

PEER REVIEWED

Recorded Lectures are Not for Everyone: Lower-Performing Students Benefit from Attending Live Lectures

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Abstract

Background: This study compares student assessment outcomes from material taught using different lecture styles in a didactic science course. **Methods:** Exam scores were compared from questions referencing material presented via live and recorded, live-only or recorded-only lectures. In addition, students were surveyed as to which lecture delivery method they preferred. **Results:** Entire cohorts show a scholastic equality in assessment outcomes among the different lecture styles. Despite an equal preference for live or recorded lectures, the poorer-performing students displayed a significant improvement in exam scores from material presented live. **Conclusion:** Most poorer-performing students benefit from attending live lectures.

Key Words: recorded, live, optometry, lecture, assessment outcomes

Background

Lecture styles and delivery methods are as diverse as the instructors delivering them. Most delivery methods can be placed into one of two large categories: live or recorded. The live lecture is the typical, and often preferred, in-person lecture style for most instructors.¹ Advantages of this method include personalized interactions with students, instant student feedback and the ability to monitor attendance. The recorded lecture can be given at any time, reviewed any time, and is often shorter because of a reduction in interrupting activities that occur during a live lecture.

Many institutions of higher learning have adopted recording of their live lectures and make these recordings available to students to view or review at any time. Many lecturers have concerns about the use of the recorded lecture as discussed below. One glaring question is how effective these recorded lectures are for students who stop attending live lectures.

The literature is varied on the impact of recorded lectures on student performance. A study by Shiau et al. (2018) found that in an introductory epidemiology graduate course there was no difference in overall performance between students watching traditional lectures vs. recorded lectures from home, which were followed by in-class discussions. In addition, more than half of them reported that watching recorded lectures from home was a good time management strategy.²

Some studies suggest re-watching lectures increases comprehension of presented content and results in higher exam scores.^{3,4} Williams et al. (2015) examined students' exam performances in an introductory biology course in which recorded lectures were available. The number of students that attended the live

lectures was high (89.5%), and 65% watched at least one recording. A minimal difference was observed between students who attended only the live lectures and those who re-watched the lectures as recordings. The investigators concluded there was no benefit to providing the recordings because their attendance rate was high.⁵

There are other instances in which a correlation between attending live lectures and performance has been observed. Zureick et al. (2017) studied a first-year medical school histology class. Initial findings showed a positive correlation between attending live lectures and performance on exams. Upon further examination, they discovered that consistency was the key to student success. If students attended live lectures only or watched recorded lectures only, they achieved statistically significant higher scores than students who used a mixed approach in which they watched some lectures live and some recorded.⁶ Simcock et al. (2017) surveyed first-year biology students. They described a positive correlation in exam scores when participants attended live lectures and a negative correlation when they did not. Similar to Williams et al., Simcock et al. found that the majority of students attended lectures even though they would have access to the same material in a recorded format. They stated that they perceived that live lectures helped them learn and understand the material and, more importantly, it helped them keep pace with the material by providing a schedule.⁷

How do students and faculty perceive the use of recorded lectures? Groen et al. (2016), Kwiatkowski and Demirbilek (2016) and O'Callaghan et al. (2015) observed that students generally exhibited positive feelings about having access to recorded lectures.⁸⁻¹⁰ On the other hand, instructors thought that recorded lectures led to a decrease in class attendance, a restriction in their teaching style, and a reduction in one-on-one engagement. Kwiatkowski and Demirbilek also found that instructors had technical concerns, and in fact many faculty members were not familiar with the technology itself.⁹ Groen et al. reported that the faculty felt that recorded lectures helped average- to lower-performing students in achieving better grades but did not impact the success of the high-performing students. They suggested recordings helped lower-performing students because they were an additional resource and led to an increase in confidence.⁸ A survey of first-year medical students in Ireland indicated that the students preferred live lectures, and the majority stated they did not believe recorded lectures should replace live lectures.¹¹ They stated that recorded lectures should only be used as a revision tool.

