, hcd}@soton.ac.uk, saw@ecs.soton.ac.uk

Abstract

The Growth of MOOCs is matched by interest into the potential for learning analytics to provide an objective frame to motivate learners and reveal broader insights into learners' behaviours. Visualising live MOOCs data creates the potential to provide a manageable and understandable interface to data to help orchestrate learning and inform subsequent stakeholder decisions. This paper presents outcomes of collaborative work between two European universities investigating FutureLearn platform datasets. the paper used two examples of the dashboard functionality to explains the rationale for the analytical investigations which were performed. One strength of this approach is that it can present analytical data to different institutional stakeholders such as learning designers, educators, facilitators, and administrators.

Keywords

MOOC, Dashboard, Learning Analytics, Collaboration

1 Introduction

Universities offering MOOCs are accumulating large amounts of learner-generated data. Analysing such big datasets can provide invaluable insights to education providers. However, we are warned about the sterile results that such analyses can yield often if they are made in a restricted variety of contexts (WESTON, 2012). The increasing use of learning analytics in Computer Supported Education has been widely documented (BAKER & SIEMENS, 2013; SIEMENS, 2012; ELIAS, 2011). One of the most salient purposes of learning analytics is that of visualising learner activity so that educators find the assistance they need to make appropriate interventions (DUVAL, 2011). However, as REICH suggests, "big data sets do not, by virtue of their size, inherently possess answers to interesting questions." (2015). We believe that research resulting from cross-institutional collaboration is key to identifying good practice, systematically investigating learner behaviours, and potentially achieving excellence in MOOCs. The task of raising interesting questions and finding their answers from a position of institutional isolation is an arduous task. The benefits for collaboration, bringing together different views and experiences is particularly significant when it comes to learning analytics.

One of the most important goals for consolidating efforts towards learning analytics is that of achieving a feedback loop to improve the performance of educational products based on learners' feedback (CLOW, 2012). This objective motivated our ambition to build a dashboard. The design drew on the assumption within Laurillard's conversational framework that learning occurs as the result of a constant and reciprocal exchange of feedback between learners and educators (LAURILLARD, 2002). Popular MOOC platforms such as edX and FutureLearn record learner activity data, and provide that data to their consortia's institutions. edX provides a service called Insights, visualising learner activity from different angles. FutureLearn provides curated data to its partner institutions, incorporating demographic data and that resulting from learner activity.

This paper shares insights gathered from a collaborative project between the University of Southampton (UoS) and the University Autónoma of Madrid (UAM). The project objective was to develop a dynamic dashboard that visualises data provided by the FutureLearn platform in near-to-real time. we argue that one of the most valuable purposes of visualising learning activity should be of making the outputs of the data accessible to a broader range of educators so that learning can be orchestrated in response to the evidential behaviours of the cohort or specific subsets of the cohort; concurrently educational stakeholders (planners, managers) may gain a greater insight into the effectiveness and potential optimisations of the MOOCs for which they have oversight.

2 Two Universities, two Platforms

UAM became a member of the edX Consortium in 2014[1] (CLAROS et al., 2015). EdX courses consist of weekly sections, which are composed of one or several learning sequences. These learning sequences are composed mainly of short videos and exercises, moreover, they can have extra educational content such as html pages or interactive educational resources. All courses have online discussion fora where students can post and review questions and comments to each other and teaching assistants. edX courses can be categorised as xMOOCs, falling in the behaviourist paradigm where the assessment is based on the completion of exercises. This allows metric measurements of student progress such as that conducted by Colvin et.al. (2014), using Item Response Theory. Such an approach also allows the production of successful completion certificates based on students' performance in the MOOC assessed activities.

UoS, was one of the first FutureLearn partners, joining the consortium in the autumn of 2013[2]. The FutureLearn course structure is similar to that of edX. FutureLearn courses are divided in weeks. Each week contains a set of activities, which in turn contain a set of steps. Each step is composed of a set of learning objects of different types depending on their purpose: videos, articles, exercises, discussions, and quizzes. Each step is linked to an associated discussion board in which the main topic of conversation is meant to be the step content. This architecture reflects FutureLearn's pedagogical underpinnings inspired in social constructivism and Laurillard's conversational frame-

[1] https://www.edx.org/school/uamx

[2] https://www.futurelearn.com/partners/university-of-southampton

work (LAURILLARD, 2002; FERGUSON & SHARPLES, 2014). In this paradigm, learning is the result of the social interaction between peers, and the platform is built in order to afford such social interaction. Accordingly the platform data is served to institutions with a structure that specifically supports the study of the social interactions of the learners.

Both UAM and UoS have produced a set of MOOCs with similar structures. Both are divided in weekly modules, both have videos as the main source of input to elicit learner activity, and both record this learner activity. In both cases, the experience of the MOOC can be very similar for a passive learner who exclusively consumes content. However, experience of active learners can manifest quite differently. Learners in UAM with edX are encouraged to frequently and automatically self-assess as they progress in the course, whereas learners in UoS with FutureLearn are encouraged to self-reflect on and comment in the discussion on each step of their progress.

Such difference in pedagogical approaches are reflected in the datasets held by the institutions. Although both are represented in tabular data with common metadata elements such as the timestamp, the learning object, and the learner ID, they are different in some of the information they provide. For example, edX data allows much more detailed analyses of the learner performance in the courses based on how much time they spend in a video or in a task, and the outcome of the automated assessment. That is, the interaction between the learner and the platform. On the other hand, since, in th FutureLearn platform it is easier to ascertain what the topics of such conversations, the data supports far deeper analyses on learners' conversations.

3 The UoS MOOC Dashboard

In the summer of 2015, UoS and UAM embarked on a joint project aimed at realising a cross-institutional and cross-platform analysis of their respective MOOCs data. For this, an experimental dashboard was developed, inspired by lessons learned from the development of the Open-DLAs by the UAM (GARCÍA, 2015). The new dashboard is in its first phase and it is based on the UoS FutureLearn MOOCs data. The UoS Dashboard was created to dynamically visualise the data provided by FutureLearn. Both the

dashboard and the data are securely hosted in the Web Observatory server of the UoS, meeting the UK Data Protection Act of 1998 (JISC, 2013).

The data is obtained via two main sources: surveys and learner activity. Surveys provide intent, satisfaction, and demographic data in csv format. Learner activity provides comments logs, quiz results, step activity, enrolment activity, and peer-review activity. Learner activity data is served in daily updated datasets, also in csv format. The datasets contain metadata such as timestamps for each event, and anonymised author id.

The dashboard was developed under Shiny, an R based framework and R Studio an R-based interface that makes it easy to create interactive web applications directly in R, without the need to write any HTML or JavaScript. This framework offers a number of control widgets such as range sliders and drop down boxes that can be placed in the user interface file.

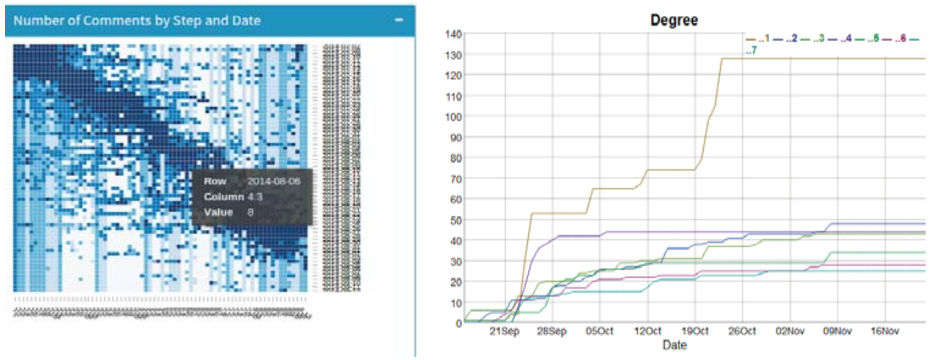

Figure 1: Charts from the UoS MOOC Dashboard

The dashboard offers a wide range of dynamic visualisations on screen, which provide further information by hovering the mouse on specific areas of the graphs. For example, Figure 1 (left hand side) represents the number of comments made in each step and each date in the MOOC entitled "Developing Your Research Project" (DYRP1). The mouse is placed in a point in the chart that displays a specific date (row), a specific learning object (4.3) and a specific value, visually represented with the darkness of the pixel colour (the value is 8). This representation allows the identification of the participation patterns followed by the learning community. The darker descending line indicates that learners tend to follow the course in a linear sequence. With the dashboard, all educators will be able to access this chart for their courses without any coding effort, which will allow them to identify not only patterns, but also outliers that may help make inferences about the reactions of the learning community towards the content of the course as it progresses. That offers the potential to become a useful tool for educators in the course to quantitatively assess their learning materials in terms of usage.

Another example is the visualisation of the degree-centrality evolution of selected students (see also Figure 1, right hand side). Based of the previous work of CLAROS, COBOS & COLLAZOS (2015), we applied Social Network Analysis (SNA) techniques to the DYRP course social network based in the students' activity at the discussions, in order to generate learning analytics visualizations in the dashboard. We wanted to identify the most socially active students in a course and to track their evolution in the course's social network taking into account the incremental growth of their connections in the network. In this case we generated a visualisation with the evolution of the Degree Centrality of these students. This analysis and visualisation could potentially assist facilitators who want to enhance the connectedness of the learning communities in MOOCs, as suggested in LEON-URRUTIA et al. (2015).

4 Conclusions and Future Work

Building tools for visualising learners' behavioural footprints in MOOCs is a difficult task if looked from one single angle. Collaboration between different institutions with different experiences can provide a wider visual field with which deeper and broader analyses can be conducted. In this paper, we have reported the development of The UoS MOOC Dashboard, a MOOC visualisation suite jointly developed by the UoS and the UAM. The participation of representatives from both institutions in the development process has been mutually beneficial, building expertise that can will be transferred to their respective institutions and learning technology teams.

Tool like the MOOC Dashboard render both up-to-date and historical information on how courses are progressing. The choice of the aspects to be visualised has been made

from the awareness of different educational paradigms with which the two collaborating institutions were working, both through their institutional traditions; and the MOOC platform consortia to which they belong. The result has been a dashboard that looks at the student progress from two key perspectives: learners' social interactions and learners' performance. The inclusion of demographic data in the mix can help educators and course designers make decisions based on their target audiences. However, perhaps the most significant potential outcome of this dashboard is that of making MOOC learner data available to a wide range of educators. Drawing on REICH (2015), although big datasets themselves cannot guarantee to answer interesting questions, perhaps making big educational datasets available to educators through visualisations to can help generate interesting questions, and assist in finding their answers.

The MOOC dashboard is designed for use by all those involved in the development and delivery of the courses. As future work, it is intended to assess the usability, the impact, and the validity our tool. We will study the interactions of the end users, survey their satisfaction and usage patterns and calibrate the dashboard measures to review its theoretical robustness. This usage data will be gathered both actively and passively. That is, hooks will be installed in the application that will provide metrics of usage of different elements of the dashboard, and surveys will be distributed to end users for self reflection on the use of such a tool.

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Increasing MOOC completion rates through social interactions: a recommendation system

Hugues LABARTHE[1], Rémi BACHELET[2], François BOUCHET[3] & Kalina YACEF[4]

[1] **LAMOP, obediences@gmail.com**

[2] **Ecole Centrale de Lille, remi.bachelet@ec-lille.fr**

[3] **Sorbonne Universités, UPMC, LIP6, francois.bouchet@lip6.fr**

[4] **University of Sydney, kalina.yacef@sydney.edu.au**

Abstract

E-learning research shows students who interact with their peers are less likely to drop out from a course, but is this applicable to MOOCs? This paper examines MOOC attrition issues and how encouraging social interactions can address them: using data from 4 sessions of the GdP MOOC, a popular Project Management MOOC, we confirm that students displaying a high level of social interaction succeed more than those who don't. We successively explore two approaches fostering social interactions: 1) in MOOC GdP5, we give access to private group forums, testing various group types and sizes, 2) in MOOC GdP6, we implement a recommendation system, suggesting relevant chat contacts using demographic and progression criteria. This papers presents our preliminary findings.

Keywords

MOOC, social interaction, completion rate, attrition, student groups, recommendation system, chat

1 Introduction

Massive Open Online Courses are based on distance learning platforms, therefore improving relationship between students is crucial to offering a better learning experience. Over the last few years, hundreds of thousands of students have contributed to discussions (forum posts, private messages, social networks…). Whether these discussions have a specific educational scope or not, it seems that the more the users are contributing, the better their odds to pass the final exam and get the certification (YANG, WEN & ROSE, 2014). However, stimulating these users' relationships raises several issues, the most general one being: how to improve a user-centered experience and facilitate the users' involvement? This paper paves the way towards a novel approach to intensify social interactions between MOOC students through the use of an embedded recommendation module. We present the preliminary work that led to this module, trying to provide answers to the following questions: 1) what is the impact of social interactions between students? 2) what is the best way to allow students to interact with each other?

We study those questions in the context of the GdP MOOC, a successful French MOOC on project management which has already had 6 sessions over the past 3 years, with over 85,000 unique students registered so far. This paper is organized as follow: in section 2, we present the GdP MOOC and innovations from one session to the next. Section 3 analyzes the impact of social interactions in previous sessions of the GdP MOOC and how it supports our choice of grouping students. In section 4, we present a first approach tested on the 5th session of the GdP MOOC, and how the lessons learned help us design a new approach with a recommendation module. Finally, in section 5 we provide a glimpse of that module and how it is implemented in the 6th session.

