

Massively Empowered Classrooms

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Introduction

MOOCs (Massively Online Open Courses) have taken the world by storm. They enable the best teachers at top universities to reach a global student audience and democratize education. While MOOCs have received enrollments from motivated self-learners worldwide, institutional adoption of MOOCs has been slow. This may be mainly due to lack of any role for teachers in the adopting institution. We propose an alternate model called **MECs (Massively Empowered Classrooms)**, which retains the benefit of massive online collaboration during learning, while empowering teachers in adopting institutions.

Our motivation for MECs came from talking with educators in India, where there is a great disparity in the quality of education, and difficulties associated with scale. We focus on undergraduate engineering education in India as our main scenario, and speculate on applications and other parts of the world towards the end of this document.

Undergraduate Engineering Education in India

Outside of the IITs, national institutes of technology, BITS, IIITs, and deemed/autonomous universities, almost every state in India has a *big* university with several hundred colleges. For example Visvesvaraya Technological University (VTU) in Karnataka has about 208 colleges, and Anna University in Tamil Nadu has around 500 colleges. The huge numbers of students in these universities presents serious challenges: it is very hard to find adequate numbers of well trained, qualified faculty, and colleges struggle to provide adequate infrastructure for a well-rounded learning experience. This results in a situation where colleges are at different levels in terms of the quality of education, as well as the infrastructure they offer their students. They form a “pyramid” under different parameters, and as could be expected, there are several challenges in the middle and bottom of this pyramid.

- Serious shortage in quantity and quality of teachers: Most faculty do not have PhDs and many have just finished a BE or ME degree recently and may not have adequate teaching experience.
- Evaluation system: The university conducts exams simultaneously across all colleges under their purview. Grades for each course are divided into two parts: 1) an internal assessment done in the college accounts for 20-25% of the grade; and 2) a university-wide exam conducted synchronously across all the colleges with the same question paper. The university manages all the administration and grading of this exam. Since the same exam is administered to students at every level in the pyramid, it is challenging to adequately test students’ understanding of the subject; exams catering to students at the top of the pyramid are likely to be outrageously difficult for those from the bottom. Also, a relatively small number of evaluators have to assess a very large number of answer papers, resulting in shortcomings in the evaluation process.
- Unmotivated students: Students want to do just enough work to clear the exams and get a job. Due to high demand from the industry, even students who haven’t mastered subjects are employed and learn job skills during their first year in on-the job training programs.

Downward spiral: The combination of the above three issues has created the following negative feedback loop.

- Teachers get demotivated because they are in an environment where there are neither avenues for collaborative efforts, nor rewards for competitive performance. Students are not keen on learning since they only want to do enough to pass their courses and get a job.
- Industry hires students who have basic raw smarts, and trains them on the job.
- Students get demotivated because their peer group constantly reinforces that getting a job and being successful has nothing to do with learning course material. Neither the industry nor academia has demonstrated that learning in the class and mastering course material has long term benefits for students.
- Universities find it difficult to test students on their understanding of a subject, as it has to evaluate all levels of the pyramid with the same instrument.
- Universities find it difficult to upgrade a curriculum rapidly since it is difficult to train all the teachers and bring them up to speed in a short time. Classroom or teaching enrichment is often resisted by teachers because they feel it threatens their role in the classroom.

Motivators: We investigated what would motivate people in this system, and ascertained the following.

- Students are motivated to do just what it takes to crack the exam, and whatever it takes to get a good job.
- Teachers in top-of-the-pyramid institutions are motivated to amplify their reach, increase their impact, and improve the overall quality of the system.
- Teachers in other institutions are motivated by a reduction in workload (in terms of preparation for lectures, grading assignments etc.) because they are already overloaded with work. Of course, there are many teachers who want to learn the subject better themselves and be better teachers. Teachers also may be motivated to be recognized for the work they do. Another motivation could be to enable the better teachers to have “upward mobility” towards better colleges, in the upward direction in the pyramid.
- College administrators are motivated to give students better value for money. That is, college administration treats students as paying customers and wants them to have a good experience.
- University administration is motivated to uplift the overall standard of the university.
- Industry is motivated to improve the quality of students coming out of these colleges and entering the workforce with a meaningful transcript.

