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

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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 (Del-
gado 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.

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 invests 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

<table>
<thead>
<tr>
<th>Required infrastructure</th>
<th>Teaching and learning benefits</th>
<th>Students’ Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• MOOC studio rooms</td>
<td>• Teachers’ satisfaction</td>
<td>• Course enrollment</td>
</tr>
<tr>
<td>• MOOC production equipment</td>
<td>• Learning expectations</td>
<td>• Demographics</td>
</tr>
<tr>
<td>• Tutoring rooms</td>
<td>• Teaching expectations</td>
<td>• Online participation</td>
</tr>
<tr>
<td>• Technology labs</td>
<td>• Students’ satisfaction</td>
<td>• Students’ interaction patterns</td>
</tr>
<tr>
<td></td>
<td>• Perceived learning</td>
<td>• Retention and attrition</td>
</tr>
<tr>
<td></td>
<td>• Students’ self-efficacy</td>
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</table>

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.

<table>
<thead>
<tr>
<th>Metric Dimension</th>
<th>Metric</th>
<th>MOOC as a Service</th>
<th>MOOC as a Replacement</th>
<th>MOOC as Added value</th>
<th>MOOC as a Driver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum alignment</td>
<td>Number of students’ credits</td>
<td>Not applies</td>
<td></td>
<td>Not applies</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Faculty qualifications</td>
<td>**</td>
<td>**</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td></td>
<td>Learning gains</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Students’ achievement</td>
<td>*</td>
<td>**</td>
<td>*</td>
<td>**</td>
</tr>
<tr>
<td>Institutional effort</td>
<td>Tutoring time</td>
<td>**</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use of support services</td>
<td>**</td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Planning and teaching time</td>
<td>*</td>
<td></td>
<td></td>
<td>**</td>
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<td></td>
<td>Material course development</td>
<td>*</td>
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</table>

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.

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.
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