

# Online Learning versus Blended Learning: An Exploratory Study

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## ABSTRACT

Due to the recent emergence of massive open online courses (MOOCs), students and teachers are gaining unprecedented access to high-quality educational content. However, many questions remain on how best to utilize that content in a classroom environment. In this small-scale, exploratory study, we compared two ways of using a recorded video lecture. In the *online learning* condition, students viewed the video on a personal computer, and also viewed a follow-up tutorial (a quiz review) on the computer. In the *blended learning* condition, students viewed the video as a group in a classroom, and received the follow-up tutorial from a live lecturer. We randomly assigned 102 students to these conditions, and assessed learning outcomes via a series of quizzes. While we saw significant learning gains after each session conducted, we did not observe any significant differences between the online and blended learning groups. We discuss these findings as well as areas for future work.

## Author Keywords

Online education; blended learning; massive open online course; MOOC; massively empowered classroom

## ACM Classification Keywords

H.5.2 [Information Interfaces and Presentation]: User interfaces; K.3.0 [Computers and Education]: General

## INTRODUCTION

As a large number of high-quality educational videos become freely available online, many educators are facing the question of how to leverage video for the benefit of their residential classrooms. As opposed to a purely online learning experience, such *blended learning* offers many potential benefits. For example, classroom discussions can add interactivity and personalization over pre-recorded videos, students can benefit from peer and social interactions

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in the class, and local teachers remain a motivator, counselor, and advocate for students. Another form of blended learning, in which online videos are played during class, offers additional benefit in low-resource areas where students cannot access computers or the Internet on their own and there may be a lack of teaching staff and expertise.

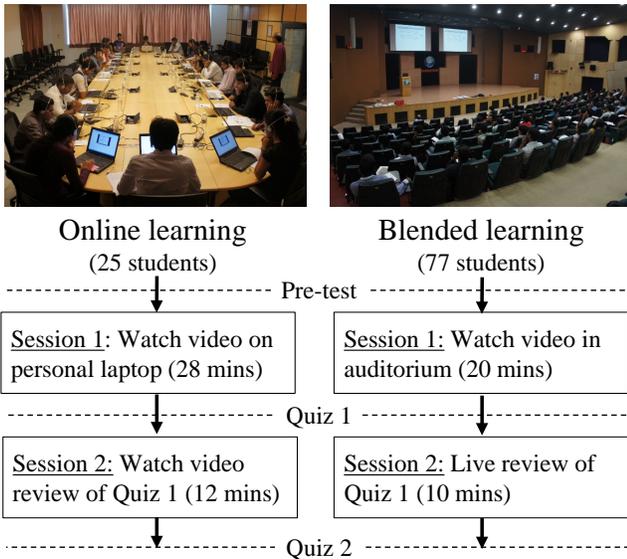
Despite the appeal of blended learning, there have been very few studies that rigorously evaluate the benefits and drawbacks compared to an online-only learning experience. One exception is the work of Schreiber et al., who describe an experiment in which medical students viewed live and recorded lectures [1]. The study found no significant difference in test scores between conditions, though students expressed a preference for the live lecture. One limitation of the study is the absence of a baseline exam, making it impossible to measure actual learning benefits for students.

In this exploratory study, we revisit the question of blended learning versus online learning while overcoming some limitations of Schreiber et al. Via a controlled experiment, we show significant learning gains from each of four activities: viewing a recorded lecture on a personal computer, viewing a recorded lecture in a classroom, viewing a recorded quiz review on a personal computer, and receiving a live quiz review in a classroom. However, we do not find any statistical difference between students who used a computer and those in the classroom. This preliminary inquiry motivates some future work, including analysis of pause and replay events during personal playback of video.

## METHODOLOGY

Our experiment aimed to address two questions that are core to understanding blended learning versus online learning: (i) how does viewing a video on a personal computer compare to viewing it as a group, in a classroom, and (ii) how does viewing a video tutorial compare to attending a live tutorial?

To address these questions, we randomly assigned students to two conditions (see Figure 1). In the online learning condition, students viewed a video lecture, took a short quiz, and then watched a video tutorial that reviewed the answers to the quiz. In the blended learning condition, students reported to a classroom and watched the video as a group, took a short quiz, and then reviewed the quiz with a live lecturer. We also administered baseline and final quizzes, in order to evaluate the learning benefits of both sessions.



