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# Source Effects in Online Education

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## Abstract

While most MOOCs rely on world-famous experts to teach the masses, in many circumstances students may learn more from people who share their context such as local teachers or peers. Here, we describe an experiment to explore how the “source” of video content, the teacher, affects online learning, specifically in the context of higher education in Indian colleges. The proposed experiment will compare three content sources – a local lecturer (teacher from an Indian engineering college), a local peer (both male and female students similar to the targeted audience), and

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an internationally recognized expert (a Stanford lecturer). Students will watch videos by the various source authors, after which we will measure differences in their preference, engagement, and learning. In addition, we discuss our experiences with helping students prepare video lectures and describe the support and processes we used to curate interesting and clear peer-generated content.

## Author Keywords

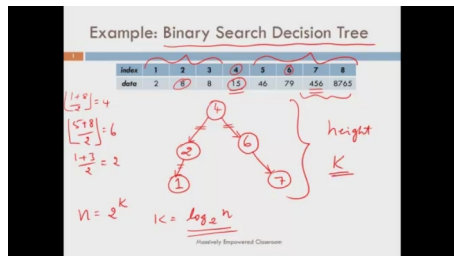
Online education; peer learning; source effects; MOOCs

## ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## Introduction and motivation

One of the motivating philosophies behind the MOOC movement is that the best teachers are singular, internationally recognized subject-matter experts. However, in many educational contexts, learning from a local peer has been shown to be a highly effective method of teaching. Given these two conflicting notions, we describe an experiment to examine how the “source”, or lecturer, of video content might impact learning outcomes in online education. Our aim is to understand how students react to content produced by different sources such as local teachers, international



experts, and peers (“local” and peers referring to individuals from similar cultural and educational backgrounds), and to explore how effective these alternative teaching sources might be for learning.

Engineering students in India naïve to MOOCs frequently tell us that if they were to watch online lectures, they would prefer to learn from international experts (i.e., professors from recognized universities, such as those who would normally teach a course on edX or Coursera). However, after actual exposure to such lectures in MOOCs, Indian students often find those same lecturers difficult to learn from, citing language or accent, pace, examples, and divergence from their college curriculum. This seeming contradiction motivated us to explore how peer learning might bootstrap or even replace “expert” teaching in some scenarios, something that has not yet been evaluated. Another strong motivation to explore peer learning is that there are relatively few international subject-matter experts, which makes content creation difficult for even a single language, much less the native languages of many online learners. Conversely, peers represent a potential low-cost, unharnessed resource for content creation.

Peer learning has been demonstrated as a powerful teaching tool in a variety of domains. Work by Gandhi et al. [1] showed the effectiveness of videos of local farmers demonstrating best practices in farming and animal husbandry relevant for the local context and in the local dialect of that region. They showed that peer learning at scale is not only an effective tool for disseminating information and behavior change, but is also more cost-effective. Similarly, in traditional educational contexts researchers have explored the

applications of peer learning in higher education [2], as well as peer and self-assessment in massive online classes [3], showing that in certain contexts, peer learning is an effective tool for learning. While there will always be a place for world-class lecturers in MOOCs, we wonder if peer-generated content in online learning might supplement or even replace expert content in certain cases to be more culturally relevant, understandable, linguistically appropriate, and cheaper to produce at scale.

Before exploring these themes, key questions remain regarding whether students can produce quality content, and how best to support peer production. While MOOC professors have significant teaching experience, and often have professional recording equipment and editing teams, students are usually novice teachers with very limited equipment. Given these disparities, can peers produce educational content which is as good as, or even better than, existing sources of content for certain audiences? Also, how might students actually produce such content?

In the following section we describe our experimental design motivated by these research questions. We plan to conduct the study on a platform called Massively Empowered Classrooms (MEC), an experimental educational platform designed to support MOOC-like functionality and blended learning for Indian colleges. The experiment focuses on content for teaching the Design and Analysis of Algorithms course which is a foundational course in computer science with ample existing online material allowing comparisons across sources.

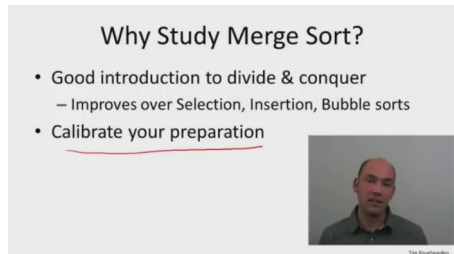
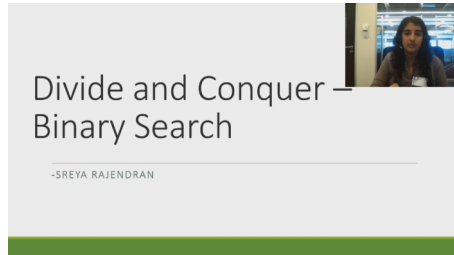


Figure 1: Screenshots of (from top to bottom) a sample MEC video, peer video and a Stanford professor’s video.