2 Context: the GdP MOOC

Both the data analysis and the implementation attempts described in this paper are carried out on the GdP MOOC, a French MOOC on project management (cf. Table 1 : main figures for the sessions). The first session (**GdP1**), the first xMOOC in France, was developed from an existing Open Course Ware website (8 editions, 400 laureates

from 2010 to 2012 (BACHELET, 2012a & 2012b)). It was set up with almost no financial resources using a personal home studio and run by an open team of volunteers. École Centrale de Lille (ECL) sponsored the project, various free Google services were used and Instructure hosted the course on Canvas, an Open source MOOC platform. Enrollment opened in Jan. 2013, and course started in March, offering 2 tracks: Basic and Advanced. An additional "Team project" track helped in recruiting volunteers for the next sessions. This last team track runs on different platforms, and provides no analytics.

GdP2 (Sept. 2013) added a functional analysis course, lasting one more week. It became possible to earn European University Credits (ECTS) by ECL, by taking a webcam (ProctorU) or an on-site table exam (on AUF campuses in 2 developing countries). French startup Unow provided Canvas technical support from this session on. 200 ECL 1st year engineering students followed the advanced track as part of their curriculum.

GdP3 developed webcam and on-site table exams further and doubled the course content. Students had to choose one amongst 7 specialization modules. This was the fifth week of the MOOC, which now started with a 4 weeks long "Core course" curriculum. A peer evaluation algorithm (BACHELET, ZONGO & BOURELLE, 2015) was used to grade advanced track submissions, thus reducing instructor's workload.

In **GdP4**, 17 partnerships with universities were developed and 1500 students were enrolled thanks to their professors. Self-evaluation was added for advanced track submissions and used in the grading algorithm. Bonus were awarded when peer grading was accurate, based on an automatic assessment. A new version of all Core course videos was shot, most of them closed-captioned for accessibility. With a choice of 2 specialization modules, the MOOC was officially 6 weeks long. In **GdP5**, 3 new specialization modules were available and scholarships were created to help students attend the monitored exam. As for **GdP6**, still in progress, figures provided in Table 1 might evolve.

Table 1: Enrollment and completion across 5 sessions of the GdP MOOC

	GdP2	GdP3	GdP4	GdP5	GdP6
Enrolled	10,848	11,827	19,171	17,579	23,500
>1 quiz in basic track	5,711	5,899	8,120	4,842	7,537
>1 deliverable in advanced track	1,011	705	1,197	725	970

3 Identifying factors to associate students

Based on work such as (YANG, WEN & ROSE, 2014), we assumed social interaction is a strong indicator of involvement in the MOOC and of chances of completing it, which means that encouraging social interactions could be a good way to reduce attrition[1]. To confirm this hypothesis, we analyzed data coming from sessions 2 to 5 of the GdP MOOC. We can observe the typical attrition pattern (a "funnel of participation" (CLOW, 2013)) in each session of the GdP (cf. Figure 1 left). We also notice that while the enrollment is increasing, the attrition rate increased as well, and there is an interesting "September effect" of increased motivation, as students in sessions 3 and 5 (starting in September) tend to drop out less than those in sessions 2 and 4 (starting in March).

[1] Of course, not all learners aim for a certification, but it seems difficult to prevent those from dropping out, thus we focus on those who declared wanting to get certified when registering

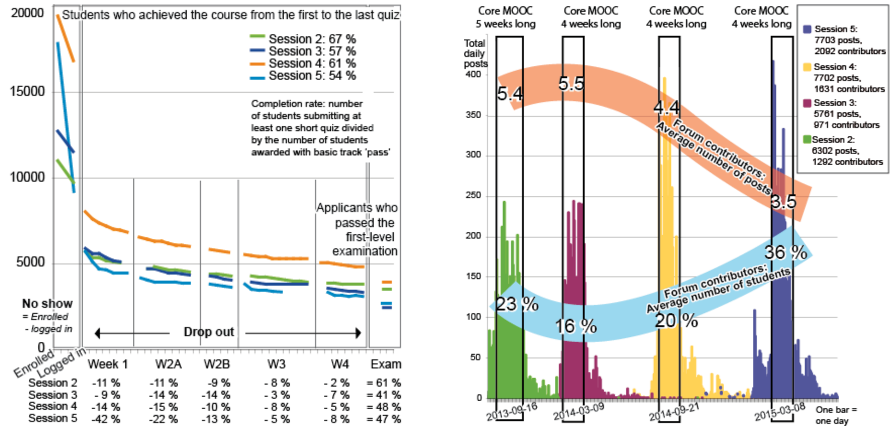

Figure 1: Daily attrition rate (left) and number of posts/students (right) in GdP2 to 5

There appears to be strong social exchanges (cf. Figure 1 right): from GdP2 to 5, with more than 50,000 forum posts and private messages sent by 8,231 of the 61,000 users enrolled (13.5%), but only 3.5% have used both posts and messages. These discussions also take place on social networks, e.g. on the Google+ group associated with the class[2]. A closer look at the nature of these interactions indicates that they have three different functions: socialization, learning reinforcement and sharing of experiences. When comparing those figures across sessions, we see that despite the increasing number of contributors (from the 16% to 36% who passed the 1st quiz) and the extended period of their activity (core period -/+ 2 weeks), the ratio posts/contributors falls from 5.4 (GdP2) to 3.5 (GdP5). This negative trend seems to be the price to pay for more crowded but untagged discussions. Nonetheless, when analyzing their success, we see that these contributors get up to 35% more chances to pass the final exam (cf. Figure 2).

[2] https://plus.google.com/communities/106082830821352352460

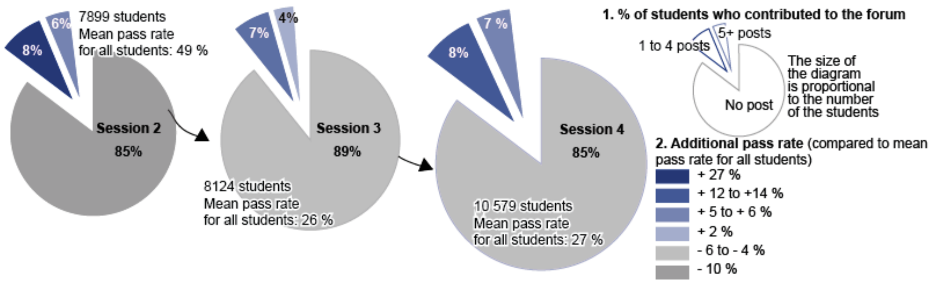

Figure 2: Comparison of forum activity and completion in GdP2 to GdP4

4 Attempts to increase social interactions

4.1 Students groups in GdP5

In parallel with the analyses from the previous section, in the 5th session of the GdP MOOC we tried associating students in small groups. In Canvas, groups provide private discussion pages (forums), wiki pages, and a list of group members with a link to their profiles. A discussion thread visible by everyone explained how to access the groups in and allowed participants to report technical issues. Moreover, 2 threads were created in the private discussion pages: the first one, available from day 1, to encourage group members to introduce themselves and explain their motivations, and a second one, in the last week, to collect a feedback on the feature and students' use of the groups.

In this experiment, we created 34 groups: 4 groups of 50 participants, 10 groups of 10 participants and 20 groups of 4 participants (380 participants overall). 5 criteria were considered: country of origin, study level, age, family status, and previous experience with MOOCs (not only the GdP MOOC – even if we know some previous students return (BOUCHET & BACHELET, 2015)). Those criteria came from an initial research questionnaire filled by the majority of participants. We tried to select a subsample of students as representative as possible from the diversity of students registered. Students could not apply to take part in the experiment, nor refuse to be in a group.

In groups of 4 and 10 students, no more than one person posted a message (or two) in the group discussion. In large groups, up to 9 persons posted in one – but only one person posted more than one message, meaning no real interaction happened. Although the data was underwhelming, lessons could be learned that guided us to change our approach:

1. **visibility of the teammates:** persons recommended to interact with should be very visible and not only accessible through a dedicated page otherwise soon ignored.

2. **visibility of the contacts:** it should be clearly visible when one is being contacted, as even students who tried to interact didn't seem to come back after their initial post.

3. **need for a large sample size:** a larger proportion of the MOOC participants should be included to be able to measure the impact on attendance and/or completion.

4. **need for a large number of recommended contacts:** even in large groups, activity was very low. Making more contact suggestions could give a chance to students willing to interact to find other students also interested. Although the quality of the social interactions is critical, as we cannot guarantee people in a group will be responsive, giving the freedom to contact many peers is the best way to enable high quality interactions.

5. **individualizing interactions:** as private discussion pages looked like the general ones, the interface was easy to understand, but students failed to perceive their additional value, particularly in large groups (no difference in talking to 50 or 1,000 students). Therefore we recommend instead letting students form small groups on their own.

4.2 Recommendation and chat modules in GdP6

Previous results and interviews with the pedagogical staff led us to change our approach and to design and implement on Canvas: 1) a recommendation system, 2) a chat module allowing direct interaction with recommended students (cf. Figure 4).

The **recommendation widget** is displayed on the navigation bar on the left side of the screen in a space normally empty. It displays 3 lists: a list of suggested contacts in green, a list of contacts marked as favorite in orange and a list of ignored contacts in grey (A). In each list, other students are represented as a thumbnail showing their name and photo (if any). When bringing the mouse pointer over a thumbnail, it also displays the beginning of their biography (if any) as well as 4 icons: one to send a private message, one to contact them through the chat, one to add them as a favorite and one to ignore them (B). The **chat widget** is shown on the bottom right-hand corner of the interface and minimized by default (C). When a message is received, an icon is added and a sound played (D). Bringing the mouse pointer over the widget expands it, giving access to two tabs: in the first tab (E), the favorite contacts appear and a chat can be initiated with up to 6 of them at the same time. The second tab gives access to a list of previous chats, and one can reopen them to keep interacting with the student(s) associated to that chat (F).

Figure 4: the recommendation and chat widgets in GdP6

Recommendations were provided using data from the research questionnaire (as in the GdP5 experiment) and progress information (in terms of number of quizzes replied to). We used lessons learned from the GdP5 experiment in the following design decisions:

1. **visibility of the teammates:** the location of the recommendation widget allows it to be visible on all the pages one visits: it is thus easy to reach out to others at any moment.

2. **visibility of the contacts:** once a person has been added as a favorite, they are easily accessible through a tab in the chat, and incoming messages are notified through both sound and a blinking icon on the chat interface, which is itself always visible.

3. **need for a large sample size:** over 8000 participants are taking part in the experiment – an increase of one order of magnitude compared to the GdP5 experiment.

4. **need for a large number of recommended contacts:** each student is provided with a set of 100 recommended contacts – of which the 20 first ones are always visible.

5. **individualizing interactions:** through the chat that one can use with one or several contacts, we provide more freedom to students to decide who they want to interact with.

5 Conclusion

Finding both (a) the right combination of factors to use to suggest students other students to contact, and (b) the right way to make them interact with each other, require experimenting various strategies. However we believe stimulating interactions between students is a key to keep students involved in a MOOC and improve the experience for those who enjoy interactions with others. The preliminary results from GdP6 indicate that interactions between students are happening. In the future, we envision using those approaches for a homework as a way to promote their use, as the few messages collected in the GdP5 experiment revealed that the lack of understanding by students of what they could do with those tools was the main reason why they did not use them.

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A MOOC on regions in the EU: concept, results and lessons learned

Pauliina MÄKÄRÄINEN & Wolfgang PETZOLD

European Committee of the Regions, Brussels
{pauliina.makarainen, wolfgang.petzold}@cor.europa.eu

Abstract

The paper presents the making and impact of the first-ever MOOC delivered by an EU institution, the European Committee of the Regions, between October and December 2015 on "regions, EU institutions and policy-making"[1]. Produced together with 50+ experts such as European and local politicians, as well as experts from EU institutions and academia, the main objective was to contribute to capacity-building of regional and local officials. Following an initial survey among the latter, content and methods were built on their expressed qualification needs and delivered through an eight-weeks' course, which included the possibility of weekly live feedback (web streamed debates). 7,500 participants from 80+ countries, more than 50% of which below the age of 35, had enrolled in the course at it beginning. The paper will be updated end-January once results from an online evaluation are available.

Keywords

Corporate MOOC, EU insitutions and policy-making, MOOC prodcution, interactivity, MOOC evaluation

[1] https://iversity.org/en/courses/regions-eu-institutions-and-policy-making

1 Why a MOOC on regions, EU institutions and policy-making?

In the past decades, regions and cities have increasingly become involved in EU policy-making and implementation. Whereas this varies from one Member State to the other depending on its grade of decentralisation, the importance of administrative capacity-building on EU affairs has increased. This fact concerns in particular policy implementation, e.g. of the European Structural and Investment Funds, but as well compliance with EU environmental and public procurement legislation and the provision of services of general public interest, for which knowledge of EU rules and procedures are key. Participants in events held by the European Committee of the Regions[2] (CoR), the EU's assembly of regional and local representatives, such as the annual European Week of Regions and Cities-OPEN DAYS, and numerous trainings offered by public and private institutions underline that there is a growing interest and demand for dedicated information on EU affairs.

