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Embedding MOOCs in academic programs as a part of curriculum transformation: a pilot case study

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Keywords

moocs, embedding, pilot, transformation, curriculum, part, study, programs, case, academic

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Embedding MOOCs in academic programs as a part of curriculum transformation: a pilot case study

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Abstract. The University of Wollongong's first locally developed and hosted Massive Open Online Course (MOOC) "The Reluctant Mathematician" was a highly scaffolded MOOC designed to support stressed and low-efficacy maths learners. It was developed to lift maths skills at our university and also in the community – where maths skills continue to be a challenge and in some cases a source of stress. Internally the MOOC provided an alternative online way to support students who struggle with mathematics at university level, and as a complement to the existing face to face services. This paper describes a successful approach to using MOOCs not only for addressing skills shortage among university students, but also to engage staff in the hybrid learning aspects of curriculum transformation. Based on a small-scale pilot, the paper describes the narrative of engagement of academics, and highlights the main elements which were conducive to their engagement in selecting and using the MOOC as a support for an assignment in their curriculum. A framework is proposed educators who are interested in using MOOCs for a similar purpose.

Keywords: MOOC, open-education, curriculum design, re-use, OER

Introduction

The 'maths skills crisis', which has been on the national education policy agenda for some time, has implications not only for students, but also for tertiary education staff. This skills crisis is characterized by a lowering of maths skills in students and the community, and the removal of maths pre-requisites for university entrance. This skills crisis is slowly impacting mathematics education through a vicious cycle (Professions Australia 2008), where fewer and fewer high-school students study advanced or intermediate mathematics, resulting in fewer students enrolling in university mathematics classes. This, in turn, leads to a reduction in the number of mathematics teaching staff in universities, and to lower numbers of enthusiastic, mathematics-qualified teachers in schools (Professions Australia 2008). In addition, universities are expected to face an increase in the number of students enrolling in university courses who are short on maths skills, and who struggle in the classroom across a wide range of disciplines including nursing, economics and finance, education and even engineering. The ultimate

consequence of this vicious cycle is expected “shortage of skilled professionals in the fields requiring tertiary mathematics education, including engineering, science, finance and the actuarial profession, all of which are areas on which our society and economy depend for continued prosperity” (Professions Australia 2008).

There have been numerous staff and projects engaged in finding solutions to the ‘maths skills crisis’ over many years at the University of Wollongong, and the current strategic push for Curriculum Transformation provides additional motivation and mandate to do so within the framework of a review of entire course curricula.

One of the four themes of the Curriculum Transformation project is “Technology Enriched” and one of the related 5 Transformational Practices that will positively impact the student experience is “Hybrid learning@UOW”. These approaches align with an extensive body of research on what best delivers engaging student experiences and relevant lasting impact (Huber and Hutchings 2004; Kuh 2008). The re-use of a MOOC as a self-paced resource and activity parallel to the classroom activities represents an early case of the “Hybrid learning” and “Technology enriched” approaches being undertaken and evaluated.

This approach draws on student-centered online instructional scaffolding, inspired by MOOCs video lesson and quiz approach. This approach does not focus on merely delivering content online, but rather scaffolds the skills that students need to acquire, and uses online tools to ensure this gradual acquisition. The result of this approach has demonstrated benefits not only to student performance, skills enhancement, self-efficacy, and anxiety issues, but also to the engagement of teaching staff across disciplines. Where the original module was developed to address the shortage in generic maths skills, staff members are now seeking similar educational programs to support discipline-specific maths applications as well as gaps in students chemistry skills.

The paper is organised as follows. First, a description of the original MOOC and its design are provided, to understand the general context of the engagement. Then, the reuse of the MOOC and the main elements conducive to the engagement of academics are summarized, based on interviews with academics. The MOOC elements which are conducive for resource re-use are summarized and discussed. Next, future directions for actions are proposed. The paper concludes by suggesting a framework for educators who are interested in using MOOCs for a similar purpose.

Original MOOC – “the reluctant mathematician”

Massive online open courses (or MOOCs) have displayed explosive growth over the last few years, with growth in the number of students, courses, platforms (such as EdX, Coursera, Udacity, FutureLearn, OpenLearning, etc.), and staff involved (Pappano, 2012). Being offered by prestige universities such as Stanford, MIT, or Berkeley, being accessible to anyone with an internet connection, and being more affordable than many other higher-education

options makes them an attractive ways to learn about various topics (Delbanco, 2013). MOOCs have also been viewed by some as a threat to traditional Higher Education institutions and programs (Campbell, 2013; Delbanco, 2013; N. L., 2013).

