

MOOCs - From Theory to Practice: The Technology Upheaval

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Abstract: Over the past few years, Massively Open Online Courses (MOOCs) has been supplementing class room learning by renowned Professors worldwide, allowing students to have their doubts clarified and by providing different perspective of topics from several traditional subjects at the comfort of their desk. MOOCs has several objectives that include being open, participatory and distributary. The extent to which these objectives are reached is debatable. While resources are aplenty, thanks to the vision of the pioneers in education like the Cambridge, MIT and the Stanford University willing to open their gates to the world, proper direction, training and engagement are still required for most of the stakeholders to ensure effective utilization. Further, with the learning requirements having shifted from theory to practice, MOOCs has certainly taken a new direction. This of course is not without its own challenges. In this paper, we identify various challenges in present day MOOCs and the suggested countermeasures. While some of these have been identified recently, few more are based on our own practical experiences.

A survey is also conducted to summarize learner's preferences, their willingness to adapt to new courses and their preparedness to deliver their own MOOCs courses. Results indicate that most learners prefer mixed courses that are a combination of Theory and Practice. Almost equal number of learners expressed interest in Industry relevant courses as those for Curriculum related courses. However, the preparedness of users in creating and delivering their own MOOCs courses is quite low, although vast majority are using MOOCs courses for their curriculum design, which is encouraging. We also suggest few methods and tools to enable teachers develop their own MOOC Courses.

Keywords: MOOCs, Curriculum delivery, Industry relevant courses

1. Introduction and Motivation

The huge popularity of MOOCs is because of the flexibility it offers, particularly to part time students in Institutions who would not be able to attend classes in fixed timings [1].

Characteristics of the MOOCs can be described as being open, participatory and distributary where the learners also involve in research, discussions and are contributors to knowledge [2]. Among the most popular MOOCs providers are Udacity, Courseera, edX, Open2Study, FutureLearn [3]. Such students can access the class lectures recorded and compiled as a MOOC. These MOOCs courses also serve as

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invaluable reference to teachers, particularly those who are teaching it for the first time. The graphic below by the Forbes shows the distribution of more than 4,200 MOOCs courses by various subjects as on Jan 2016.

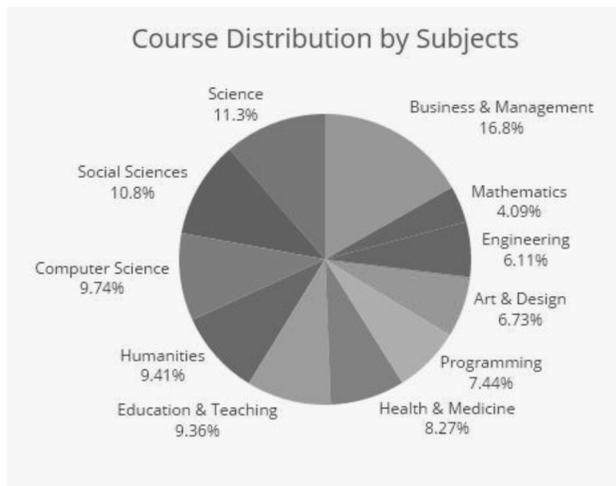


Fig. 1 MOOCs distribution by Subject

Although several MOOC Courses already exist as is obvious, Teachers still struggle to organize, assimilate and then disseminate the content. Webinars play a major role in facilitating teachers with this job. IUCEE was a pioneer in Webinars, offering several mini courses in evolving fields at that time such as Datamining, Network Security, Sustainable energy systems to name a few. These have been offered as a paid service with certification to Constituent Institutions in India and have been highly popular with faculty handling these courses or doing research. For a Teacher, beyond a shade of doubt, these resources have been helpful for preparation and incorporation in their classroom lectures. Also a recent Paradigm of Blended classroom learning with MOOCs was introduced, allowing teachers to integrate MOOCs as part of their curriculum. The Flipped Classroom model introduced in 2012 suggests reversing the regular classroom learning activities with group based and other active learning strategies beyond classroom [4]. The out of class activities could be supported by MOOCs.

While these methods of learning were in existence for almost a decade, something unforeseen has happened. There was a sudden Technology upheaval in the past five years, the Industries expectations have raised higher and the focus started shifting from

theory to practice. In Computer Science and Engineering, 4G Technologies have replaced the 3G technologies, the databases are replaced by Data warehouses, Big Data analytics have taken over Datamining, Mobile technologies have gained focus while existing Web Technologies have discovered a complete new dimension in the form of rich, dynamic, interactive web pages that improved the user experience beyond comparison. Even in other traditional disciplines like the Civil and Mechanical Engineering, tremendous advances were seen particularly in the areas of Machine design, Construction to name a few.