On the other side, the rapid technological development of online communication tools and the use of social media provide for cost-efficient information and training opportunities independent of time and location of the target groups. An online survey conducted by the CoR in April 2015 proved that a MOOC on "EU and regions" was seen as an interesting alternative to traditional trainings even by those, who have no or little experience in using online learning facilities. End-2104, the CoR – as the first among the EU institutions – made the delivery of a MOOC part of its 2015 communication plan in order to complete its digital communication tools, increase its reputation and enhance its role as partner and service provider towards regional and local authorities. This MOOC was delivered between October and December 2015. It was subject to a comprehensive ex ante and ex post evaluation among its followers and contributors.

[2] http://cor.europa.eu/en/Pages/home.aspx

2 Concept, production and marketing

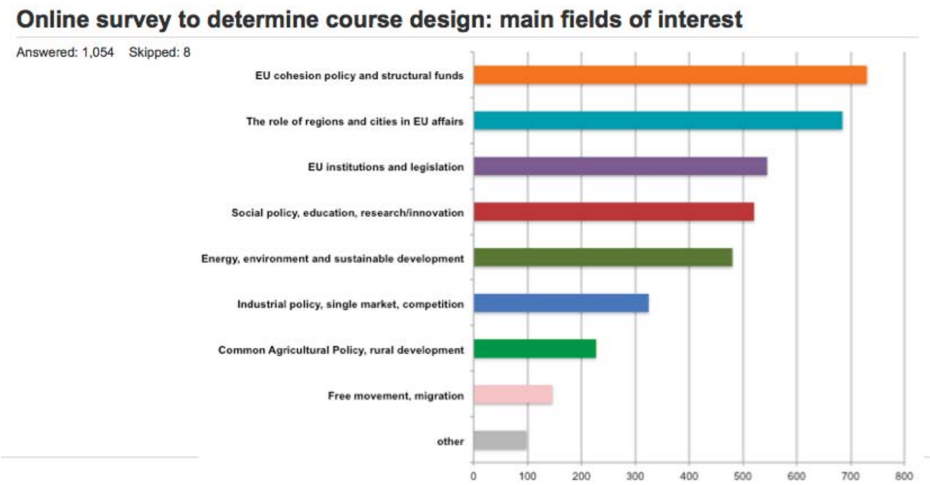
In order to prepare **the concept of the course** and adapt it better to the needs of its potential participants, the CoR conducted an online survey between 27 March and 1 April 2015 among 6,600 EU, national, regional and local officials, other representatives, academics, students, consultants etc. The survey[3] focused on

a) themes possible participants would be most interested in, and
b) preferred methods and tools, the potential time participants would invest, and their general interest.

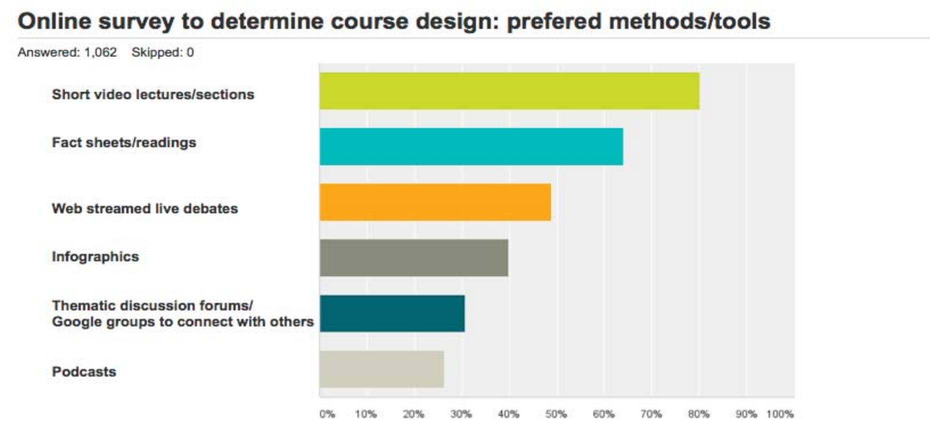
The response rate of 16% or 1,062 responses from 40 countries as well as a number of individual emails received were quite encouraging and gave a good idea of what course design and production should respect in order to meet expectations of potential participants. The results can be summarised as follows:

- About 70% of respondents represented either regional or local (57%) or national (12%) authorities and half of the total of replies came from six EU Member States (Belgium, United Kingdom, Italy, Ireland, The Netherlands and Spain).
- As regards the course content, the top three fields of interest mentioned were "EU Cohesion Policy and Structural Funds" (69% would be interested in it), the "role of regions in EU affairs" (65%), and "social policy, education, research and innovation" (49%).
- Concerning preferred methods/tools, most respondents mentioned "lecture videos/short video sections" in the first place (80%), followed by "fact sheets/readings" (64%) and web streamed live debates.
- A majority of 66% said they would invest 1-2 hours per week in following a MOOC on regional and EU affairs and 20% said they would even invest more than 2 hours weekly.
- 37% said that they had already experiences with online learning, while about 57% said they hadn't but would try for the first time.

[3] http://cor.europa.eu/en/welcome/PublishingImages/EN/MOOC survey report.pdf



These results were communicated to the respondents and those to become involved in the design and production of the MOOC and its different elements.



Further content development and production was overseen by the CoR Events Unit, who was supported by other CoR services as well as by external service providers and experts from other EU institutions and agencies, European organisations/associations and academics. In particular, the production of the videos and the provision of a MOOC platform was contracted out to external providers (CECOFORMA/Old Continent). The MOOC provider, Iversity, was selected following a market study. With regards to possible cooperation and development of the course content, the following potential partners approached during the fact-finding and research period:

- the European Parliament's Research Service (EPRS);
- European Commission DGs, namely DG REGIO, DG EMPL, DG AGRI, DG MARE, DG GROW, the JRC's-S3 platform etc., the European Administrative School (EAS), Eurostat, and the EIB;
- European regional/local associations such as the Council of European Municipalities and Regions (CEMR) and Eurocities;
- Research associations such as the Regional Studies Association (RSA), the Association of European School of Planning (AESOP), and the European Regional Science Association (ERSA);
- and individual academic experts of the European University Institute, Florence, the College of Europe, Bruges, the HEC University, Paris, the London School of Economics, the University of Groningen, Strathclyde University Glasgow, the Erasmus University, Rotterdam, and the European Institute for Public Administration (EIPA).

As capacity and interest of these institutions and individuals varied, partnership arrangements remained informal, and speakers in videos or live debates finally spoke in their personal capacity and references to institutions and organisations are made when they are. Based on the survey, some didactical considerations and feedback received through the above-mentioned contacts, the following topics were identified as being of particular relevance:

(1) EU institutions and legislation
(2) The role of regions and cities in EU affairs
(3) EU Cohesion Policy and Structural and Investment Funds
(4) Research and innovation and the role of regions and cities

(5) Environment, climate change and sustainable development policies
(6) Free movement and migration
(7) EU competition policies and state aids
(8) The EU budget, programmes and projects

Initially, these eight themes were broken down into about 30 sub-themes including the idea to elaborate on them in the given context. However, due to the lack of resources and time limit the potential participants had indicated in the survey, the development of material was finally narrowed down to the eight themes listed above.

The **production of the MOOC** was thereafter built on eight modules (or chapters), each of which lasting one week. The following recurrent elements of the each chapter were:

- Three videos of one, three and 15 minutes to include an overview on the module, a statement by a CoR member and a lecture by or a debate among policy experts and academics;
- one thematic factsheet per chapter developing the topic in more detail; one infographic summarising key facts in the form of figures, graphs, maps etc;
- a live lunchtime debate, which will be web streamed from CoR premises on Fridays and focus on questions received by course participants throughout the week;

A weekly test in the form of a multiple choice quiz, which will reflect on the themes of the week.

In addition, participants were invited to use thematic discussion groups (one per chapter) and a dedicated Twitter account in order to connect to representatives of other regions and cities and exchange views and to exchange information among themselves.

Marketing began on 1 July, with a dedicated website[4] containing information about course content and development, a flyer (5,000 copies), which was distributed at CoR conferences and to CoR visitors' groups, a video trailer[5] (2,200 clicks by end-October),

[4] http://cor.europa.eu/en/events/Pages/CoR-online-MOOC.aspx

[5] https://www.youtube.com/watch?v=xyucs6JCUvg

a twitter account[6] (720+ followers by end-October) and several mailings by Iversity and the CoR to, e.g., the representation offices of the European Commission in the Member States, the 500+ Europe Direct Information Centres (EDICs), the 300+ Jean Monet Chairs, the offices of regions and regional associations in Brussels, and the network of national schools of administration in the Member States.

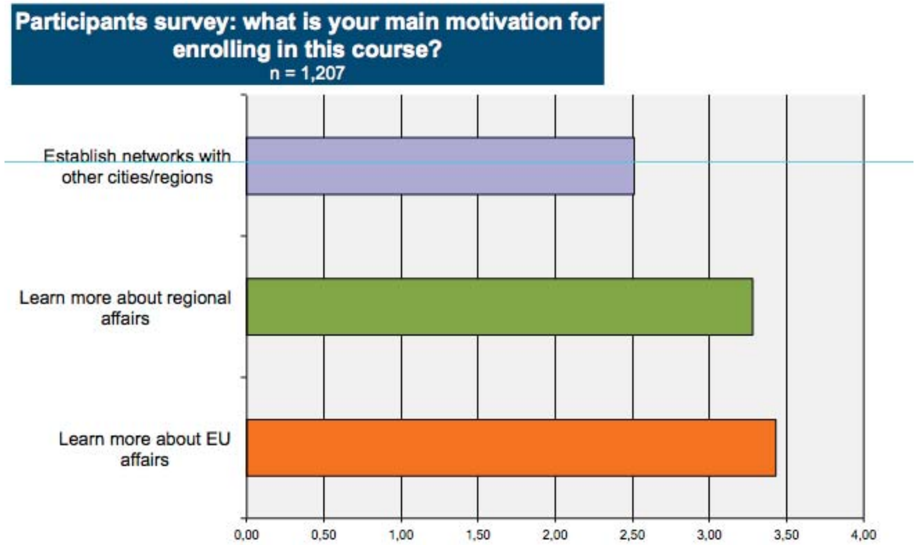
Following a sneak preview with about 150 online followers on 23 September 2015, course delivery began on 19 October. The dates was chosen in order to make use of further outreach possibilities of two big conferences with 6,000 respectively 900 participants, which the CoR hold each year together with other EU institutions: the European Week of Regions and Cities-OPEN DAYS, and the European Conference on Public Communication (EuroPCom). By mid-October 2015, registrations had reached 7,500 enrolled participants from 80+ countries.

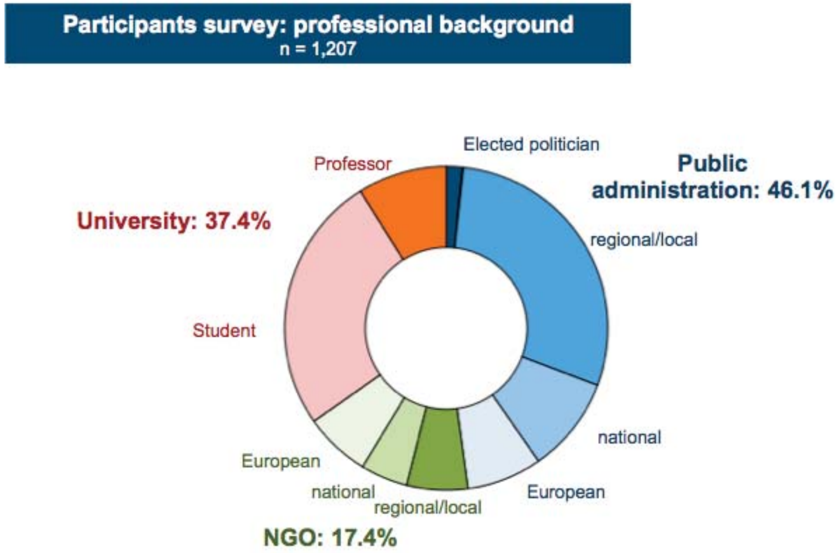
3 Delivery, results and lessons learned

3.1 Delivery

On the occasion of the sneak preview, a second online survey among the enrolled participants was carried out, which aimed at measuring the expectations of the former at the beginning of the course. It resulted in 1,207 responses and gave a good insight into the course population and issues, which will be compared with the perception after course delivery.

[6] https://twitter.com/EU_MOOC?lang=en





3.2 Results: participation rate, interactivity and impact

At the time of writing, the MOOC was running in its last week with weekly activity rates between 40 in week 1 and 6% in the current week of the total population enrolled (8,200+). Participants had posted in the order 250 questions, many of which had been answered by other course participants,

During the weekly live debates, which had been followed online by between 60 and 250 participants, 60 questions had been discussed with 15 experts. Recordings of these debates had been viewed between 250 and 2,200 times.

Interaction via the Twitter account (about 800 followers by the end of the course) was less obvious and will be subject to the impact evaluation. The latter will be carried out mid-December 2015 focusing on these issues:

(1) Overall assessment of the course;
(2) Assessment of different elements (pre-produced videos; factsheets, quizes; links; live debates);
(3) Assessment of the interactivity with other course followers;
(4) Usefulness of the delivered content for the professional environment of the participants respectively for their studies;
(5) Suggestions for improvement.

Results from the online survey among participants will be correlated with results from feedback by the speakers, discussants and service providers as well as with other data (e.g. impact on the CoR website). In the first half of 2016, it is planned to keep the MOOC accessible for registered participants.