MECs for India

MEC’s goal is to empower both teachers and students by harnessing the energy of the university community through online sharing of course content (slides, assignments), participation in discussion forums, and quizzes that enhance learning and understanding. We want MECs to supplement, rather than supplant, in-class education through a viral adoption path that co-exists with the existing university system. In particular, we want to utilize the motivation of some teachers to amplify their reach and impact, and the motivation of most teachers to reduce their workload and gain recognition. We also want to utilize the motivation of students to pass exams and get jobs. We want to reward students who put in the effort to understand the material by providing a separate MEC exam and MEC certification, and to reward teachers who contribute to the community (based on student scores in their class, and by measuring their efforts in content creation, participation in forums, etc.).

Our goal is to create an instance of a MEC for every science and engineering course in a university, in every state in India. One instance of a course is the simultaneous orchestration which happens in all the several hundred colleges, and culminates in a synchronous exam taken by all the students. Each instance

of a MEC will have (1) hundreds of teachers, and (2) tens of thousands of students from all these hundreds of colleges. Among the hundreds of teachers, a small subset of teachers will be given *MEC affiliate* badges, and will be called *affiliates*. MEC relies on affiliates for content creation. We will seed each instance of MEC with at least one affiliate before we start the course. Over the duration of the course, enthusiastic teachers can earn affiliate badges by contributing content.

Below, we describe the role of each of these players, together with expectations from the MEC platform for each of them. Technology can help, but at the end of the day, both teachers and students will have to expend some additional effort.

Affiliate teachers create content for the course. The MEC platform should enable them to make their content available to others without much overhead. Ideally, the amount of effort needed for them to “convert” what they present in the classroom to make it available for the MEC should be as minimal as possible. Of course there will be some additional overhead associated with repurposing content for the new format, creating problem sets, quizzes, and homework, and adapting courses for optimal recording. However, we hope to make this as painless as possible with various aids and good design. Teachers use content produced by affiliate teachers, adapt it to their needs and deliver their lectures. MECs can be successful with little or no additional effort by non-affiliate teachers; indeed, MECs will likely serve to save non-affiliate teachers significant work by providing outlines, slides, quizzes and other course supplements. Of course, we also want to make it rewarding for all teachers to enrich the material for their (and other) classes. We want to make MECs into an engaging community activity rather than a “teacher training” program. MECs should allow us to identify and recognize all top performing teachers; we want to reward teachers who are active in forums and provide active help to the MEC community.

MECs enable students to get content for the course, network with students and teachers all over the state through forums, and access self-assessments for the course. MECs provide discussion forums, as well as online quizzes with assessments. The current proposal is to give students a separate examination, coupled with a certificate signed by MSR, or a suitable consortium with MSR participation, to recognize and reward top performing students. The hope is that the certificate will improve employability. We also expect to reward teachers (affiliate or otherwise) whose students get the best scores in the MEC exam.

We present the workflow for teachers below. Tasks labeled “(Affiliates)” are expected to be performed by affiliate teachers, and are optional for teachers are not affiliates:

- (Affiliates) Upfront work before course starts
 - Create course outline
- Every lecture
 - Download content from MEC system
 - Content creation
 - Prepare lecture plan
 - (Affiliates) Break lecture into segments appropriate for digital viewing
 - (Affiliates) Make skeleton slides for each segment
 - Teach lecture in class
 - (Affiliates) Video recording
 - Record while teaching in class (or before class) using tablet with A/V recording facility
 - Post-process recording, to break video into segments
 - Use professional help to finish up

- Push slides to MEC system
 - Monitor dashboard for usage and iterate
- Every week
 - (Affiliates) Prepare practice assessments and push practice assessments (MEC merely distributes these, but does not grade them or track them)
 - Download assessments, create own assessments, distribute them and grade them.
 - Monitor usage of slides, videos as well as quizzes and assessments
 - Participate in discussion forums
 - Query and get data on usage, scores, statistics etc.
 - Monitor where their class stands relative to others

Next we present the workflow for students. Tasks that are required to get MEC certification are labeled as “(MEC)”.