However, disruptive technologies also have the potential to spur innovation within existing members of the sector (Conole, 2007). It may be possible for Universities to embrace the MOOC phenomenon to advance their own educational practices. The suggested benefits to universities resulting from offering MOOCs typically refer to an academic training ground for students (Campbell, 2013), a pipeline of paying students (Campbell, 2013), and / or a source of revenue resulting from online students paying for accreditation (Valentin, Nafukho, Valentin Jr, Johnson, & LeCount, 2014).

This paper, however, identifies and describes another benefit to the uptake of MOOCs by traditional universities. Following the principles of open learning, which supports reuse and repurpose of educational resources, this paper presents an example of benefits to internal students, as well as to staff engagement, as a result of re-purposing a MOOC designed for the general public. In the case described here, teaching staff became interested and inspired to reuse and re-purpose an existing MOOC originally designed to address shortage of maths skills and / or aversion to the learning and usage of maths identified in on-campus students in their own disciplines. Such expressions of interest from teaching staff in accounting, engineering, and natural sciences suggest wider potential for the re-use of MOOCs within other curricula.

MOOC design

Addressing the maths skill shortage identified in the local community, the University of Wollongong (UOW) developed and hosted a reusable Massive Open Online Course (MOOC) “The Reluctant Mathematician”, which was run in the last 4 weeks of the summer holiday, prior to Autumn session in 2014.

Out of 11 maths topics included in a pre-existing pre-university summer program, 4 were selected by staff of the School of Mathematics and Applied Statistics as the ones most widely-applicable to university and community use. The four topics selected were fractions, basic algebra, factorisation, and indices. Each topic had the same learning sequence:

1. A theory refresher video lesson, including recapping terms;
2. A series of short video lessons with a mathematician solving maths problems at the whiteboard, starting with easy ones before moving on to more complex problems
3. Video-embedded quizzes – a hybrid resource/quiz where the learner needs to try their skills (described next).

4. A self-testing long assignment – a series of 50 maths problems. This task was substantial, and required 2-3 hours to complete. In the case of the novices it could take a whole day, including breaks for reviewing lessons, text-book and/or resources.
5. A final optional assignment task, asking the students to make their own video lesson, inspired by some recent advances in research in maths education (Hoban et al, 2009).

The learning sequence shows scaffolding in action, the first item is teacher demonstrates maths, the last item is student practices maths on their own, and there is a gradual reduction in support by the teacher of the course of the sequence such that the student gets used to doing aspects of the maths on their own until they can do it all on their own.

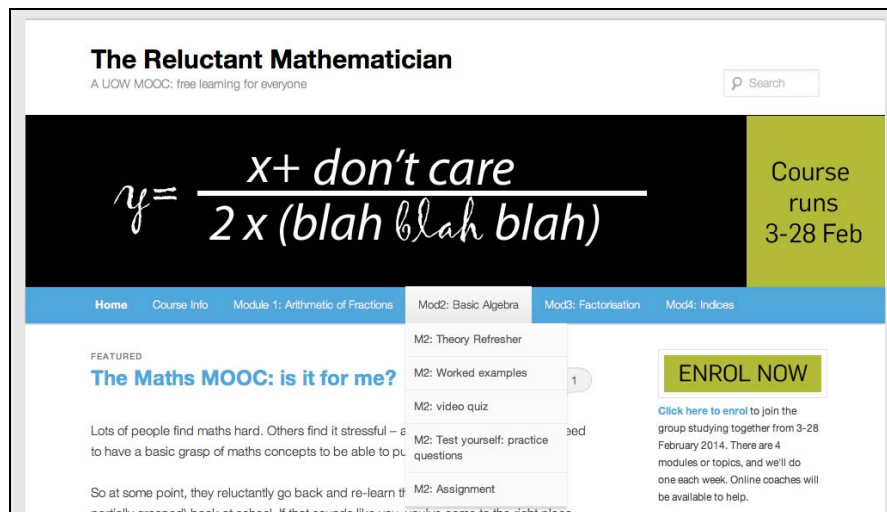


Fig. 1. Original MOOC homepage showing pull-down menu navigation to the items in the learning sequence