3.3 Lessons learned

At the current stage, it is too early to draw final lesson from experiences made with this first MOOC developed by an EU institution. Following the results of the final evaluation, conclusions will be drawn with regard to the impact of a MOOC on institutional reputation and capacity building for local authorities. Moreover, aspects of the production of a MOOC including a more interactive content development will be discussed.

In view of the results of the evaluation, the MOOC (or parts of it) will be either revised or another, may be more elaborated course could be developed, possibly in cooperation with external partners and in more than one language. The final evaluation report will be presented end-January 2016.

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OpenCred: exploring issues around the recognition of non-formal learning via MOOCs in Europe

Andreia INAMORATO DOS SANTOS[1], Gabi WITTHAUS[2] & Yves PUNIE[1]

[1] **European Commission, JRC IPTS, {andreia-inamorato-dos.santos, yves.punie}@ec.europa.eu**

[2] **Loughborough University, G.R.Witthaus@lboro.ac.uk**

Abstract

OpenCred was a study on the credentialisation and recognition of non-formal, open learning in Europe which was carried out between June 2014 and November 2015 by the IPTS in collaboration with the former Institute for Learning Innovation, University of Leicester. It was designed to support the OpenEdu Project[1] of the IPTS, which, on behalf of DG EAC, proposes strategies for higher education institutions to open up education in Europe. OpenCred was based on qualitative research, namely desk research and in-depth interviews, aiming to raise main issues that open learners, HE institutions and employers face in the credentialisation and recognition of non-formal, open learning.
The research found no examples of entire degree recognition for open learning in higher education institutions. Also, it showed that for the institutions analysed, current practices with MOOCs and recognition of open learning are experimental, aimed at learning from and experiencing these new opportunities for modernising their educational offer. The main motivation for the learners interviewed was to

[1] http://is.jrc.ec.europa.eu/pages/EAP/OpenEdu.html

learn something new or to improve existing knowledge. Certification was not the main goal but provided an important added value. Formal certification based on robust assessment was seen as key for the employer organisations consulted.

Keywords

Open education, MOOC, assessment, credentialisation, recognition, non-formal learning, ECTS

1 Recognition of non-formal, open learning

The term 'recognition' is used in two different ways in the context of non-formal, open learning: firstly, there is a commonly held conception of recognition as being simply the validation of a learner's learning outcomes by a provider of education; secondly, there is the notion of recognition as the validation of credentials by a different institution or an employer, usually carried out through credit transfer. For the purposes of this paper we refer to the first as credentialisation and the second as recognition.

2 The OpenCred study aims and design

The OpenCred[2] study aimed to explore issues and practices in the credentialisation and recognition of learning in open education in order to inform the debate and to offer recommendations to higher education institutions (HEIs). It also aimed to inform European policy for the recognition of non-formal open learning on a wider scale.

The design of the study included 1) desk research of current practices in open learning recognition in European countries, and 2) six in-depth interviews: two with academics from HEIs, two with MOOC learners and two with staff members from employer bodies. The two learners interviewed had completed MOOCs taught by the two academics

[2] Upcoming JRC IPTS report: JRC IPTS (2015) OpenCred: an analysis of assessment and recognition practices in MOOC-based learning in Europe (in press)

interviewed. The interviews provided a snapshot of current recognition practices and challenges.

3 Key findings from the literature

In 2012 the Council of Europe highlighted the value of validation of non-formal and informal learning for promoting employability and mobility, particularly for the socio-economically disadvantaged and low qualified. In the recommendation, the Council invited all EU countries to establish validation systems that would allow individuals to obtain recognised qualifications on the basis of non-formal or informal learning by 2018 (COUNCIL OF THE EUROPEAN UNION, 2012).

In the Netherlands, the Minister of Education, Culture and Science has stated that that there will be no changes to legislation to account for recognition of learning via MOOCs and that current mechanisms for accrediting and assessing non-formal and prior learning should be sufficient to meet the needs of learners in MOOCs (VERSTELLE et al., 2014, p. 28).

At an institutional level, the OpenCred study found that there are two ways in which HE institutions recognise open learning. Firstly, open learners can gain access to a higher education programme by exemption from an entrance exam, and secondly, registered students can earn credits towards a qualification at their home institution through open learning offers from other institutions. In addition, some universities award credits for their own MOOCs under certain circumstances (GAEBEL et al., 2014).

The OpenCred study showed that there do not (yet) appear to be any HEIs in Europe offering recognition for open learning in the form of an entire degree qualification, apart from those that have joined the OERu (Open Education Resources university) consortium – in which case the institution would offer recognition for credentials awarded by partner institutions towards a particular programme.

4 Main findings from the case studies

4.1 Overview of the findings

The two HEIs participating in the OpenCred study were experimenting with MOOCs, and had no overall policy or goal driving the engagement beyond a general belief that they could reach more learners, and that publicity would be good for the institution's reputation while also providing opportunities for experimentation with new teaching methodologies. Further OpenEdu studies (OpenCases[3], OpenSurvey) confirm that this is true for most HEIs in Europe. Of the two employer bodies that were part of the study, one is a professional association which sponsors a university to run a MOOC for its members as continuing professional development (CPD), and the other one is a further education college which offers digital badges for its employees who take CPD courses. The two MOOC learners who were interviewed both stated that having formal credentials for their learning was desirable, since they could show it to employers.

4.2 Key themes emerging from the interviews

In this section we discuss the main themes emerging from the interviews.

4.2.1 Experimentation, visibility and alignment with university's mission: the rationale for institutions to provide MOOCs

The interview extracts below are revealing of some of the motivations for institutions to start offering MOOCs:

Interview extract A: *"I think they agreed to start this experiment, mainly because it was my wish, and since I'm rather a well-known professor here […] who is involved in e-learning, I talked to the president last year and he said ok, we'll just do it, mainly to find out whether it is a good idea. There is not yet a strategy or policy or concept*

[3] Upcoming JRC IPTS report: JRC IPTS (2015) OpenCases: case studies on openness in higher education institutions in Europe (in press)

whether this is now something that we should pursue further or do it all over again." (HEI1 lecturer – MOOC developer)

Interview extract B: *"Maybe it is like a commercial, an advertisement that this is a modern university, saying we know how to handle this social media stuff and so on, but there is no strategy."* (HEI1 lecturer – MOOC developer)

MOOC provision being an 'experimental activity' was something evidenced in the interview of HEI1. The interviewee also emphasised that there was no strategy for open education provision in the form of MOOCs at the university – this offer could continue and be further developed or it could be a one-off initiative. Although one should not generalise findings from a qualitative study, this extract illustrates the position of many other universities in Europe which are offering MOOCs, as has been noted in both the OpenSurvey and the OpenCases studies of the IPTS.

OpenCred data confirms evidence from the OpenEdu's OpenCases[4] study that universities perceive in MOOCs opportunities to modernise their educational offer by using digital technologies and reaching audiences in ways previously not possible. For example, extracts *B* and *C* evidence a positive outcome for the institution for MOOC provision: increased visibility and alignment with the university's mission.

4.2.2 Qualifications for the job market: the rationale for participating in a MOOC for CPD

The interview extracts below are revealing of some of the motivations for learners to take MOOCs:

Interview extract C: *"For me it was important to learn more. I learnt programming from books by self-study, and if you have a teacher you'll learn more and can go deeper, into more detail […] I also knew that it was possible to get certificates... It's important that I can show future employers a certificate, so they can see that I didn't waste my time."* (L1)

[4] http://is.jrc.ec.europa.eu/pages/EAP/opencases.html

Interview extract D: *"If I use new tools in the MOOC, I go to my classroom and I will share them. I am using all these things with students in my classroom as I've passed on to them all this knowledge from these MOOCs and this may be the most significant impact of me studying MOOCs."* (L2)

Interview extract E: *"A badge is a good thing to motivate you, but it's not really the reason for doing the MOOC. The reason is to be there and improve yourself but it would be good to have a certificate for doing it, or if the teachers agency would give you one point (points for professional development) for the MOOC."* (L2)

Interview extract F: *"The exam cost 129 Euros. That's a lot for a student to pay. Not everyone can afford that, and if you don't need the credits or you don't want a certificate, you wouldn't pay it."* (L1)

Extracts *C, D, E, and F* point to the same motivation for the learner to take a MOOC: to learn something new or improve their knowledge. Certification was not the main goal but an important 'added value' which could justify the time they spent and provide possible career progression or even a job. The requirement to pay for verified certificates was off-putting for both learners.

4.2.3 Experimentation: the rationale for offering credentials for open learning

The employers' motivation for offering a MOOC with formal credentialisation as CPD was to explore new possibilities, as is illustrated by the following quote:

Interview extract G: *"[…] the central reason for setting up the MOOC was [to test] the concepts of MOOCs and how they could meet the [institution's] various requirements. MOOCs are seen as a wave of the future and it was important to experiment with one as a test case."* (EB2)

Just like educational institutions, this employer body wanted to test out the 'MOOC concept' to assess its value for the organisation.

4.2.4 Robustness of assessment, credentialisation and recognition in MOOCs

In OpenCred, assessment was proven to be strongly connected to credentialisation. In online learning, assessment can be automated, generally leading to credentials with lower levels of formality (e.g. not including European Credit Transfer and Accumulation System (ECTS) credits), while on-site examinations were seen as appropriate for awards with ECTS credits. Peer assessment was not always seen as a robust form of assessment by academics and senior management of institutions, and students were often reluctant to participate in it. Online proctoring can have different levels of robustness, from merely validating the learner's identity to real-time monitoring via webcam, but was perceived as being less robust than on-site examinations. Conferring awards with high status also requires the institution to verify that the recipient is indeed the person who completed the assessment.

Interview extract H: *"[…] this proctored exam system requires the student to show his passport or his ID into the webcam. It makes the barrier to cheating rather high, because if there were no kind of supervision it would be very easy just to have a friend answer all the questions."* (HEI1)

In terms of the connection between robustness of assessment and formality of credentialisation, an OpenCred interviewee perceived on-site exams as more appropriate for formal credentialisation of the learning outcomes:

Interview extract I: *"[…]no-one takes an online exam seriously. If employers see my certificate and it says I did it online, they do not know that the online exam was proctored and my identity was confirmed and so on. But if they know that I took an [on-site] exam, that is much more serious. Then they know that I have learnt something important."* (L1)

The learners interviewed in OpenCred wanted to have the option to apply for a more formal type of credential via a robust assessment mechanism, even if they do not take this offer up all the time. This is in the very nature of open education in which the learner is more in control of their learning compared to traditional formal education.

5 Conclusions

MOOCs and open learning are offering exciting opportunities for people to learn new things in non-formal ways; for higher education institutions to modernise and widen access to learning and for organisations to recruit new people and provide training to their employees. This paper has looked at these issues from a qualitative point of view, based on desk research and interviews.

The research shows that for the institutions analysed, current practices with MOOCs are experimental, aimed to learn from and experience with these new opportunities for modernising their educational offer. The main motivation for the learners interviewed was to learn something new or to improve existing knowledge. Certification was not the main goal but would provide an important added value, subject to the affordability of the examination for the learner. Open education initiatives that provide more formal forms of credentialisation tend to be associated with more robust forms of assessment. Such formal certificates are also seen as key to recognition of non-formal open learning for the employer organisations consulted.

Just like educational institutions, the employer bodies in OpenCred wanted to test out the 'MOOC concept' to assess its value for the institution.

For such emerging practices to become more mainstream, it is necessary to increase the offer and value of open learning credentials for upskilling and career progression in the job market. There also needs to be the willingness to recognise these credentials – for both HE education purposes (e.g. credit transfer) and career change, development or progression.

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Classifying Students to improve MOOC dropout rates

Massimo VITIELLO[1], Simon WALK[1], Rocael HERNÁNDEZ[2], Denis HELIC[3] & Christian GÜTL[1,4]

[1] Graz University of Technology, Institute for Information Systems and Computer Media, massimo.vitiello@student.tugraz.at

[2] Universidad Galileo, Departamento Galileo Educational System

[3] Graz University of Technology, Knowledge Technologies Institute

[4] Curtin University, School of Information Systems

Abstract

The development of web technologies had a strong impact on the way educational settings are experienced nowadays. Particularly, Massive Open Online Courses (MOOCs) have increased in importance, likely due to their nonessential pre-requisite knowledge and mainly free enrollment. The flexibility that such an approach offers on the positive side, however, also represents a downside, mostly evident in high dropout rates, significantly exceeding the ones from traditional lectures. Hence, it is crucial to understand and recognize such users as early as possible, allowing course administrators, or even systems autonomously to intervene on time. The work presented in this paper tackles this problem by training different classifiers to predict if a student will complete a MOOC or not. Our results shows how such goals are reachable even when analyzing data regarding only to the first half of a MOOC's duration.

Keywords

MOOCs, online learning, classification, attrition, dropout prediction

1 Introduction

Since their first appearance, Massive Open Online Courses (MOOCs) have developed and evolved constantly, increasing their popularity and gauging the interest of various users and universities around the world. In fact, a large number of universities are either offering free or commercial online learning platforms for an abundant array of different subjects. With this worldwide spread, MOOCs are also offered in different languages, such as English and Spanish, French and Chinese. Despite their scalability and flexibility, MOOCs have always suffered from a very low completion rate, usually lower than 10% of the enrolled students, with a median average of 6.5% (Jordan, 2014). There are different possible reasons for this phenomenon discussed in the literature. Potential explanations could be related to the structure of the MOOCs, the tools and the learning environment. Within MOOCs, high levels of self-organization is required by the students, which might also be responsible for the high dropout rates. For example, not keeping up with the course will likely lead to students struggling with the assessments, particularly once new and more advanced topics are presented. Identifying such students as early as possible would make it possible for educators to intervene and implement counteractions (i.e., connect better performing students with those who have been identified to be close to dropping out) to mitigate the overall dropout rate.