These changes led to the need to apply Computer Science to solve complex Engineering problems ever more than it once was. The gap between Industry requirements and academic offerings was suddenly narrowed down, creating a challenge to both the teachers and the learners. Learners who adapted themselves to a 'leisure but thorough' style of learning, confining themselves to the depth of specific subjects rather than to the width of courses catering to Industrial requirements find the change even threatening and difficult to deal with.

2. Practical MOOCs

Luckily, the benefits of online practical orientation were realized much earlier than one might expect in the form of Virtual labs introduced in 1996. These labs give an experience to teachers and students alike to practice and conduct experiments which otherwise would have required costly resources and personal presence. These were further strengthened by the open source initiative founded in 1998 which has made it possible today for any user to access the most advanced software at the comfort of their home desktop or laptop for free. Today, more than 100,000 students are using these online labs under the Virtual Labs project. It is stated that while the average student gain factor is 80, the average economy gain factor is 25 [5].

An Interesting fact is that IUCEE may be seen as the first to offer a complete online webinar based practical course with certification on Low power VLSI Design in 2013, where enrolled learners were supplied with Kits and Professor Alen Rux delivered instructions online. IUCEE of course has also been planning for Virtual Labs in collaboration with the International Association of Online Engineering (IAOE) and has been in parallel making

commendable effort in promoting MOOCs. SkyFi labs have been offering practical certification courses with the IUCEEs support, although for a nominal cost.

The most significant development in recent times is the Industry oriented courses in recent technologies offered in the form of MOOCs. It is really amazing to see the transition of Professors from reputed Institutions from teaching conventional courses to Industry relevant courses and adapting so well to the current trends in Industry. The best part is that the learner has the option to enrol free for these courses and do an optional certification at a throw away price as in the NPTEL,edX or Courseera.

3. Challenges and Solutions

The biggest and common concern in many works concerned with MOOCs has been the student attention. Unlike traditional face to face learning where a teacher can focus on a limited group of students, in MOOCs, the instructor has to deal with all enrolled students, clearing their doubts through posts, evaluating their submissions and has little scope for personal interactions or to look into improvement of the learners. This concern was addressed by appointing a team of associate faculty who could help the tutor with evaluation and handling queries. In [6], the authors suggest an innovative method for enhancing MOOCs discussion forums based on improved search for any topic using Datamining techniques. Creative Problem Skills (CPS) is a technique that improves user involvement and engagement and can be accomplished through knowledge sharing using online tools such as discussion boards, chat rooms, electronic rooms etc.,[7]. The discussion boards and open communication platform create opportunity for naïve and immature learners to post unwarranted messages, sometimes even venting out their frustration on the course teacher. This may have a detrimental effect on the entire learning process. Strict measures are required to identify and punish such abusers. Student dropout rate is another problem, solution to which has been proposed by Gené, Núñez and Blanco [8]. They have proposed a gamification model that encourages students to use the attractive and addictive elements in a game environment to complete the given course. Another challenge in case of programming courses is the method of evaluation on a large scale. Thomas Staubitz et al., in [9] suggest interesting strategies for the framing and automated assessment of Programming exercises. Another challenge is the

length of the video and the assimilation capacity of the learners. In [1], authors suggest that students prefer shorter videos of six to nine minutes duration that explain specific topics rather than a single video with multiple topics.

A severe deterrent to the System is creation of own groups by users and communication by e-mail to share assignments and submissions. Strict user anonymity is to be maintained while enrolling them for courses. An excellent solution offered by the NPTEL in recent times is to keep the internal evaluation separate from the external examination which is proctored and held at specific test centres. It is also a very good idea that for many courses, the internal evaluation is only for a candidate to assess his learning and is not a strict prerequisite for the examination.

Even though MOOCs is certainly kicking off and is likely to be adopted in curriculum by most Universities and Institutions of many countries in the years to come, there are certainly some issues to address: a) Improving the user experience b) Increasing learner involvement through online group activities c) Flexible examination and evaluation based on different user learning styles and preferences and d) Specifying policies to prevent unnecessary and unconstructive messages. In [10], authors suggest assigning different activities to different users based on their preferences and assessment and also mapping varying levels of content to different objectives. This will certainly lead to a better and thorough evaluation of the candidate. Self-evaluation, peer review are other suggested methods, although still not actively implemented. The varying ages and levels of experience of learners might cause serious doubts on accuracy of evaluation. In [11], authors propose an automated Peer Assessment System [PAS] that uses the original Mail-based Randomized Double-Blinded Peer-assessment System, which is very useful to review programming assignments in particular and could be integrated with MOOCs. Authors in [12] examine a very interesting aspect of correlating the pattern of user clickstreams to his performance in quizzes on that topic. This information allows Models of quiz performance to be designed and also pre-assess the shortcoming of the particular student to take measures to prevent attrition.

