

## Developing an Online Course: Challenges and Enablers

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Conference Topic: Technology in Learning

### INTRODUCTION

Current innovations in teaching methods and educational technologies, combined with the advent of the Internet, advancement in infrastructure that allows for connectivity at a global level, and developments in open access, have been “leading scholars to rethink the learning environment for students at MIT and around the world” [1]. Technology now allows professors to transfer even more information outside the classroom enabling them to flip their classroom and use in-class time in a different manner. Building on these trends, MIT established the Office of Digital Learning (ODL) in 2012. The mission of the ODL is to help the MIT community lead the world in education by creating, using and leveraging learning technologies and digital instructional content [1]. MITx is a constituent organization of ODL, aiming to support development of MIT-quality online courses, and to further the understanding of best practices in digital learning [2]. Some of the online courses developed by MITx have been designed as Massive Online Open Courses (MOOCs) offered to a global audience, while others are still only used within MIT to enhance residential education.

Through the end of 2013, MITx had already collaborated with numerous groups of MIT faculty, staff and students and as a result 15 MOOCs were offered globally through the EdX platform and 23 online courses were designed in order to be offered at a residential level at MIT within the flipped-classroom framework. Although the flipped, otherwise also called inverted, classroom model is not as new as the MOOC classroom, both the flipped classroom and especially the MOOC model, are practices that call for new approaches when it comes to curriculum development and classroom implementation. While some limited work has already been done on understanding how groups of scholars or individuals work in order to prepare such courses, no systematic state of the art process has been identified yet. On the contrary people usually appear to be following a trial and error approach.

Through this study we hope to understand the process the MIT faculty members and their teams went through while developing their online courses through MITx and identify enablers and challenges.

## **1 THE PEDAGOGY MODELS**

### **1.1 The flipped classroom**

The inverted, or otherwise called the flipped classroom, is a classroom where “events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa” [3] usually, but not always, with the help of technology. In most cases instructors would offer to their students some preparation material online before the class takes place, such as readings or videos-on-demand presenting parts of lectures, simulations, or would even pose questions to the students that would later on be discussed in class. Then they spend the in-class time engaging their students in group learning, active learning, laboratories and hands-on projects. [3-5]. Through this model, students have the chance to take their time at home, listen to the preparation lectures or go through the material at their own pace, reverse the videos and watch it as many times they want, reflect, and then come to class ready to pose and discuss some deeper questions and work with their peers to internalise the material. This way “the end result can be a classroom that is more inclusive, more active, and more learner-centered than the traditional classroom” [6]

### **1.2 The Massive Open Online Course - MOOC**

The advent of the Internet, development of new technologies, and need for global mobility, have resulted to the quest and the development of new teaching styles “both from the pedagogical and technical point of view” [7]. Massive Open Online Courses (MOOCs) seem to be providing an answer to this quest. According to Mc Auley et al “an online phenomenon gathering momentum over the past two years or so, a MOOC integrates the connectivity of social networking, the facilitation of an acknowledged expert in a field of study, and a collection of freely accessible online resources.” [8] Participants in a MOOC may vary from a few dozen to thousands of students. These massive numbers call for a completely different course development process, instructional pedagogy and course assessment model. Furthermore the fact that MOOCs are courses that run around the clock to serve students all-over the world does not provide so much space for clarifications and corrections on-the-go in comparison to a small -scale traditional course. Therefore painstaking attention is necessary through the course design process to prevent mistakes or issues that might lead to miscommunication later on, when the class will be offered to a global audience.

## **2 PURPOSE OF THE STUDY AND RESEARCH QUESTIONS**

Although the number of instructors that decided to either flip their existing traditional classroom or develop and deliver a MOOC rapidly increased over the last few years, a state of the art process to develop such educational material or full courses does not seem to have been established yet. In this study the author is attempting to study some of the first groups that collaborated with MITX and the ODL at MIT in the first two years of its existence.