In order to tackle this problem, we have conducted different classification experiments, aimed at identifying students who did not successfully complete a MOOC over those who did. To this end, the remainder of this paper is organized as follows: section 2 covers related work on MOOC attrition and retention, section 3 describes the study setup followed in section 4 by the discussion of classification results and findings. Section 5 focuses on future works.

2 Related Work

The "Composite Persistence Model in the context of online learning" (CPM), in which the persistence decision is driven by different factors, was first demonstrated by ROVAI (2003). Further, the author analyzed different factors, which potentially influence students and their motivation to engage in MOOCs.

HERNÁNDEZ et al. (2014) proposed an attrition model for open learning environment setting (AMOES), which picks up the idea of the Funnel of Participation Model (CLOW, 2013) and further develops it. In particular, the authors suggest to group participating students of a MOOC into the following three classes: persistence learners, healthy attrition and unhealthy attrition. Persistence learners are those users who completed the course. Students who drop the course without actually showing interest to finish it in the first place are aggregated in the healthy attrition class. The unhealthy attrition includes the rest of the students who did not complete the course.

ANDERSON and colleagues (2014) analyzed students' assignment fraction, which represents the fraction of assignments a student undertakes over the total amount of lectures and assignments that were completed. Further they also classified students according to time interactions, to their date of registration, as well as to their final grade distributions. They were able to split the students into five different classes, showing again that MOOCs are in fact different from traditional offline courses in many aspects. JIANG et al. (2014) tried to predict the final score/grade of students participating in a four week long course from University of California (UCI), using only information about the first week. For the classification experiment, the authors used a logistic regression classifier and the following four feature-sets: average quiz score, number of peer assessment completed, degree of social integration and whether or not the student was an incoming UCI undeclared major student (meaning the student already had to pass a full year of biology and chemistry because of low scores at enroll time). Their results showed that the degree of social integration strongly correlates with a high distinction certificate (i.e., score). BOYER & VEERAMACHANENI (2015) designed a real time prediction model. In a first experiment the feature sets used to classify students consisted of all the data available from the beginning of the course until the particular week considered. The second experiment conducted in their work used a rolling window approach. The window size represents the amount of information (i.e., number of weeks) from the past, which is considered for the prediction model. The rolling window approach was applied to an on-going course to make predictions about the same course; the former approach was used to collect data from a previous course to make predictions for a different one. BALAKRISHNAN & COETZEE (2013) used Hidden Markov Models and K-means classifier to predict possible dropouts and to identify patterns of these students. Similarly, their results also hint at the importance of the interactions between students for the success of the predictions.

In this work, we further expand on the idea of detecting students who are likely to complete or drop out of a MOOC, using well-known methods of machine learning.

3 Material and Methods

3.1 Datasets

Our datasets consist of the detailed request logs from 5 MOOCs, offered by the University of Galileo in Guatemala. The 5 MOOCs we used are "Android 2013", "Cloud Based Learning 2013", "Introduction to E-Learning 2013", "Community Manager 2014" and "Medical Urgencies 2013". Each of this MOOCs had a duration of 8 weeks. General characteristics about the used datasets are reported in Table 1. For every MOOC we have the logs of all requests conducted by the users who registered for the courses. Each log consists of 5 different fields: the request timestamp, the origin URL, the requested URL, the ID of the student who performed the request and the kind of resource (i.e., assessment, peer evaluation, etc.) that was requested.

Table 1: Basic characteristics of the used datasets.

MOOC	Total Student	Completed Course	Not Completed Course	Dropout Rate
Android	593	77	516	87%
Cloud Based Learning	279	123	156	56%
Introduction to E-Learning	245	81	164	67%
Community Manager	821	320	501	61%
Medical Urgencies	118	49	69	58%
Total	2056	650	1406	68%

We started processing this data and created a list of sessions for each user, where each session was defined by an inactivity period of 30 minutes. Using this list, we created 6 groups of features:

- **General information**: total sessions, total sessions requests, total sessions length, average sessions length, average timespan within clicks, average requests per session, average requests per day;
- **Per week requests**: total number of requests per week (from week 1 to 4);
- **Per tool requests**: Assessments, Assignments, Course Board, Evaluation, Storage-File, Forums, Learning-Content, Peer Evaluation;
- **Evaluation per week**: Assessments + Assignments per week (1 to 4);
- **File Access per week**: Evaluation + Storage-File + Learning-Content per week (1 to 4);
- **Interaction per week**: Forums + Peer Evaluation per week (1 to 4).

All our experiments have been conducted with different combinations of all feature sets, however, due to limitations in space, we will only report the combination that worked best for our prediction task.

3.2 Classification Settings

We aim at identifying likely to fail students at a time at which it is still possible to intervene and correct their behaviors. To do so we apply two different algorithms, K-means and Support Vector Machine (SVM). The first is an unsupervised method which groups the samples into K clusters by minimizing the within-cluster mean square distance. On the other hand, SVM is a supervised model, which classifies new examples according to a labeled training set. In particular, we first used the feature sets, extracted from the logs of each MOOC from week 1 to week 4 (half of the course), to cluster the students of each MOOC into two separate clusters (students likely to complete the courses and students likely to fail the courses) using K-means. For our experiments, we set random starting positions for the two centroids (completed and not completed) over a total of 200 initializations. Additionally, we used the extracted features to train a SVM, allowing us to classify/predict if a user will complete a MOOC or not. We split the datasets in a stratified way, with 75% of all students in the training and 25% in the test set. For each feature set we ran a k-fold cross validation prediction experiment. The results obtained were then evaluated according to the F1-score. This metrics is a measure of accuracy, and is computed as harmonic mean of precision and recall. Precision represent the fraction of retrieved instances that are relevant, while the recall represent the fraction of relevant instances that are retrieved. Thus, F1-scores equal to 1 mean perfect predictions, while the closer they get to 0, the worse the predictions get. For evaluating our two proposed methods we present the calculated F1-scores of our prediction experiments.

4 Results and Discussion

Although we have only used information of the first 4 weeks of the MOOCs, the results we were able to obtain are very promising. For the clustering approach with K-means, we were able to obtain F1-scores between 0.64 and 0.75 for almost all the MOOCs. Lower F1-scores were measured for "Cloud Based Learning", which is likely due to a delay during the first week of the MOOC where only a very small amount of requests were conducted. In contrast, when using all data from all five MOOCs, we were able to obtain F1-scores greater than 0.7. Our results also showed the predominance of some feature sets over others. For example the "General Information" combined with other features set displayed the exact same scores as it had when considered alone. Thus such a feature set already carries enough information and could be further analyzed to improve the clustering.

The SVM performed better than the clustering algorithm and nearly always obtained better F1-scores. Table 2 lists the best performing feature combinations on the cumulative datasets of the 5 MOOCs for SVM. F1-scores using the data of each MOOC individually, range between 0.7 for "Medical Urgencies" to 0.965 for "Community Manager". The best performing feature sets were respectively "General Information" and "Requests Per Tool". The average scores for each MOOC were always between 0.85 and 0.9. We noticed better scores (always higher than 0.91) for the "Community Manager" MOOC, which exhibits a higher number of enrolled students and requests. In general, the feature sets with the best scores were "Requests Per Tool" and "General Information + Requests Per Week".

Table 2: SVM F1 Score

Feature Set	Cumulative
General Information	0.927
Requests Per Week	0.882
Requests Per Tool	0.938
General Information + Requests Per Week	0.931
Evaluation	0.918
Interactions	0.945
File Access	0.908
Evaluation + File Access	0.938

5 Conclusions and Future Works

The obtained results indicate that it is possible to predict if a student is going to complete a MOOC or not, when only considering the first half of the course. Both of our presented approaches provided promising F1-scores for all the MOOCs individually and combined.

For future work we want to focus on trying to further minimize the required input data for the prediction experiments. In particular, we are interested in training a general classifier, which uses data from finished MOOCs, which can predict if students are going to complete a MOOC or not for new MOOCs. Further, we plan on improving our feature sets in order to improve the performance of our classifier. Another research of interest is on modelling the group of users belonging to healthy and unhealthy attrition, and further modelling three groups of healthy attrition.

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Workshop about Scalable Feedback and Assessment Activities in Open Online Education

Julia KASCH, Peter VAN ROSMALEN & Marco KALZ

Open University of the Netherlands, julia.kasch@ou.nl

Abstract

The open and often massive character of MOOCs (Massive Open Online Courses) implies that learning environments should allow and support teachers to facilitate large numbers of students. This workshop is organized in the framework of a PhD project about scalability which is part of the SOONER Project (http://www.sooner.nu). The SOONER Project is a Dutch research project which focuses on the structuration of Open Online Education (OOE) in the Netherlands (KALZ, KREIJNS, VAN ROSMALEN & KESTER, 2015). Within this workshop we will concentrate on scalability aspects in OOE and how OOE can be improved on a meso-level by designing and implementing scalable feedback and assessment activities. The workshop will be relevant for scientists and MOOC developers who want to brainstorm in an active way about scalability support in OOE.

Keywords

MOOCs, scalability, feedback, assessment, support

1 Objective

Although bringing lots of benefits to learners and teachers all over the world, MOOCs can hinder learning and overload teachers if not designed effectively and sustainable (SHAH et al., 2014; LIU, MACINTRYE & FERGUSON, 2012; FERGUSON & SHARPLES, 2014). MOOCs with large student numbers can put a large burden on teachers who have to facilitate the courses and support students (SONWALKAR, 2007). Large enrollments can challenge teachers and their educational approaches, resulting in decreasing educational quality which may increase dropout rates (LAWS, HOWELL & LINDSAY, 2003; CLOW, 2013). To maintain or even improve the quality MOOCs, teachers and/or MOOC administrators have to apply scalable solutions which ensure high-quality and social MOOCs without increasing teacher load (LAWS, HOWELL & LINDSAY, 2003; SPOELSTRA, VAN ROSMALEN, HOUTMANS & SLOEP, 2015; VAN ROSMALEN et al., 2008).

Several different scalability approaches can be found in the literature from Learning Analytics (CLOW, 2013) to algorithms about peer-review (PIECH et al., 2013; KULKARNI et al., 2014), to models about adaptive MOOCs (SONWALKAR, 2013). Still, there is no detailed overview of what kind of scalable approaches/tools can be implemented on a course level (meso level) when taking into account different (learning) activities that take place within MOOCs.

Scalability can relate to several aspects in MOOCs such as support and/or feedback (FERGUSON & SHARPLES, 2014) and/or assessment methods (DE VRIES et al., 2005). Within this workshop we will focus on two related aspects: (1) scalable feedback methods/tools and (2) scalable assessment methods/tools. The goal of the workshop is to discuss and identify scalable feedback and assessment methods and which requirements these approaches (should) meet in order to be(come) scalable.

The leading research question that will be discussed and explored in this workshop will be: *Which feedback and assessment methods/tools are known, expected and/or needed to be effective and scalable to MOOCs?*

2 Workshop structure

The workshop is designed according to the Nominal Group Technique which takes into account the input of each participant (pooled judgements) aiming for creative and innovative ideas/solutions (DUNHAM, 1998). The expected duration of the workshop is 3 hours with a maximum number of twenty participants.

The workshop is structured as followed (DUNHAM, 1998), after a short introduction the participants will be introduced to the workshop objective and procedure. Then the participants will get time to individually think about and writing down ideas and solutions regarding feedback and assessment methods/tools. Different colored sheets of paper and other materials will be provided by us. No teamwork will take place in this round to ensure that every participant gets the chance to produce ideas.

Next, everyone will share his/her ideas with the group whilst the generation of new ideas will be encouraged. Duplicate ideas will be omitted and not included in further discussions. During the discussion round people can further explain and elaborate the ideas. The goal of the discussion is that participants get more insight in scalability needs and/or solutions and reflect on the ideas of others. People can explain underpin their ideas leading to a creative group discussion where every person brings in his/her personal background knowledge and experience.

The participants are then asked to choose a (to be fixed) number of ideas that they think are most innovative/important and rank them. After a short break ideas with the highest vote will be shortly discussed and related to this Phd project. Additionally, the way in which the results will be further used within this PhD project will be presented and discussed. The final results will be summarized and will used as input to a roadmap for scalable support in online learning. Furthermore, the results will be reported back to the workshop participants.

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Learning Design and Conceptual Issues. Is there a conflict between open and closed learning spaces? Can closed facilitate openness?