4. Short Survey and Conclusion

In order to gauge learner's interest and preferences in online learning, a Questionnaire was prepared and

circulated among large group of Faculty (more than 200) of the Institution of varying levels of experience. Questions included:

- 1) Did you register/complete any MOOCs course in the past two years? :
- 2) If yes, how many? :
- 3) No. of certifications :
- 4) Specify the platform (edx, coursera, udacity etc.) :
- 5) Is it related to curriculum/beyond curriculum? :
- 6) Nature of the course - Practical/ Theoretical / mixed/general :
- 7) If you consider enrolling for future courses, which do you prefer - Practical/Theory/mixed/general :
- 8) If Practical, which type of course do you prefer? - Industry oriented/ Curriculum oriented :
- 9) What are two challenges you faced when doing the course? :
- 10) Do you prefer workshop based training / MOOCs? :
- 11) Have you attended any webinar courses? :
- 12) If yes how many? :
- 13) No. of certifications :
- 14) Which do you prefer, Live Webinars/ MOOCs? :
- 15) Do you use MOOCs in your classroom instruction delivery? :
- 16) Do you use MOOCs for preparation? :
- 17) Do you plan to create a MOOCs course in future? :
- 18) Do you plan to deliver a webinar in future? :

The table below shows a partial view of the Survey results.

For question 7, 64.7% of the respondents indicated 'mixed', indicating they prefer courses that are a

Table 1. Partial view of survey results

i	ii	iii	iv	v	vi	vii	viii	ix	x	xi	xii	xiii	xiv	xv	xvi	xvii	xviii
YES	2	2	Courseera	BC	Gen	Mixed	Both	None	Both	IUCEE	2	1	Both	Not	Not	Yes	Yes
Register ed	2	Not Yet	Udacity, NPTEL	C	Mixed	Mixed	Both	Doing practical work, time management	Both	Yes	2	0	Both	Not	Not	Yes	Yes
YES	1	1	Courseera	BC	Practical	Mixed	Industry Oriented	None	Workshop based	No	0	0	MOOCs	No	Yes	No	No
YES	3	1	Courseera	BC	Mixed	Mixed	Industry Oriented	Time management	Both	Yes	1	1	Webinars	Yes	Yes	Yes	Yes
								Prerequisite Subject Knowledge, Meeting assignment deadlines									
YES	2	1	NPTEL	C	Mixed	Mixed	Curriculum Oriented	Meeting assignment deadlines	Workshop based	No	0	0	MOOCs	No	Yes	No	No
YES	2	Not Yet	Courseera, NPTEL	Both	Mixed	Mixed	Industry Oriented	Meeting assignment deadlines	Both	No	0	0	MOOCs	Yes	Yes	No	No
Yes	2	0	Courseera, NPTEL	C	Theoretical	Mixed	Curriculum Oriented	Deadlines	MooCs	No	No	0	MOOCs	No	Yes	No	No
Yes	2	1	Allison	C	Mixed	Mixed	Industry Oriented	Transition to online learning	MooCs	Yes	1	0	Both	No	Not	Not	No
YES	3	1	Courseera, NPTEL,edx	C	Mixed	Mixed	Industry Oriented	Meeting assignment deadlines	MooCs	No	0	0	MOOCs	No	Yes	Yes	Yes
YES	1	1	Courseera	BC	Mixed	Practical	Curriculum Oriented	Meeting assignment deadlines	Workshop based	Yes	1	0	MOOCs	Yes	Yes	No	Yes
YES	8	2	Courseera, edx	C	Mixed	Theoretical	Curriculum Oriented	None	MooCs	Yes	2	1	MOOCs	No	Yes	No	No
YES	3	2	Courseera	BC	Mixed	Theoretical	Industry Oriented	None	Both	No	0	0	MOOCs	No	No	No	No
YES	2	Not Yet	NPTEL	B	Theoretical	Theoretical	Industry Oriented	Meeting assignment deadlines	Workshop based	No	0	0	Both	Yes	Yes	Yes	Yes
YES	2	0	edx, NPTEL	C	Practical	Mixed	Curriculum Oriented	Meeting assignment deadlines	Workshop based	No	0	0	MOOCs	No	Yes	No	No
YES	0		Courseera, NPTEL	Both	Theoretical	Mixed	Industry Oriented	Assignment due dates, balancing academic work	MooCs	No	0	0	MOOCs	Yes	Yes	Yes	No
YES	2	2	Courseera	Both	Practical	Practical	Industry Oriented	Time management	MooCs	Yes	1	1	MOOCs	Yes	Yes	No	No
YES	2	1	Courseera, NPTEL	BC	Theoretical	Practical	Curriculum Oriented	None	MooCs	Yes	2	0	MOOCs	No	No	Yes	No