Motivation behind attending lectures or watching recorded lectures varies. Some students will attend lectures from specific lecturers while watching recorded lectures of others. In addition, the subject matter and access to additional materials play a significant role in determining live attendance or watching a recorded lecture.¹² Szpunar et al. (2014) found that students can be overconfident in their learning of material when they watch recorded lectures.¹³ Watching recorded lectures also increases on days closer to an exam.¹⁴ Jackson et al. (2018) investigated whether students were accessing recorded lectures during mandatory, scheduled self-study time. They found that students preferred to access the recorded lectures on their own time rather than during the mandatory study sessions.

This study examined student performance on exam questions regarding lecture content delivered in lectures they watched live in the classroom only, watched live in the classroom and had access to a recording of the lecture later, or watched only recorded lectures at home. This research is timely with many institutions switching to online instruction. This leads to the question of the effectiveness of these virtual learning platforms, especially for lower-performing students.

Methods

A total of 307 first-year students (152 and 155 from the first and second cohorts of the study, respectively) in a genetics/biochemistry course were evaluated and surveyed. Three lectures given by the same instructor were chosen as the lectures for which three different delivery methods were utilized. The lecture delivery methods included: in-classroom live only (L-only), in-classroom live and recorded

(L+R) and recorded only (R-only). The same three lectures were used in each year of the study; however, the delivery method changed for a particular lecture across different years.

The recording of lectures was done using Panopto (Seattle, Wash.), a video recording and live streaming software. Panopto recordings can be scheduled for the time, date and classroom location of live lectures, or the software can be used to make remote recordings that are uploaded to the learning management system used by the students. Students had access to all lectures after they were delivered via Panopto recordings posted to Blackboard Learning Management System (Washington, D.C.) for their review at any time.

Attendance was recorded for each of the in-class delivery methods. Attendance was recorded as questions embedded within the lectures, which the students could only answer at the time of the live lecture. These questions were not used to determine official course performance.

To evaluate student performances, a set of predetermined questions for each lecture was included in the exams students took as part of their normal assessment for the course. The same questions were used in each year of the study. Depending on the lecture and the year the lecture was given, lectures were delivered 3-6 weeks before the assessment used to evaluate the students' performances. Statistical analysis of student performance on exam questions related to lectures given in different styles was performed using a Mann-Whitney Test using a P value of $<.05$ as significant.

Student perceptions of the use of live or recorded lectures were obtained by survey questions embedded at the end of the exam. Students were asked if they preferred live or recorded lectures and the reasoning behind their preference.

This study was approved by the Salus University Institutional Review Board.

Results

Assessment outcomes between lecture styles within the two cohorts

Any significant differences observed in assessment outcomes could be the result of the students' abilities in each cohort, the difficulty of the material presented, or the lecture delivery style. To assess these parameters, I compared the results within each cohort as well as the results between each cohort of the three lecture styles.



Table 1. [Click to enlarge](#)

Table 1 shows the results comparing assessment outcomes (percentage of questions answered correctly on exam) from the different lecture styles within each cohort. This comparison helps to determine whether one lecture style is better than another within a cohort. There is a statistically significant difference in assessment outcomes between L+R and L-only lectures in the first cohort ($P<.05$). The first cohort also presented a significant difference when the assessment outcome for the L+R lecture was compared to that of the R-only lecture ($P<.05$). There was no difference when comparing the assessment outcomes between the L-only and R-only lecture styles of the first cohort ($P=.42$). On the other hand, the second cohort showed a statistically significant difference when comparing all lecture styles with each other (L+R vs. L-only, $P<.05$; L+R vs. R-only, $P<.05$; L-only vs. R-only, $P<.05$).

In addition to examining the whole cohort, I looked for any assessment outcomes differences between lecture styles within the top 10% and the bottom 10% of each cohort as determined by final grades

(Table 1). There were no significant differences between any lecture styles in either cohort for students in the top 10% of the cohorts. The only significant difference in the lecture style assessment outcomes in the bottom 10% of the cohorts was observed between the L+R and R-only lectures.