The research questions explored in this paper are:

1. What was the process a team followed in order to complete the development of the online course?
2. What factors have enabled the teams during this task and what were challenges the teams had to face?

## **3 METHODOLOGY**

### **3.1 Population**

People recruited to participate in this study have been MIT faculty, students and staff who have collaborated with MITX and the ODL and developed courses during 2012 and 2013. One additional group of people working on an additional course that was completed in May 2014 was also recruited to participate in the study. The last course has now been developed, but has not yet been taught, as it is planned to be offered in Fall 2014.

### 3.2 Data Collection

Data collected included an online questionnaire containing both structured and open-ended questions. Furthermore participants were invited to participate in a videotaped interview session. Ten participants responded to the online questionnaires, representing 8 different courses. In addition to the questionnaires 2 faculty members and one graduate student participated in 30 – 60 min long interview sessions discussing the course development process.

### 3.3 Data Analysis

Mixed methods were used to analyse the data. Frequencies were counted in the cases of structured questions, while a general inductive approach [9] using qualitative open-coding analysis method was used to analyse the open-ended questions and the interviews. “The primary purpose of the inductive approach is to allow research findings to emerge from the frequent, dominant, or significant themes inherent in raw data, without the restraints imposed by structured methodologies” [9]

## 4 FINDINGS

Tables 1, 2 and 3 describe the population that participated in the study as well as their involvement with the courses, while Tables 4 - 7 present information regarding the courses developed by the participants. Results presented in Tables 1 to 7 stem out of the participants’ responses to the online questionnaires

*Table 1. Profile of MOOC developers and instructors*

Faculty	Staff	Students
3	5	2

*Table 2. Type of involvement in the online course*

Course Developer	Course Instructor	Both
4	2	4

*Table 3. Prior experience with online courses*

Yes (as a student )	No	Did not respond
1	8	1

*Table 4. Field of the online course*

Science	Technology/Engineering	Math
1	3	4

*Table 5. Level of online course*

Undergraduate	Graduate
5	3

*Table 6. Setting where the online course has or will be offered*

Offered only residentially at MIT	Offered residentially at MIT and to a global audience as a MOOC through the EdX platform
5	3

*Table 7. Timing of online course development*

While the course was offered	Prior to the course being offered
6	2

When discussing the process followed by the developers, through the online questionnaires as well as the individual interviews it appears that the 7 courses were developed by a team of faculty, staff (postdoctoral associates or research scholars) and students while one course was developed by a single faculty member. Furthermore pre-existing materials were used for the development of the 7 courses while one team designed one course completely from scratch.

In regards to the process followed in all courses the developers appeared to first decide on the syllabus and the pedagogy, then gather or develop the materials to be used in the course along with the problem sets to be used, and as a last step they placed the material on the web. In cases where the course was offered while it was being developed it appears that, after the syllabus has been decided, development and upload of the course materials was taking place on a weekly basis.

Table 8 presents factors that appeared to have helped the groups through the development process of the course. Table 9 presents challenges the developers faced, while Table 10 presents additional challenges that groups faced in the cases where they were designing the course as it was offered online.

*Table 8. Factors facilitating the online course development process*

Time	<ul style="list-style-type: none"> <li>Developing the whole course prior to be offered</li> <li>Good time management within group</li> </ul>
Course content	<ul style="list-style-type: none"> <li>Having pre-existing syllabus/materials</li> <li>Being able to use the MIT Open Courseware material</li> </ul>
Technical issues	<ul style="list-style-type: none"> <li>Support provided by the MITX or via communication with the EdX platform developers</li> <li>The ability to code in Python and having the chance to add extra features to the platform to support additional assessment tools needed for the course</li> </ul>
Testing materials	<ul style="list-style-type: none"> <li>Using assigned MIT students to watch the online content or to solve the online problem sets developed before they are officially offered to the enrolled students</li> </ul>
Pre-preparation	<ul style="list-style-type: none"> <li>Having been enrolled and having completed a similar EdX course as a student before developing the MITX course</li> </ul>