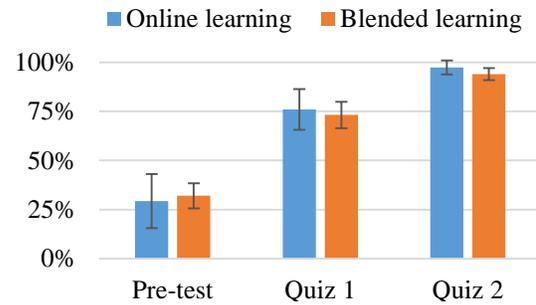
**Figure 1: Overview of the experiment.**

Our participants were 102 undergraduate students who were invited to Pune, India for a day-long event. The event focused on promotion of MEC (Massively Empowered Classroom), an online educational platform on which all of these students were registered. The lecturer for our study, a professor at a premier engineering college, appeared in all of the videos as well as the live session.

The lesson focused on algorithms for computing the convex hull. The pre-test asked four questions, probing knowledge of convex shapes, the definition of convex hull, and the complexity of computing the complex hull. The video lecture covered these subjects and explained the gift wrapping algorithm for efficient computation of the convex hull. The first quiz contained five questions, including four that were repeated from the pre-test; however, the repeated questions used different data (i.e., different points or shapes). The quiz review briefly explained the answers to the quiz. Finally, the second quiz asked six questions, including four that were repeated from the pre-test (with different examples). All quizzes were administered using paper and pencil.

Students in the online learning condition were encouraged to pause or replay the video as needed. We did not invite any questions from students except for the live quiz review, and even in this session, no questions were asked. We allowed students to take notes, but did not allow them to refer to these notes during the quizzes. In the auditorium, we reseeded students until they could easily read the on-screen text.

We conducted our analysis in two parts. The first part focused on questions that were unique to quizzes 1 and 2, as these were slightly harder and may better illustrate learning differences. The second part focused on the four questions that were repeated across tests, indicating acquisition of basic knowledge over time. However, as we later found an error in one variation of a repeated question, we restricted our analysis to three of these questions.



**Figure 2: Average scores for the common questions across tests. Bars indicate 95% confidence intervals.**

## RESULTS

For each of the three questions that were unique to a given quiz, we observed no significant difference between the online learning and blended learning conditions. For the questions that were repeated across quizzes, the results appear in Figure 2. Considering the average score for these questions, we did not observe any significant difference between the online and blended groups for any of the three quizzes. However, we did observe significant improvement of scores as a result of each session conducted. Using a paired Student's t-test, we found significant benefits of the video lecture viewed on a personal computer ( $t(24) = 5.9$ ,  $p < 0.001$ ), the video lecture viewed in an auditorium ( $t(76) = 9.4$ ,  $p < 0.001$ ), the video-based quiz review ( $t(24) = 3.9$ ,  $p < 0.001$ ) and the live quiz review ( $t(76) = 6.3$ ,  $p < 0.001$ ).

We observed that students in the online learning condition frequently paused or replayed parts of the video. We eventually encouraged students to move ahead to allow a fair comparison with the group in the auditorium (who could not pause or replay). Students in the online condition spent 40% longer on the video lecture and 20% longer on the quiz review. A group discussion confirmed that students highly valued the ability to pause and replay parts of the video.

## DISCUSSION

While our experiment did not reveal significant differences between the online and blended conditions, we did observe significant learning gains in all sessions conducted. The learning observed in the classroom video session may suggest a practical way to extend the benefits of educational videos to those lacking computer and Internet access. On the other hand, students in the online condition valued the ability to pause and replay. In future work, we plan to instrument the video player to better understand these behaviors.

Our study has several limitations, the most prominent being its short duration and scale. In addition, we had the utmost attention of students; in long-term, unsupervised use, students might engage differently with either condition. We look forward to addressing these limitations in future work.

## REFERENCES

1. Schreiber, E., Fukuta, J., and Gordon, F., "Live lecture versus video podcast in undergraduate medical education: A randomized controlled trial," *BMC Medical Education*, 2010.