David RÖTHLER[1] & Alastair CREELMAN[2]

[1] **WerdeDigital.at, PROJEKTkompetenz.eu, Austria**

[2] **Linnaeus University, Sweden**

1 Background

The issue of openness is central to all discussions on MOOCs and although there are widely differing interpretations of openness in terms of copyright, a key characteristic of all MOOCs is that they are open to all. In this workshop we would like to explore the constraints of openness and whether closed or restricted learning spaces can actually enhance an open course. An often reported factor for MOOC dropouts is the overwhelming nature of the interaction. An open forum for thousands of participants is an extremely noisy and daunting environment for all but the most experienced open learners. Participants range from complete beginners trying an online course for the first time to experienced professors curious to see how their colleagues run a MOOC and in such an environment the inexperienced participants risk drowning in an information overload. In such an open and diverse space it is impossible to create the trust and support needed to foster effective collaboration and the risk is that only the most vocal members will be heard whilst quieter and more unsure participants will simply leave. A further important element is language. Many MOOC participants are not native English speakers and many only have passive skills in English. They are naturally reluctant to engage in complicated discussions with native speakers and many simply are unable to express themselves well enough to explain what they think.

The question here is whether closed or at least restricted learning spaces can complement an open course by providing certain groups with "safe" zones where they can discuss in more secure and supportive small groups or be able to discuss the course content and issues in their own language? Issues of privacy and trust are central to creating a collaborative learning environment and especially learners with little or no experience of online learning and weak study skills and learning confidence need to feel part of a supportive community where it is fine to ask questions and make mistakes. By using closed or restricted groups within an open course we believe that silent learners can be activated and motivated.

Such groups can be created by online peer support communities like Open Study[1] or MOOCLab's Find a study buddy[2] service. Another option is to provide webinars to a restricted number of participants, possibly focusing on one geographical area or language, offering local support as well as giving participants a chance to build their peer network. As an example of the above we will present two supportive courses accompanying MOOCs run by Virtuelle PH in Austria[3]. These activities can be regarded as a form of blended learning where two different formats – in this case both online – are being combined. These additional offers provide a more secure more closed environment for learning and interpersonal exchange.

Another form of a more private space is the so called MOOCbars offered by many partners (e.g. Volkshochschulen) of the ichMOOC. The ichMOOC organised by German adult education institutions in 2015 explored personal online representation. The MOOCbars intended to gather MOOC participants from a certain region to on-site meetings where they could further discuss the issues raised by the MOOC. It can be

[1] http://openstudy.com/

[2] http://www.mooclab.club/pages/study_buddy/

[3] compare http://www.virtuelle-ph.at/oer & http://www.virtuelle-ph.at/openair2.

assumed that these supportive and more private structures added value to the MOOC and thus contributed to its success.

Recently the term "Inverse Blended Learning" was coined by EBNER et al. (2015) to describe these accompanying measures. The idea is not to supplement a traditional on-site course with elearning elements but to guide learners through online environments with informal on-site support structures. Thus a MOOC can also be used to build strong local or regional social capital. Even if a MOOC has a connectivist approach the strength of the online ties can be debated as described by BELLEMARE (2013):

> *"The Social Capital Returns to MOOCs – or Lack Thereof*
> *One thing I have not seen addressed anywhere in online debate about MOOCs is how they rob you of what I see as a fundamental aspect of the usual college education, i.e., the social capital returns to going to college. This is not the same thing as the social returns to education, which are about what society at large gets from you being educated, i.e., the public good/positive externality associated with education. Rather, this is about the social capital that you acquire by going to a brick-and-mortar college, by which I mean the emotional skills and the social network you gain by being thrown into interacting daily with roughly the same group of similarly intelligent folks for three to four years."*

The questions we intend to raise in this workshop are:

- Which types of closed learning spaces can complement openness?
- Can we see MOOCs as learning eco-systems with a variety of providers offering more or less restricted spaces (break-out groups, webinars, local language groups, F2F meetings) as well as layers of engagement (signature track, tutoring, examination)?
- How can MOOCs offer better support for non-native English speakers?
- Ways to close parts of a MOOC e.g. closed discussion groups, web conference systems, synchronous/asynchronous spaces
- Local/national learning groups online, on-site as a protected environment e.g. so called MOOCbars (Map of MOOCbars connected with the ichMOOC https://goo.gl/HvhNeh)

- Privacy and trust in educational groups – empathy, support, ok to make mistakes

Workshop plan

- Short introduction of participants and facilitators (online and on-site)
- Short presentation to ignite the discussion
- Collection of ideas from participants using online tools
- Small discussion groups
- Concluding plenary summarising results

Workshop format

The proposed hybrid workshop is open for online participants all over the world. The workshop will show the opportunities, challenges and constraints of opening up on-site rooms with webinar technology (Adobe Connect). The general idea is, that online and on-site participants can interact via the web video conference system. Wireless microphones and several webcams, notebooks, smartphones and tablets will provide the interface for an open discussion.

We intend to market the workshop via social media and hope to have truly international online participation with groups in different locations as well as individuals at home. The workshop is intended as well as an open showcase and experiment how an online crowd can interact with an on-site group preferably seamlessly.

We will conduct the workshop in co-operation with the ongoing Nordplus project Webinar – for interactive and collaborative learning[4] (see project blog[5]) and the Tempus BLATT project[6]. Partners and target groups of these project will be invited to join.

[4] http://www.nordplusonline.org/Projects2/Project-database

[5] https://effectivewebinars.wordpress.com/

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TeachEng, a Multi-Paradigm MOOCs Provider Platform to Teach Future Engineers

Sébastien COMBÉFIS, Marie-Françoise LEFEBVRE, Quentin LURKIN, Cédric MARCHAND & Philippe MÉLOTTE

École Centrale des Arts et Métiers (ECAM), Brussels, Belgium, {s.combefis, m.lefebvre, q.lurkin, c.marchand, p.melotte}@ecam.be

Abstract

MOOCs platforms propose courses in various subjects ranging from engineering to philosophy through business and management. They can be qualified as general-purpose MOOC platforms, which aim at reaching the largest public. Recently, specific platforms emerged, targeting a reduced and well-identified public. This paper is about a new multi-paradigm MOOCs platform targeted to future engineers which proposes public and private courses to support teaching for students, lifelong learning for graduated engineers and trainings for professors. The paper briefly presents this specialised platform and how it has been set-up.

Keywords

MOOCs platform, Engineering, SPOC, Lifelong learning

1 Introduction

Several existing *general-purpose MOOCs platforms* (GPMP) propose a wide range of courses whose subjects are ranging from engineering to philosophy through business and management. Such MOOCs providers include edX, Coursera and Udacity (TANEJA & GOEL, 2014). The main paradigm of such platforms is to reach the largest possible audience by proposing a lot of courses in many domains. Keeping the proposed courses not too similar, while increasing the number of courses is quite contradictory. Is therefore the future of MOOCs threatened? A recent tendency sees the emergence of *specific MOOCs platforms* (SMP). For example, the Fun platform proposes courses for French-speaking learners. This paper presents the *TeachEng* project, and the different paradigms that build it up. The platform is targeted to three different audiences: students in engineering, graduated engineers and professors. The remainder of the paper presents the *TeachEng* project, its structure and the goals behind it.

2 TeachEng Project

The *TeachEng* project consists in the development and deployment of a MOOCs provider platform that gathers courses targeted to students in engineering and graduated engineers. *TeachEng* is a multi-paradigms platform which serves several orthogonal but coherent goals. *TeachEng* /ti :tʃeɪndʒ/ is the contraction of *"Teach Exchange"* /ti :tʃ ɛks' tʃeɪndʒ/ since the platform is to be used for exchanges between students, professors and industrials. It is also the abbreviation of *"Teach Engineering"*, to be understood as:

- *Teach Engineers* since it is used to teach engineering-related subjects;
- *Teach me Engineering* since it allows everyone to train itself in engineering or to update itself.

2.1 Platform goals

The three publics the platform is targeted to are also providing content for it:

- graduated engineers can propose trainings about subjects related to their professional experience to students and to professors;
- professors can propose courses or tutorials to students or to graduated engineers for lifelong learning;
- and finally, students can also build courses or tutorials in the frame of projects, for example, or to build remediation material to be used by other students.

The *TeachEng* project is built to satisfy five goals involving the three aforementioned publics that are the main actors of the platform, as consumers as well as producers. The five subprojects composing the main *TeachEng* project are the following:

- *Short courses for students*, to be integrated in their programs, will be the opportunity for them to open their mind to subjects not included in their programs. It is also the opportunity for the school to test new subjects that could be integrated in the future, with a reduced risk.
- Proposing *trainings for graduated engineers and professors* in a lifelong learning approach. These trainings, built by professors and industrials, provide an opportunity to stay up-to-date and to align the training proposed by the school with what is done in the industry.
- Proposing some of the existing courses in the form of a MOOC, especially for *transfer students* that cannot always follow all the courses they have to take due to schedule issues.
- Proposing *introductory courses for secondary school students*, to prepare them to enter higher education. It is at the same time an opportunity to advertise the school and for the future students to improve their initial level.
- Proposing to professors to include *e-learning activities* in their courses by developing short SPOCs.

The main common point between all these subprojects is that the proposed courses must be relevant for an engineer, ranging from technical courses about stability, electronics, chemical sciences, physics or informatics to management, economics and communication. The second common point is that all the subprojects offer an opportunity to open one's mind, to satisfy one's curiosity and to learn new subjects.

2.2 Course lifecycle

The courses proposed on the platform, for the five subprojects, are first proposed as SPOCs and then eventually opened to the world as MOOCs. This lifecycle follows the one proposed in (COMBÉFIS & VAN ROY, 2015; COMBÉFIS, BIBAL & VAN ROY, 2014) where a course gradually becomes a MOOC after a SPOC phase where it gets tested and evaluated by learners. Some courses, in particular those proposed by industrials, may remain privates for confidentiality or intellectual property reasons. An optional intermediate phase consists in opening the SPOC not only to students but also to anyone upon registration (employees of partner firms, for example).

3 Conclusion

To conclude, this paper presents a MOOCs provider platform, different from the widespread general-purpose MOOCs platform, that gathers several paradigms into a coherent whole.

The proposed courses target a specific public, that is, graduated engineers, students in engineering and their professors. Moreover, these courses are first proposed privately to serve specific internal purposes before being opened to the world. The platform is therefore different from the big ones (edx, Coursera, Udacity…).

We think that this kind of platform will continue to emerge as one possible solution to ensure a future for MOOCs and their sustainability. More specific MOOCs platforms will continue to appear, to learn languages, subjects specific to a country or region… One important aspect to take into account to the success of such platforms is to foresee a way to finally open the proposed courses to the world.

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STEM MOOCs in practice – experiences from ChalmersX first MOOC on graphene science and technology

Christian STÖHR

Chalmers University of Technology, Department for Applied IT, Division for Enginerring Eduaction Research, christian.stohr@chalmers.se

Abstract

Chalmers University of Technology launched its first MOOC on the edX platform in 2015. This short article reflects critically on the planning and production process and their impact on the performance of this MOOC. The contribution is based on experiences of the production team and participant feedback. The results show that in a challenging development context, the xMOOC design provided a suited model that, despite its pedagogical limitations, can be built upon. The development focused on the video production and the assignments for the learnes can be improved. Neverthless, the learners perceived the MOOC generally very positively.

Keywords

MOOC, Graphene, online learning, course development, STEM education

1 Introduction

Chalmers' first MOOC "Introduction to Graphene Science and Technology" was created from scratch in late 2014 and ran in spring 2015. 9,566 people were registered at course start, 366 received an honor certificate (4%). This article discusses the course design and implementation including some results of the feedback from the participants of the MOOC. The contribution is based on experiences of the production team during the development process as well as participant feedback gathered through interviews and two surveys.

Instructors and support structure

In this MOOC only one instructor was teaching the course to keep the course as a coherent integrity. This decision reduced coordination efforts, but resulted in an extremely high workload for this teacher (c.f. ALARIO-HOYOS et al., 2014 for similar experiences). As others (c.f. KIERS & JORGE, 2015), Chalmers created structures to support the instructor(s) during the whole MOOC process. This included multiple roles such as production support, pedagogical support, marketing support as well as the project leadership and a steering group.

Design choices

The course development faced some challenging "newcomer" conditions. The course content centered around a material with no prior educational material available. The instructor was comparatively inexperienced in teaching and the new production and support team lacked established routines and processes. Under those conditions and despite its pedagogical limitations, the xMOOC model (c.f. SIEMENS, 2013) was chosen, as it is accessible, flexible, scalable and reduces complexity (c.f. KIERS & JORGE, 2015). To connect theory and practice, the instructor-led lectures and quizzes were enhanced by interviews with experts from research and industry as well as actual lab experiments.

Video production

Most time and focus was put on the video production that attempted to follow established best practices (c.f. GUO, KIM & RUBIN, 2014). After some testing, it was concluded using a script significantly reduces the necessary time for recording, post production and the otherwise burdensome subtitles production (c.f. ALARIO-HOYOS et al., 2014, p. 173). At the end, the course consisted of 68 videos with an average video length of 8 min (9h in total). The average effort, though varying a lot and decreasing over time, can be found in Table 1. The production could not be completely finished before the actual course start of the course. As a consequence, the team adopted an AGILE project management approach (MARTIN, 2003). Working in 2-3 weeks production cycles, significantly improved coordination and efficiency.

Table 1: Average effort for 10 min of finished video

Manuscript revision	Video recording	Post production	Subtitles
40 min	40 min	60 min	30min

Assessment

The course contained both formative and summative feedback. Formative, in form of 25 short, ungraded test-yourself quizzes after the videos and a weekly update video that were perceived as very helpful. Summative feedback involved 7 weekly graded assignments as well as a larger assignment at the end. Those included multiple choice and checklist quizzes as well as image based problems. The final assignment included the reading of an actual research article to demonstrate the ability to understand and reflect upon real graphene research. To cope with the fairly high prerequisites, a self-assessment was provided in a pre-survey that was in fact strongly correlated with the learners' performance. Unfortunately, time constraints and the focus on video production set limits to the development and review that partly resulted in a mismatch between objectives, assignments and lecturing. Criticism included the tight submission schedule, unclear questions, the missing opportunity to check answers one by one, the lack of explanations and correct answers after the deadline as well as the lack of mobile support for some assignments. The feedback stresses the importance of a constructive alignment approach that we attempted, but that was not fully implemented.