### Experiment Design

The proposed study seeks to explore the role of “source effects” in online education by comparing three sources – a MEC lecturer (teacher from a local college - People’s Education Society Institute of Technology, Bangalore), a peer (both female and male Indian students, who had recently taken the same class) and an internationally recognized expert (Stanford professor). We have prepared the content and study design, though have not begun the experiment.

The videos cover three topics from the three sources and students will be randomly allocated to different videos for a given topic. As noted in Table 1, each lesson topic compares at least two versions. The MEC version is present for all three topics and serves as a control. Lectures from four students (two male and two female) were prepared for Binary Search and Quick Sort. We used the Merge Sort and Quick Sort lectures from Tim Roughgarden’s online algorithms class (with consent from Prof. Roughgarden and Stanford). The presentation order of the Binary Search and Merge Sort topics are randomized to control for potential order effects.

The first few seconds of all the peer-generated videos contain an introduction by the student (name, college and topic) along with a video capture of his/her face. The Stanford videos also have a video capture of the professor throughout the video. While some other MEC videos contain video capture, those used in our experiment do not. All three sources of the videos comprise either a combination of slides and handwritten text, or handwritten text only. Though the visual presentation and pedagogy differ across versions, the technical points explained are similar (students exposed

to any of the videos of a particular topic would learn the same subtopics).

Each student will see only one version for any given topic, the allocation of a video being done on the basis of his/her unique user ID on MEC (using a hash function) and completely independent from other students and demographics.

We will concentrate on measuring three aspects for each video: engagement, preference, and learning. Our metric for engagement is the number of seconds watched, which we compare across videos for a given topic. Students always have the option to stop watching a video, as many do for videos they find unengaging or otherwise difficult to understand. To measure preference, we ask in-video questions, including a Likert scale to rate the video with additional space for writing qualitative feedback. At the end of the video students can also fill out a more detailed survey. To measure learning outcomes, we will count the number of correct and incorrect responses to two in-video questions which are the same for all versions.

Although we take care to facilitate a fair comparison, we are still left with many confounds such as varying lengths of the videos, different production quality, recency bias, the particular topics chosen for the experiment, and many more.

It should also be noted that throughout the experiment design we have tried to pay attention to the associated ethical concerns. Students will have an option to opt out of the experiment and it will also be made clear that opting out will not have any negative influence on their grades or performance.

Topic and Sequencing	Sources Compared
Binary Search <i>(shown first or second with 50/50 chance)</i>	MEC vs. Peer
Merge Sort <i>(shown first or second with 50/50 chance)</i>	MEC vs. Stanford
Quick Sort <i>(shown third)</i>	MEC vs. Peer vs. Stanford

Table 1: Experiment design. For each lecture, students are randomly assigned to one of the sources listed (with equal likelihood). Those assigned to the “peer” condition are further divided between four peers.

Sample Peer Content (produced by a female student from a college in Bangalore):

<http://mlxstorage.blob.core.windows.net/mec-v3/seBinarySearchf2.mp4>

Sample content on MEC by a local professor:

<http://mlxstorage.blob.core.windows.net/mec-v3/seBinarySearchMEC.mp4>

Sample content from Stanford professor:

<https://class.coursera.org/algo-004/lecture/1>

Figure 2: Links to sample content used

We had six students record videos for Binary Search and Quick Sort, fundamental topics in the course that all students would learn. The content and narrative of the lectures was decided entirely by the students. We provided some logistical support (sound proof rooms and touch screen laptops) and helped fix and point out errors in the videos. Students were given options to use slides, webcams and touch screen input tools as well.

Recording error-free videos that were of acceptable quality was an iterative process. The students, just like expert content producers for MOOCs, had to prepare lecture notes before recording a video, have sufficient recording material, and sometimes rerecord multiple takes. We provided some students with laptops and webcams, reviewed initial recordings to check for technical correctness, and gave basic guidance for post-processing to create a video of reasonable quality. While this overhead was managed by the researchers and not students (peers), any MOOC lecturer would undergo similar background and post-processing work. We believe much of this overhead could be handled at scale through a set of guidelines, some faculty or staff supervision, and by other students' inputs (e.g., through notes on errors or a rating system to weed out low-quality videos).

### Current Status and Learnings

We deployed an initial pilot to test the feasibility of running this experiment and get feedback to improve our design. While we did not observe any significant differences in engagement or learning for this limited number of students, we did have some qualitative responses to our in-video questions. For instance a student commented on a video by the expert: *"I did not like the video. Reason: The lecturer's talking speed was*

*very fast, I hardly followed 1 or 2 statements in the whole lesson. The lecturer's voice modulation was also not good."* Other students commented on peer videos: *"Her voice was very clear and I can understand her lecture";* and, *"it precisely explains the concept in very less time and yes I didn't get bored"*. These comments suggest that there may be important differences from sources, based on the audience, which may impact our three key measures.

While iterating our experiment design, we have also discussed modifying the experiment to force users to make more explicit choices (e.g. watch all versions of a lecture for a few seconds and then choose one), reach out to a larger student population outside of Indian engineering colleges, have more direct interventions, and perhaps use more sources for lecture delivery, such as voice actors or celebrities.

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