Sharing experience	<ul style="list-style-type: none"> <li>• Talking to other MITx users/ course developers</li> <li>• Attending relevant MITX sessions</li> </ul>
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*Table 9. Challenges appearing during the online course development process*

Time	<ul style="list-style-type: none"> <li>• Miscalculated time needed to digitize content</li> <li>• Miscalculated time needed to upload content to the EdX platform</li> <li>• Time management within group</li> </ul>
Documentation	<ul style="list-style-type: none"> <li>• Not sufficient/clear documentation on how to add content to the EdX platform</li> <li>• Latex2to EdX not clearly documented</li> </ul>
Technical support/Video production	<ul style="list-style-type: none"> <li>• No prior experience in video producing or video editing within the group</li> <li>• Pre-existing videos were too long and the group was unable to create smaller segments of meaningful videos</li> </ul>
Changes in Pedagogy/Course content	<ul style="list-style-type: none"> <li>• Having to change problem sets/ homework as the assessment tool required was not supported by the EdX platform.</li> <li>• Realizing that the platform would allow for more/different assessment options after the course was already completed</li> <li>• Peer assessment is very difficult to implement</li> </ul>
Pre-preparation	<ul style="list-style-type: none"> <li>• Not having prior experience</li> </ul>
Team work	<ul style="list-style-type: none"> <li>• Poor team communication</li> <li>• Lack of understanding each others tasks and time constraints</li> </ul>

*Table 10. Additional challenges appearing to groups developing the online course development while it was offered*

Time	<ul style="list-style-type: none"> <li>• Insufficient time for debugging in case of an error</li> <li>• Insufficient time to digitize/post materials</li> </ul>
Team work	<ul style="list-style-type: none"> <li>• Lack of understanding each others tasks and time constraints so some people had to work overnight frequently</li> </ul>
Feedback from students	<ul style="list-style-type: none"> <li>• In case of a mistake on materials posted online feedback from enrolled students is immediate and massive</li> </ul>

When asked about their level of satisfaction and on whether the developers think their expectations were met, 7 of them responded that their expectations were met and that they would participate in the development of another course, 2 mentioned that they would like to do it again but have more time, and 1 participant mentioned that his or her expectations were not met.

Furthermore all developers stated they would recommend this experience to colleagues. Reasons supporting this decision were that a) MOOCs may be the educational model of the future, b) this is an opportunity for instructors to restructure and possibly flip their residential course, c) this is an opportunity for instructors and their team members to reflect on their course, d) this has been proven to be a great learning experience for the team. One participant also added that this experience might be more appropriate for a senior faculty member rather than for a junior faculty member with less experience on the course to be developed.

## 5 DISCUSSION

Exploring the course development process regarding online courses it becomes apparent that although facilitating factors as well as challenges resemble the ones that are usually encountered when developing a traditional course, new ones are also there to be considered.

When discussing factors that would enable the group while developing an online course, in particular a MOOC, the first thing to take under consideration is the lack of experience among most of the developers. Therefore establishing a community, setting up relevant forums, organizing sessions where people can exchange their experiences and offer advice, and enabling and promoting communication between developers of various online courses is absolutely crucial. In addition to that, getting registered in a MOOC and following a course prior to developing one appears to provide a more holistic perspective to the developers, as this allows them to better familiarize themselves with the platform as well as to experience the course from their future students' perspective.

Due to the particular nature of the online courses, it becomes obvious very quickly how the pedagogy and the content may sometimes be driven by the technology that will be used, either when it comes to the digital tools that the group will use to develop the educational materials, or when it comes to restrictions imposed by the platform that will be used to host a course. Therefore it might be more efficient for the group of developers to first explore the technological tools available, to understand the groups abilities either to use the existing tools or to program and create new ones and only then to engage in designing the educational material, to develop problem sets and to decide what the assessment type will be.