Discussion forum

The instructor invested much time to read and respond to almost all significant threads in the forum. One third of all 1,500 comments was written by the course staff. Time consuming and not scalable, the intense feedback in the forum motivated learners to engage in the class.

2 Conclusions

Summing up, it can be concluded that the production focused on video production other pedagogical considerations somewhat on the side. Despite its shortcomings, the course was generally very positively received for both its content and delivery. With the gathered experiences and data, there is a great potential for improving learning activities and assessment for a next iteration. We have only began evaluating the rich and detailed learner feedback and just started to explore the potential of triangulating these data with the activity data of edX analytics platform. Further research has to validate the usefulness of this approach for course development and educational research.

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Gamification Strategies: Experiences and Lessons Learned in MOOCs

Miguel MORALES[1], Héctor AMADO[1], Rocael HERNÁNDEZ[1] & Christian GUETL[2]

[1] **GES, Galileo University, {amorales, hr_amado, roc}@galileo.edu**

[2] **IICM, Graz University of Technology, Christian.Guetl@iicm.tugraz.at**

Abstract

Nowadays a large myriad of learning strategies are being implemented to improve MOOC learning experiences, learning outcome and retention. In this sense, gamification strategies have been proposed as a complement to learning approaches to provide a more powerful and motivational learning experience to the students. Examples of gamification strategies in the context of learning through MOOCs include rewards for learning activities, applying levels and leader-boards to encourage progress and competition, and badges for participation in forums. This article addresses lessons learned from the inclusion of three gamification strategies, preliminary findings and conclusions about experiences are presented.

Keywords

MOOC, massive open online course, gamification, learning strategies, drop-out, motivation, rettention, attrition, learning engagement.

1 Background and Motivation

Today, there are MOOCs offered in many languages, including French, German, Italian, and Spanish. Interest in MOOCs and participation in their planning and design is spreading in Europe, in the United Kingdom, for example the Open University set up a national MOOC platform FutureLearn, founded in December 2012, it has partnered with 21 universities in the UK. Spain also houses the production platform Miriada X, a cooperation between the Spanish company Telefonica and Universia, launched January 2013. From January to September 2015, have been implemented 792 MOOCs in all Europe (OPEN EDUCATION SCOREBOARD, 2015). The CLASS CENTRAL REPORT (2014) presents a summary of the rapid expansion of MOOCs over the past three years; the report showed that 400 universities offered MOOCs in 2014, with 2,400 courses implemented and an average of 18 million enrolled students. However, it is important to mention that despite the massive participation, there are evidences that only around 10%-15% of the students enrolled obtain the certificate of completion (JORDAN, 2013), in some other cases even less. Faced with this situation, it seems important to develop, experiment and research new and improved approaches to better address student engagement in MOOCs. With the identified dropout issues in MOOCs (GUETL, HERNÁNDEZ RIZZARDINI, CHANG & MORALES, 2014) and promising results in other learning settings as simulations (PIRKER & GUETL, 2015) have motivated us the transform our research results into MOOC settings, where gamified strategies could be seen as a way to improve the engagement and completion rate of MOOCs. In this poster, we will present a summary the results and conclusions of three gamified learning strategies utilized for our learning experience.

2 About Gamification Strategies used

Lately, gamification strategies have been used in educational models to engage students through their intrinsic motivation, typically makes use of the competition instinct possessed by most people to motivate productive behaviors, is particularly suited to active learners. In our course, we gave special focus to three challenges in implementing a MOOC, the first related about communication, because it is very difficult to obtain high participation of students in different topics for discussion forums. For this

case, we proposed use ***Badges and Leaderboard Forums***. In this sense, we utilized the Open Source Questions and Answers System (OSQA); this system is a free solution to connect people to information and to get some elements to help engage more deeply with topics and questions of personal relevance, allowing everyone to collaborate, answer queries and manage learning, presents different badges as electronic rewards for students based on their contributions and represent recognition within the course learning community. Throughout the course, participants could propose topics for discussion, answer questions posed by teammates, comment, vote, and exchange views and information with the rest of the participants, with the goal of developing an online collaboration through the discussion forum.

The second strategy used was performed according to quality of delivered assignments (evaluation); we intend to motivate the participants by a position within the learning group; through ***General Leaderboard – League Classifier Students,*** the purpose behind create the leagues was to avoid the negative effects of leaderboards (WERBACH & HUNTER, 2012). For the purpose to encourage the development and delivery of weekly assignments; we automatically classify students into leagues according to their accumulated grades. The leagues served to categorize students using their level of shared knowledge, three were used: *Self-taught (Expert), Curious (Intermediate) and Passive (beginner).* Inside their different categories, the students should perform well than with an overall leaderboard, motivating them to improve and upgrade their level. Our goal was to categorize in order to establish working groups for elaboration project in function of their learning level or compromise with delivered assignments. And the last one strategy is basically related to motivation for delivery of tasks, for this case we propose ***Reward Strategy***. All students who submitted their activities, received as a reward a template-authoring tool via mail (in these case we send exelearning[1] and articulate storyline[2], authoring tools template). The template was offered as a reward, but once they obtained a satisfactory grade, thus keeping a certain degree of expectation over the reward. For this activity our team developed three templates for each tool, we

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[1] Exelearning: http://exelearning.net/

[2] Story Line: https://es.articulate.com/products/storyline-why.php

consider an excellent visualization (graphic design) and a good level of interaction, because we needed to have greater interest to enrolled students.

3 Course Experiences and Initial Findings

The experience presented correspond to “MOOC: Authoring tools for e-learning courses”, implemented during the period from February 16 to March 22 of 2015, with 1,678 enrolled students and learners from 16 countries. In line with findings from other MOOC experiments, the drop-out rate is similar, with only 101 participants or 6.0% of the enrolled users completed the course. We view that gamified strategies used in our course did not increase the engagement of the participants with the delivered learning activities. However, based on an analysis the learners (58%) who successfully completed the course, we found that obtaining badges and recognition in the leaderboard forums, improved their motivation (M=3.71, SD=1.12), the use of leagues classifier students motivates your participation and tasks delivery in the course (M=3.98, SD=0.99), and using a reward strategy as template-authoring tool motivates your tasks delivery in the course (M=4.07, SD=0.99). The majority of students, 33 (60%), indicated that the template-authoring tool would be very useful for creating their own resources or generating ideas for future work and this condition encouraged participation of students. In general, these gamification strategies had a good acceptance among enrolled students and provided motivation for delivery the different assignments and generated great expectation for rewards announced.

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Developmental-AI MOOC Assessment

Olivier L. GEORGEON[1], Cécile BARBIER-GONDRAS & Jonathan MORGAN[2]

[1] **Université Lyon 1, ICAP, olivier.georgeon@univ-lyon1.fr**

[2] **Duke University, jonathan.h.morgan@duke.edu**

Abstract

We report lessons learned from our experience creating and administering a MOOC introducing students to developmental artificial intelligence. Our course, entitled Implementation of DEvelopmentAl Learning (IDEAL), covered advanced findings in developmental artificial intelligence spanning the fields of cognitive science and computer science. Its objectives consisted of conveying these findings to the general public, teaching developmental AI techniques to programmers and roboticists, and supporting international multidisciplinary collaboration amongst actors in the domain (academics, industrials, and hobbyists). Teaching materials included textual descriptions, short videos, and programming and writing activities. The course also supported community forums that allowed participants to engage in debates and work in teams. This form proved to be well fitted to the objectives. Participants reported that they found this design more efficient than lectures; and the forums proved useful in creating a productive community and conveying advanced scientific ideas.

1 Introduction

This paper reports our experience creating and administering the Implementation of DEvelopmentAl Learning Massive Open Online Course (IDEAL MOOC) in the fall 2014. The goal was to convey the cognitive science background and the programming principles necessary to design robots and virtual agents capable of early-stage autonomous cognitive development. We have been conducting active research on this topic for several years at Université Claude Bernard Lyon 1 (UCBL) with our international partners. This research is situated in the context of France's broader effort to investigate Developmental Artificial Intelligence (DAI) (e.g., OUDEYER, KAPLAN & HAFNER, 2007).

The MOOC content followed from Olivier Georgeon's course at UCBL (Master degree level). Beyond a mere course, however, this MOOC offered a place to discuss research in DAI. As such, it was a mix of a "professor centric MOOC" (xMOOC), "connectionist MOOC" (cMOOC), and Massive Open Online Research (MOOR). See a description of these categories by DILLENBOURG, FOX, KIRCHNER, MITCHELL & WIRSING (2014). The level of content corresponds to Master's or PhD level course work, but the MOOC was open to the public without prerequisite. We advertised within our academic networks, scientific and technical mailing lists (AI, robotics, cognitive science, philosophy of mind), social media (Google+ communities, Facebook and LinkedIn groups), and MOOC index. As a result, we gathered a large variety of participants, ranging from software programmers to philosophers of mind. One of the goals of this effort was to facilitate dialog between the community members and thus to help cross-fertilize their respective fields.

- Home page and registration: http://liris.cnrs.fr/ideal/mooc/
- Teaser: http://youtu.be/kQPz9InhHjk
- Syllabus: http://liris.cnrs.fr/ideal/mooc/syllabus.html
- Lessons: http://liris.cnrs.fr/ideal/mooc/lesson.php
- Google+ community: https://plus.google.com/u/0/communities/109445848302721599408
- MOOC Platform: http://claco.univ-lyon1.fr/

3 Participation

We recorded 917 registrations, 584 views of the welcome video, 445 registrations to the Google+ community, 405 first quiz completion, 63 base track completion, 41 advanced track completion, 11 participants who played a leading role in the community. Participants came from 78 countries: France (21%), USA (17%), India (7%), UK (6%), Russia (4%), Canada (4%), Germany (4%), Spain (3%), Italy (2%), Brazil (2%), Other 68 countries: 30%.

194 participants answered the optional demographic survey. Of those, 11% reported working towards an under graduate degree, 20% a Master's degree or PhD, and 59 % reported being professionals or retirees. The intellectual background represented in the course included: computer programming (69%); cognitive science, psychology, or philosophy (7%); dual expertise in cognitive science and computer programming (12%); and other backgrounds (12%).

4 Workload for the organizing team

Design and animation: 488h (Olivier Georgeon, Cécile Barbier-Gondras, and Jonathan Morgan: course design, quiz and exercise design, proofreading). This time consisted of free work performed aside from professional work and from job-search activities supported by the French unemployment benefit system. General support from UCBL: 70h (Amel Corny, Solaine Reynaud: teaser video creation and general e-learning technology advice). UCBL students: 140h (Aurélie Kong Win Chang, Rémi Casado, Florian Bernard: preliminary mock-up, exercise testing).

5 Conclusion

We were very happy with the number, the richness, and the engagement of participants. The promotion could nonetheless have been more efficient; we failed to advertise to tech blogs or podcasts, to big companies, and to local traditional media. The most represented country was France, perhaps due to local networking and to the audience of

Georgeon's lectures in French on Youtube; this shows the importance of local support. 30% of the people who viewed the teaser registered to the MOOC, which indicates good teaser efficiency. 65% of the registered participants did show up; this is a bit below average (70% reported by Dillenbourg et al. 2014), perhaps because of the long time (3 months) between the registration opening and the MOOC beginning. 7% of the registered participants (11% of the show-ups) completed the MOOC successfully and received a certificate of participation; which is above the average in the literature.

Team-work played a central role in this MOOC. We felt the need for more efficient team management tools in the MOOC platform. There are a few actions we could have taken to favor team formation. For example, providing open permanent video hangouts or chat, or displaying participants who visit the same page at the same time could generate more encounters by serendipity. Team forming remains nonetheless challenging because of the diversity of interest, availability, and varying backgrounds of the participants. Designing this MOOC took much more time than expected. We found it analogous to writing a book and then teaching a class. Our motivation came from our passion for the subject, our pleasure doing it, and from the expected professional repercussions. The 11 participants who played a leading role in the community did impressive work. Some examples include re-programming the exercises in a different programming language, writing long documents to share their vision of developmental AI, and engaging in intense debates. Some were PhD students, professional roboticists, or retirees (anecdotally, we heard amusing complaints that their non-retired team members did not keep up with the workload). We hope that this community will remain active, and that it will play an active role in Developmental AI in the future. Now we keep the course available as a "permamooc".

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Social MOOCs (sMOOCs) and the classroom. A cross-fertilization path proposed by ECO project

Alessandra TOMASINI, Paola CORTI & Susanna SANCASSANI

Politecnico di Milano, METID, alessandra.tomasini@polimi.it, paola.corti@polimi.it, susanna.sancassani@polimi.it

Abstract

ECO project (Elearning Communication Open-Data) focuses on applying and extending to a pan-European scale the experimentation of the implementation of OERs and of a “social” pedagogical approach in education, directly working with teachers. In Italy this objective will be prosecuted through an experimentation of a path in two steps: a course in flipping classroom, at first, and secondly, through ECO platform as a place where to create one’s own course. The aim is to facilitate a reciprocal influence, sort of cross-fertilization, between MOOC online didactic, which offers Open resources, and face-to-face teaching, that proposes mechanisms of social and collaborative learning. This paper describes how this path has been designed.