Video-embedded quiz

For effective outcomes, online learning experiences must engage the students (Greenagel, 2002). In order to engage students in activities based on their specific skills deficiencies, we developed a series of 3-4 video-embedded quizzes for each of the 4 maths topics. These quizzes allowed for a greater degree of scaffolding and formative feedback than a standard quiz, as follows: videos demonstrated the worked solutions to various maths problems however the demonstration would stop at 3-4 places in the solution sequence, and ask the

student to answer a quiz regarding the particular step in that problem. After the submission of a quiz question, the student would receive feedback as to whether their answer was correct and then the video would continue and demonstrate the correct method of thinking and working out that step, before moving on to the next aspect of the solution item. Each video included around 3-4 quiz “stop points”. This way, the student could test their understanding by completing a quiz question, before the video continued. The videos were rated highly by students in the online form used to collect feedback on students’ satisfaction with the MOOC resources.

Reusing the MOOC

After successfully running the original MOOC, evident in students’ responses and performance (Lambert, Forthcoming), UOW staff were contacted by a university wide email, titled: “Do your students need maths skills to succeed?”, two weeks prior to start of session. All respondees were invited to a meeting to discuss the potential next steps in the evolution of the MOOC to meet stated shortfalls of skills within various classrooms of various different disciplines. Subsequent to interviewing staff, one program was selected within the Faculty of Engineering, with several subjects relying on the maths skills addressed by the MOOC. A single subject “*Workplace Health and Safety*”, was selected for initial re-use within a new Masters’ level subject. Based on multiple discussions with the academics involved, the following elements were highlighted as conducive for this re-use:

- The learning experience was scaffolded. Rather than a teacher-led experience, the MOOC provided a student-paced environment for individual learning and practice.
- The MOOC’s content was modular, therefore allowing teaching staff to select only relevant modules. This was therefore not burdening students with irrelevant tasks.
- The content covered by students was flexible and self-determined. The modular structure of the MOOC enabled students to only engage in learning pathways relevant to them.
- The content was delivered outside of class time, and therefore did not compromise existing subject structure.
- The MOOC applied to a wide range of skill level. Thus, academic did not need to match students to resources, but rather, the MOOC enabled students to improve the skill at the level relevant to them.
- The MOOC addressed learning-related stress and anxiety by providing a private self-paced experience. Students’ practice and learning are conducted privately, with no risks of being judged, shamed, or mocked.
- The MOOC’s delivery was customizable: a subject-related banner and introduction video addressing the specific subject-related cohort was offered to subject coordinators (Fig. 2).

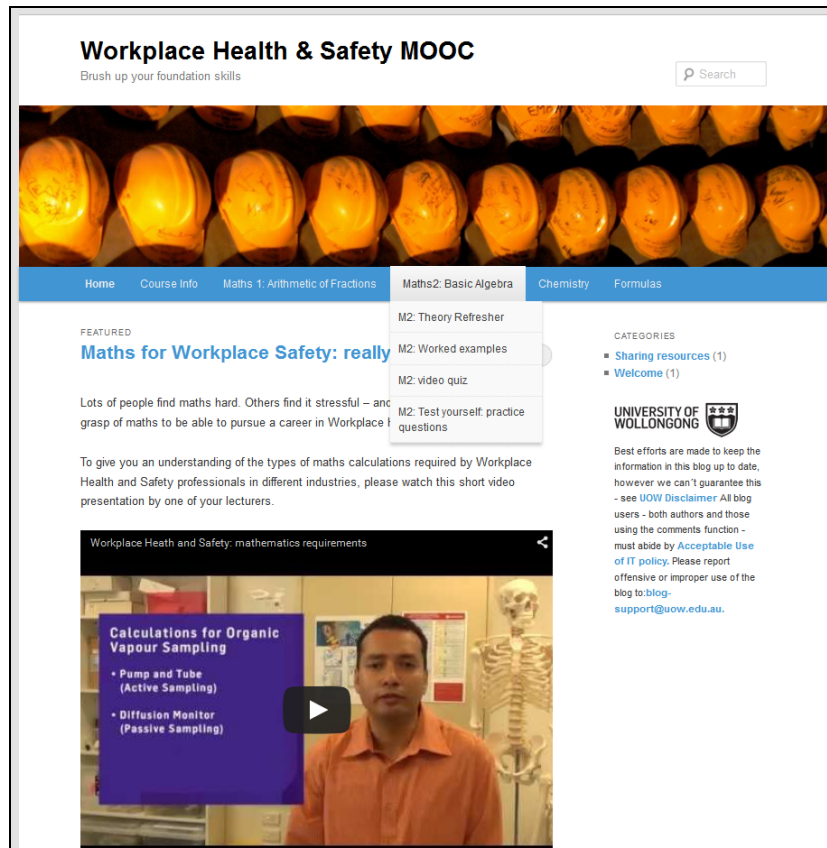


Fig. 2. Re-used MOOC homepage showing pull-down menu navigation to the items in the learning sequence, and a customized welcome video featuring the subject coordinator

In addition to the uptake in the *Workplace Health and Safety* Masters level program, there were expressions of interest in customizing this MOOC for chemistry students.