- Student work flow
 - Initially
 - View course outline
 - View community and create friends in the social network
 - Every lecture
 - Attend class in conventional classroom by the local teacher
 - After class, during self-study: view content from local teachers as well as affiliates using MEC. A reputation ranking system for content would make content and its modifications easier to consume.
 - Every week
 - Answer assessments produced by local teacher for university internal grade
 - (MEC) Answer MEC quizzes online
 - Be able to see where they stand relative to others
 - Participate in discussion forum
 - Take university final exam for university grade
 - (MEC) Take cumulative MEC exam

In addition to the workflows above, the platform should support data collection and analytics as listed below:

- Monitor usage and activity in all instances of the course, analyze data, compute statistics
- Automatically grade assignments (including programming assignments)
 - Give actionable feedback to students who make mistakes and help with their learning
- Be able to identify the best teachers and students for awards

Design choices, Assumptions and Threats

We have made some specific choices in our design of MEC. We explicitly state our assumptions, and threats to adoption and use below.

- Our design relies on at least one enthusiastic affiliate teacher, who needs to do extra work. Our assumption is that the scope for wide impact would be motivation for affiliate teachers. We need to pick affiliate teachers who command respect from all teachers. Over time, enthusiastic teachers who actively contribute to content creation and other aspects of the course, can earn an affiliate badge and become MEC affiliate. If affiliate teachers stop using the system or fail to

create content to drive the system, that MEC instance will likely fail to function . Affiliate teachers can perhaps be given financial compensation for their extra work (paid for by some industry-academia-government consortium).

- Our design does not require extra effort from non-affiliate teachers, and allows fair bit of flexibility in involvement from non-affiliates. One extreme is an enthusiastic non-affiliate teacher, who ends up earning an affiliate badge due to the effort they put in. The other extreme is a teacher who does not use the MEC content, lectures on her own, and prepares assignments on their own. The MEC system will still function as long as a good number of non-affiliate teachers consume content, even if they are not active contributors. We want to reward enthusiastic teachers, and empower them to use MECs to enhance their reputation and careers. Our expectation is that MECs will reduce workload for most non-affiliates (even those passively consuming content), through lecture outlines, slides, videos, quizzes and assessments from the MEC system.
- Our design assumes that students will show some enthusiasm in participating as part of the MEC community. We also assume that enough students will want to take the MEC exam to get a certificate from MSR/Consortium. If students largely ignore MEC, it will fail.
- We need to carefully engineer “pull” from the ecosystem, by making MECs *cool* and something that everyone want so be part of. Unless there is grassroots enthusiasm to be part of MEC, the project is unlikely to scale in terms of usage and adoption.

MECs worldwide

In current MOOCs there is a definite asymmetry, where a few chosen teachers reach millions of students, and hence there is democratization only at one end. By having a role for teachers in adopting institutions, MECs enable teachers to adapt content and redeliver them in their class rooms. It can enable creation of a content market place if there are alternative ways of teaching the same concept (particularly if the variants are modifications from a base source), and hence can be presented as ranked options to the next student who wants to view the content. It could be interesting to enable students to rate the best version, and create rankings and evaluations among teachers, just like MOOCs rank and rate students using quizzes. Thus MECs have the potential to create another level of disruption if millions of teachers also participate (democratization for both content production and consumption), in addition to the effects on millions of students.

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