mixture of theory and practice. 23.5% indicated Practical while 17.6% have chosen Theory only courses. Response to question 6 indicates these candidates have earlier taken theoretical courses in majority. 52.9% chose Industry oriented course while 41.1% have chosen Curriculum oriented courses, indicating that Industry oriented courses are slightly preferable. 52.9 % indicated that they faced challenges with assignment submission deadlines, 29.4% reported no problems. Interestingly, very few others mentioned overall time management as a challenge.

When asked to choose between face to face workshop training programs and online MOOCs, 41.2% chose MOOCs 29.4% preferred Workshop training, another 29.4 % preferred both. 41.1% of the respondents have attended webinars earlier and a whopping 70.5 % have voted in favour of MOOCs against live Webinars. Both approaches have their pros and cons. While MOOCs allows learner to see the Teacher delivering lecture on Screen, it has fewer options for the Teacher to control his screen. Also this would mean some means of recording the lecture (preferable in HD) would be required. Webinars on other hand do not require screen presence of the

Teacher, consume lesser bandwidth and offer complete screen control with many options to the presenter. Again, MOOCs tools offer better options for online exams and assignments.

Both methods allow users to access the recorded lectures at a later stage, although Webinar organizers expect at least minimum audience online to justify the 'cost per reserved seat'. MOOCs would count on the number of enrolments and user visit frequency in the duration of the course.

76.4% claim using MOOCs for curriculum design while only 23.6 % are using it for curriculum delivery.

When asked about future interest in creating MOOCs 35.2% of respondents responded positively. The percentage was same for Webinars. Course Builder by Google, Open MOOC are free tools that are suggested for a beginner to design a MOOC course while anymeeting, gotomeeting are tools that can be freely used to deliver Webinars with some restrictions. Developers need to be aware of Copyright issues and request for permissions from the Copyright owner if they are to use material already shared in MOOC [13]. Developers are free to use material from Public Domain. The other alternative authors suggest is to use material under General License terms that includes Create Common (CC) license or the GNU Lesser General Public License (LGPL).

While it is true that the same learning style does not suite all courses, some guidelines could be applied to similar categories of courses to make them more interesting and sustainable. User response indicates that they are interested in courses that combine theory and case studies relevant to Industry. Also they occasionally do not want to miss the human interaction component and confine themselves completely to online learning. An accurate feedback system might in fact reveal learners preferences for each of the course categories in a subject and dynamic models can be built to accommodate changing preferences with time.

In [14], authors classify Learners into six categories-Vocational Learners, Educators and Researchers, Higher education students, Hobby Learners and Prospective students. Authors also confirm that Hobby Learners generally form the largest group. Further work can be carried out to map these user attributes to their preferences and design the courses accordingly. For example, a large Group

of hobby listeners may prefer shorter videos and easier quizzes when compared to a group with more Educators and Researchers, whose focus would be on 'learning to teach' and may prefer comprehensive videos with moderately difficult quizzes and a few case studies.

Vocational Learners on the other extreme prefer quizzes to be more competent and the videos to focus on building applications rather than just preach theory. This argument is validated by our survey that consisted of Educators and Researchers, majority of who preferred mixed courses.

In this paper, we elaborated on several challenges faced by the MOOCs, solutions to some of which have already been proposed while some are yet to be. Survival of MOOCs is essential for every learner, be it an occasional learner or a serious one. It is difficult to imagine MOOCs shutting down its doors on learners, may be gradually though not suddenly due to the indifferent, unaccountable attitude of learners. People will have to travel places, spend huge amounts to learn courses and on certifications that are offered for free at the comfort of their door step.

It is time for Industry also to realize the importance of MOOCs in bridging the Academy-Industry gap and start valuing the MOOCs certifications more seriously. In fact, they might consider making at least few MOOCs courses a prerequisite for campus recruitment. On the other hand, institutions can consider enabling every experienced teacher to develop at least one MOOCs course to help them focus on the advanced learning aspects and research on specific topics. Also, it would provide a blended learning experience to learners, helping them revisit a particular topic several times if required, which is not practically possible in the classroom environment.

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