Proposed framework to guide MOOC re-use

We have summarized the themes that emerged with interviews with the academics involved in this project to develop a proposed framework to guide MOOC re-use in the curriculum, by focusing on key success elements of this reuse are applicable both to teaching staff and to students, as follows:

Teaching staff:

Addressing a pressing need – the need to improve students' maths skills was identified in a consultation process with academics closely involved in

existing attempts to address this need. The School of Mathematics and Applied Statistics has been addressing this need in many other ways over the years, and their familiarity with the needs was essential to the selection of the content.

Low time demands – as most of the content was already prepared and relevant to the teaching staff's needs, teaching staff members were not required to devote a lot of time to the customization or implementation of the component. Minimal customization (banner and welcome video) was sufficient for the initial launch of the components, and future customization of questions forms, to integrate subject-related content (for example, calculating the levels of permitted gas levels as part of the fractions module) was possible and staff from the Learning, Teaching and Curriculum area were able to advise on digital resource development methods that was suitable for staff in the Faculty to do on their own. While that involved the purchase of a licence for the software Camtasia and a graphics tablet (to allow handwritten inputs) the costs were under AU\$500 and the time required to create their own workplace safety based maths calculation video samples was rated as achievable by the staff, to be done a few at a time over time.

Students:

User control – the teaching staff were impressed by the degree of control and self-direction available to students. It was evident that the MOOC provides students with the option of selecting their own content areas, and skill levels to be taught and demonstrated. Indeed, web usage data shows that these features were taken advantage of by most students (Lambert, Forthcoming). Many students first attempted the concluding assignment, before undertaking the full learning sequence, and then selected the content relevant to them.

Scaffolded learning experience – the teaching staff believed that a scaffolded approach would be effective at addressing students' skills deficiencies.

Safe and tailored learning environment – the teaching staff believed that providing students with a private, as well as responsive, learning experience would address students' specific skills deficiencies in a discrete, non-intimidating and stress-reduced environment.

Future research

Examining the effectiveness of the reused modules is the next step. We intend to undertake a pre-post study, evaluating the effect and benefits of these modules on the following:

- Attitudes and perceptions (Anxiety and confidence, Expectations of future usage, and Expectations and prospects of future learning), and
 - Performance in maths (quiz marks);
- Controlling for the following factors:
- Online usage
 - Perceptions of usefulness

In addition, the university will be engaging more academics with this and other MOOCs, as a result of its current success. This engagement will provide further confirmation and refinement for the proposed framework for re-use, as well as establishing the value of MOOCs as aspects of the Hybrid-learning and/or Technology Enhanced Learning approach to Curriculum Transformation.

Furthermore, there is interest in developing a similar MOOC for essay writing skills, as this is another pressing need identified across many teaching disciplines in the university.

Conclusion

The quality and performance of MOOCs worldwide has set a high standard for modern distance education in general and online education in particular. The case study presented here shows how meeting these standards by academic institutions when they address the wider community can produce re-usable resources for the benefit of enrolled students. The case described staff engagement with MOOCs for the purposes of solving particular local problems (maths skills) during a university-wide curriculum transformation process. Re-using MOOC elements within an existing subject served as a useful and informative pilot for the curriculum transformation process, with regard to two major aspects: hybrid learning and technology enriched learning.

In addition, the paper suggested a design framework which is conducive to re-use, and highlights both teaching staff related as well as student related aspects in the design. Teaching staff related aspects involve addressing a pressing and need across a wide range of students, modular content, and customizable delivery presentation. Student related aspects involve student control over content and pace, a scaffolded learning experience, and a learning experience which is at the same time both tailored to individual needs as well as safe, thus reducing anxiety and stress. Further examination of this framework, measuring pre- and post- MOOC usage levels of student performance, anxiety, and stress will inform the framework's generalizability.

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