Restrictions posed by technology undoubtedly lead scholars to pose the question of whether teaching a course online would be the most appropriate teaching strategy. Are the existing tools allowing for the appropriate assessment? Instructors and institutions are now definitely able to reach out to a bigger pool of students, but can they take the most advantage of it or does pedagogy get sacrificed for the sake of quantity and efficiency? When examining the developers' responses in this study, all but one mention that their expectations from the class were met at the end. However, it should definitely be noted that all courses developed and examined in this study were courses in a Science, Technology, Engineering or Math (STEM) field and it can be argued that STEM courses by nature may be better served by digital assessment tools in comparison to humanities and social sciences (HASS) courses, where assessment is usually based on paper writing, discussions, and work is analysed qualitatively.

## 6 FUTURE WORK

While this study only examined STEM courses developed at the time that MITX was still in its infancy, it is understood that more courses representing more disciplines are already developed and offered either residentially at MIT or as MOOCs. At the same time the EdX platform, as well as other tools used by instructors and their teams to develop and host the courses are also constantly updated to better serve the educational community. Therefore it is of great value for the educational community to understand if and how the flipped classroom and the MOOC pedagogy and assessment models continue to get driven by technology, and what new models of pedagogy and assessment may have already become available as technology gets updated.

In regards to working processes it is also crucial to understand what would be an efficient model for instructors to work together and provide the appropriate feedback to the software engineers, while at the same time it is imperative to understand how digital tools and the various features offered by the hosting platforms can be better documented and communicated to the instructors and course developers.

Furthermore studying courses that belong to non-STEM fields to understand whether the process in this case is different can enhance this work.

## 7 ACKNOWLEDGEMENTS

The author would like to thank the MITX, the ODL, and the MIT-SUTD Collaboration office for supporting this work.

## REFERENCES

- [1] MIT Office of Digital Learning (2013), MIT Office of Digital Learning. Retrieved from [odl.mit.edu](http://odl.mit.edu) on May 8<sup>th</sup> 2014
- [2] MIT Office of Digital Learning (2013), MITx. Retrieved from <http://odl.mit.edu/mitx/> on May 8<sup>th</sup> 2014
- [3] Lage, M. J., Platt, G. J. and Treglia, M. (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. *Journal of Economic Education* Vol 31 (Winter), pp.30-43.
- [4] Gannod, G. C. (2007). Using podcasting in an inverted classroom. Work in Progress Paper presented at the 37<sup>th</sup> ASEE/IEEE Annual Frontiers in Education Conference, Oct 10-13, Milwaukee, WI.
- [5] Papadopoulos, C., Santiago-Roman, A., Portela, G. (2010), Developing and Implementing an Inverted Classroom for Engineering Statics. Work in progress Paper presented at the 40<sup>th</sup> ASEE/IEEE Annual Frontiers in Education Conference, Oct 27-30, Washington DC.
- [6] Talbert, R., (2012), Inverted Classroom. *Colleagues* Vol 9 (1), Article 7 pp 1-3
- [7] Waard, I., Koutropoulos, A., Keskin, N. O., Abajian, S. C., Hogue, R., Osvaldo Rodriguez, C., Gallagher, M. S., (2011), Exploring the MOOC format as a pedagogical approach for mLearning, Proceedings of 10<sup>th</sup> World Conference on Mobile and Contextual Learning. Oct 18-21, Beijing, China
- [8] McAuley, A., Stewart, B., Siemens, G., Cormier, D. (2010). The MOOC Model for Digital Practice. Retrieved from [http://www.elearnspace.org/Articles/MOOC\\_Final.pdf](http://www.elearnspace.org/Articles/MOOC_Final.pdf). On May 8<sup>th</sup> 2014
- [9] Thomas, D. R. (2003). A general inductive approach for qualitative data analysis. School of Population Health, University of Auckland, New Zealand. Accessed on 21 January 2013 at [http://www.fmhs.auckland.ac.nz/soph/centres/hrmas/\\_docs/Inductive2003.pdf](http://www.fmhs.auckland.ac.nz/soph/centres/hrmas/_docs/Inductive2003.pdf)