Keywords

ECO project, MOOCs for Teachers, sMOOC, flipped classroom, multicultural design

1 Introduction to ECO project

ECO project (E-learning Communication Open-Data), funded from the European Community's CIP (Competitiveness and Innovation Framework) aims at demonstrating the potential of OERs and MOOCs in order to:

- widen access to education and improve its quality;
- lower or remove technological barriers in learning processes;
- create an inclusive environment for users with special needs or at risk of exclusion.

These main objectives are meant to be reached through the experimentation, piloting and showcasing sMOOC ("s" stands for "social") best practices implemented at regional level during the project lifecycle. The expected project impact would be attract teachers and trainers in the creation of their own online courses and other OERs, developed with special attention to the training of European teachers and distributed through the project's open learning platform (www.ecolearning.eu). The MOOCs created by participants should follow ECO's pedagogical model, orienting activities toward a connective and social approach: they should propose collaborative activities on different online environments (like forum, microblogging, social networks, etc…); peer evaluation; gamification. In the deliverable "Instructional design and scenarios for MOOCs" is stated that "a MOOC represents an opportunity for participants to develop their learning experience by being part of online communities and networks. Participants are not students, but more like members of a community of interests / community of practice. The ECO sMOOC pedagogical approach draws from connectivism, situated learning and social constructivism – reflect, practice, learn how to (not about), and social contextualized learning. The model intends to provide a flexible pedagogical framework with a focus on networked and ubiquitous learning".

2 The methodology

In this paper we present the process structure of the activity as, at this stage, no data have been collected. We are still not able to say anything about the effectiveness of this approach because the first edition of this set of course at the very beginning of 2016.

ECO activities are organized in 10 regional Hubs. Politecnico di Milano – METID (the centre dealing with design, development and delivery of e-Learning and e-collaboration services www.metid.polimi.it) is coordinating one of them, the Italian Hub. In its specific context, teachers, especially coming from universities, are not used to a high level of content sharing and openness and where ICT skills and internet infrastructure are not to be taken for guaranteed in all schools around Italy, depending also on territorial peculiarities.

The aim of this step of the project, applied to this specific scenario, is to bring teachers closer to the use of OERs in general, and ECO's OERs in particular, using them as a content in a didactical project they can test with their classroom. A second level objective is to support them in getting confident with this learning approach, through their direct experience, their reflections and their discussions with others. Then, participants are invited to join the "sMOOC Step by Step" in order to go to the "next level" and create an entire course, completely online, based on the methodological approach already experimented.

The idea of these 2 steps is to promote a reciprocal influence between the online and face-to-face, that's why we refer to "cross-fertilization". The familiarization with flipped classroom approach will help teachers in experimenting the "active and collaborative learning" in class that are going to be transposed online in sMOOCs. On the other hand, the online resources can influence the level of student engagement and innovation in classroom teaching.

The most specific features of this design experience are the following:

- it is based on collaborative work: experts and teachers, coming from international institutions, are collaborating in the design, development and implementation of course structure and contents.

- It offers a content variety: course sessions were build using videos in different formats: teacher centred, animations, comics in speed drawing;
- It is based on experiential learning: the path is filled with storytelling of some best practices, presented directly by the experts that put them in place, case studies, participants' artefacts and project works creation;
- It build courses with "social" structure: the learning community embraces participants who play the role of "knowledge creators", thanks to discussion and collaboration activities in dedicated spaces, like forum and/or social networks.

3 Conclusions

The main features of this experimentation within ECO project can be resumed as follows:

- ECO project is giving teachers the chance to follow two training paths to support their professional development increasing their digital confidence, support the use they can do of OERs, and applying innovative and effective approaches in their everyday teaching activities;
- The direct involvement of teachers in online experimentation will apply the same approach proposed within the courses, so that they will turn out to be able to propose it by themselves in their classes;
- the chance to work into a multicultural and international design team, involving partners from different scenarios and different cultures may really support a multicultural, international group of participants, facilitating a stronger peer-to-peer interaction.

Giving teachers the chance to select the path that suits most their needs, their previous experiences and their objectives, will increase the possibilities that they will turn into practice these approaches in the future.

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JMOOC, MOOC promoting organization in Japan: Current situation and Potential

Yoshimi FUKUHARA

Japan Massive Open Online Courses Council, fukuhara@jmooc.jp

Abstract

After the big MOOC wave from US in 2012, many MOOC has been launched in various regions since following years, in Europe and others. In Japan JMOOC has been established as a nonprofit organization to promote MOOC under the nationwide academic-industry cooperation. The first MOOC on Japanese history has been distributed from University of Tokyo on JMOOC platform from April, 2014. So far total 90 courses were distributed from JMOOC and most of those were in Japanese with 410,000 enrollments totally. We made polls annually to investing social potential of Open Education and since last year we put more focus on MOOC. According to the result of the poll, some noteworthy aspects were clarified. Firstly more than 80% person think MOOC is worthy service, but only 3% have used actually. However 54% answered that they would like to use from now on in spite of low usage. Second potential popular courses are Psychology, History,Music & Cinema and Economics & Finance in order.

Keywords

MOOC, Regional MOOC, International Collaboration

1 Purpose

With the sense of crisis that Japan is left alone while MOOC is rapidly expanding worldwide, some of volunteers who have been engaged in open education in Japan since the early summer of 2013 discussed the need to start MOOC business in Japan. In October of 2013 they held a press conference about its establishment in the Imperial Hotel. Among its basic policies mainly made by the founder for its establishment, the following points are particularly unique for JMOOC.

- JMOOC delivers MOOC in Japanese mainly based on Japanese university lectures. Most of the lectures delivered from global MOOC entities, which have their principle place of business in America, are provided in English. So Japanese learners have difficulty learning efficiently. On a global level, large-scale MOOC entities for global learners of English are established. Moreover, MOOC entities that enable learning in a mother tongue from the non-English speaking world such as France, Spain and China, are also established and are expanding rapidly. Considering these things, we'd like to actively promote MOOC provided in Japanese.
- Its management is not dependent on funding from a certain organizations and businesses, but on business-academia collaboration with as many universities, businesses, and organizations as possible. Its money management is based on the allotted membership fees collected from each member entity

In addition, the following is JMOOC's mission statement since establishment.

"JMOOC strongly leads and realizes 'MOOC's vision to expand individual values to the whole of society's shared values through learning', for Japan and Asia based on business-academia collaboration."

We have completed registration as a general incorporated association based on this mission statement on November 1st in 2013. Since then, we started our activity, having the below purposes.

i. Enhanced social recognition of a certificate of completion
We realize the high quality learning and skill acquisition management, solve technological and systematic problems and promote the activities to enhance its social recognition so that a learner's certificate of completion is largely recognized as a social value and the power to lead the knowledge society.

ii. Form a social continued learning base:
We actively promote not only specialized knowledge education from higher education institutions to lifelong learners such as students, business people and retirees but also practical knowledge of businesses.

iii. Providing content platform to Asian countries and collaboration for it:
We provide contents and platforms designed and managed by JMOOC not only to Japan but also to Asian countries like ASEAN and necessary and effective learning opportunities to foreigners who wish to study in Japan and work for Japanese companies.

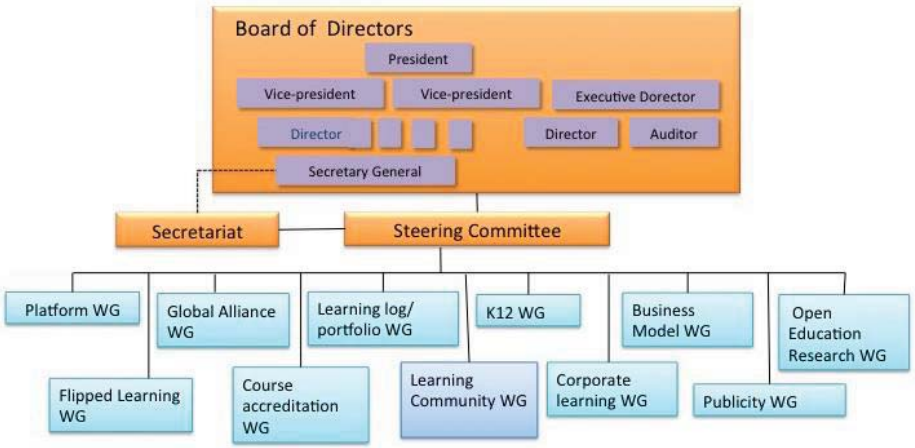
iv. Consolidation of "Flipped Learning":
"Flipped learning", using MOOC's materials for preparation to have a more difficult face-to-face class afterwards, is recognized as an effective learning method and started to spread. Considering that university education may change dramatically, JMOOC actively makes examples and intends to consolidate it in Japan.

v. Research activity to consolidate learning support technology:
MOOC is the initiative for the first time in history to make the most of information and communications technology (ICT) for education support, store all the learning activities of large-scale online learning groups digitally, gain the knowledge about new learning technology based on the analysis and continue to improve the learning based on its feedbacks. JMOOC takes the initiative to build and manage the learning platform for it, promote a research activity for consolidating learning support technology and education improvement based on Big Data analysis of authentic education.

2 Organization and management of JMOOC

JMOOC consists of members from universities and businesses and managed by the representatives of universities closely related with open education and board of directors mainly consisting of the representatives of special member companies announced to deeply contribute to its management. On the other hand, the delivery platform to deliver MOOC is provided by special member companies that voluntarily build and manage it. Below 3 systems are the delivery platforms provided by JMOOC.

- gacco:
  This is managed by NTT Docomo co., Ltd. and NTT Knowledge Square co., Ltd. Customized Japanese version Open edX, open source software version management software provided by this service, developed by American edX is provided.
- Open Learning, Japan:
  This is managed by Net-Learning co., Ltd. This company's commercial cloud service customized for MOOC use is provided.
- OUJ MOOC
  This is a platform managed by the Open University of Japan. This platform is based on CHILO BOOK developed by NPO CCC-TIES.



Also, it's the basic policy that WG (working group) consisting of volunteer members for each agenda discusses technology, policy, system and dissemination and reflect their conclusion to JMOOC's management and MOOC's service.

3 Challenges

One year has passed since the establishment of this organization and about one year has passed since the start of the initial course and clarified key challenges are found as below.

(1) Expansion of the number of courses
MOOC is basically the education information provision service intended for a general public so lectures of various fields must be opened to meet the needs of a diversity of learners. At least more than 100 or more lectures should be opened so that MOOC is accepted to have a social value, which needs to be attained as soon as possible.

(2) Expansion of the number of registered learners
More registered learners will lead to heightening MOOC's value and certifying the social value of a certificate of completion. About tens of thousands to one million registered learners are desired. To realize it, we must provide more than a certain number of high quality lectures.

(3) Expansion of lecture fields
According to the survey, the desired fields to learn varies depending on sex and ages. We hope that we cover at lease 80% of leaner's desired fields to learn. Taking it into consideration, not only university lectures but also in-house education and specialized education contents are required. Considering that it is social education infrastructure, it should also cover elementary and secondary education content.

(4) Establishing a continued business model
B to C lectures are basically available free of charge until acquiring a certificate of completion. But JMOOC manage it under business-academia collaboration so consolidating a continued business model is important in

terms of corporate perspectives to continue business. Reviewing various possibilities is necessary for it.

(5) Streamlining the opening process of lectures and reducing costs
It's essential to reduce the burden of opening lectures of MOOC in universities as much as possible. It's urgent to design lectures, standardize their production process and streamline them for it.

(6) Consolidating the full-fledged learning log analysis system
One of what MOOC essentially expects is analyzing a vast amount of learner's learning history (BIG DATA) and consolidating the research environment where we can gain knowledge about new education support. Consolidating the system is also a key challenge.

4 Future prospects

According to the opinion poll conducted on September in 2013 and 2014, expectations for continued learning is heightening and the desire to learn a variety of fields are found out. To meet this wide range of needs, we need to open many lectures. We are thinking of opening more than 100 or more lectures as soon as possible. MOOC's lecture footages record university lectures. It doesn't just separate it to 10 minute footages for each lecture. We ask teachers in charge to know in advance that the content is 10 minutes and reconstruct the content and then record it to MOOC again. That's why it's difficult to open a great deal of lectures from one university in a short period. So we think it important that we'd possibly like many more universities to join us.

Also, MOOC isn't just involved with universities in delivering lectures of each university's teacher. MOOC enables practicing active learning and Flipped Lectures, now in focus to improve the education quality, effectively and efficiently. Practicing Flipped Lectures for JMOOC lectures started at the end period of 2014. To be more precise, "Internet" lectures provided by Jun Murai, Keio University's professor, is used for "Internet" subject (Two classes contain 400 students in total) lectured at Tokyo University of Technology at the end period of School of Computer Science at the sophomore level. Students use „the Internet" lecture shown on JMOOC's certified website

and prepare for a lecture (prep) at their own pace and practice „Flipped Learning" style by joining an independent and constructive class like discussion etc. in a class to enhance the learning effectiveness.

We believe that such a learning method will be widely applied in the future with the expansion of JMOOC's lectures.

Related Web sites

JMOOC: http://www.jmooc.jp/