Table 2. [Click to enlarge](#)

It is important to note that the first cohort had the highest assessment outcomes average score with the L+R lecture while the second cohort had the highest assessment outcomes average score with the R-only lecture. The differences in the best lecture styles between the two cohorts could be the result of the content presented. To aid in the hypothesis, I compared the student outcomes of the same lecture style between the different cohorts. Recall that the two cohorts had these lecture styles presented as different lecture content. When the whole cohorts were examined, there were significant differences in assessment outcomes with the L+R and R-only lecture styles between the two cohorts but not with the L-only lectures. Again it is important to note which lecture style was the best or the worst for the top 10% and bottom 10% of the cohorts. The bottom 10% of the first cohort did the worst with the assessment outcomes of the R-only lecture while the same lecture style in the second cohort showed the best assessment outcomes. There were no significant differences between the top 10% of each cohort when comparing the same lecture style. Unlike the results from the whole class, comparison of the assessment outcomes between the bottom 10% of each cohort revealed a significant difference between R-only and L-only lectures (**Table 2**).

To assess whether there was true difference in assessment outcomes between two lecture styles, I compared the student assessment outcomes between the two cohorts using different lecture styles but receiving the same lecture content. The P-value for the comparison between one cohort who received a lecture as R-only to the second cohort who received the same lecture live was almost a significant value (**Table 3**). Table 3 indicates there were no significant differences in comparisons of lecture styles using the same lecture content in the top 10% of the cohorts. However, comparison in the bottom 10% revealed a significant difference in outcomes between R-only and L-only lecture styles of the same lecture content (Table 3).

The only significant difference in outcomes assessment when examining different lecture styles using the same content was between R-only and L-only in the bottom 10% of the cohort. I expanded the bottom percentage of the class used in the comparison to evaluate at what percentage of students there would still be a significant result. I was able to observe a significant P-value when comparing the bottom 27% but not at higher percentage values (**Table 4**).



Table 3. [Click to enlarge](#)



Table 4. [Click to enlarge](#)

Student perceptions of live vs. recorded lectures

Students were asked if they preferred live or recorded lectures via survey questions that were added to the end of their scheduled assessments. A response rate of 95.8% was achieved. **Table 5** indicates that the majority of students polled stated they preferred a live lecture over a recorded lecture. Despite a true

option not being given in the survey, several students reported they preferred both. The numbers in Table 5 associated with students who indicated they preferred both methods are from students who chose both methods as a choice. However, it should be noted that several other students revealed in the free response portion of the survey they prefer both methods despite only choosing one in the survey.



Table 5. [Click to enlarge](#)



Table 6. [Click to enlarge](#)

A comparison of the preferences of the top 10% and bottom 10% of each cohort revealed differences in L-only vs. R-only lectures between the two cohorts. All but one student in the top 10% of cohort 1 preferred L-only (92.8%) while 53.3% of the top 10% of cohort 2 favored L-only with 33.3% choosing R-only and 13.3% indicating L+R. Slightly less than half (42.9%) of the bottom 10% of cohort 1 indicated they preferred L-only, which was similar to the percentage (46.7%) indicated by the bottom 10% of cohort 2. The bottom 10% of cohort 1 chose R-only (57.1%) and only 33.3% of the bottom 10% of cohort 2 favored R-only. Twenty percent of the bottom 10% of cohort 2 indicated they liked L+R. When I combined the totals of both cohorts, more than three times the number of students in the top 10% of their cohorts noted they preferred L-only, while the bottom 10% of the cohorts showed an equal preference for L-only or R-only (**Table 6**).



Table 7. [Click to enlarge](#)

Students were asked in a free response form to reveal why they preferred live or recorded lectures. Several students chose more than one reason or, as mentioned previously, stated they preferred both methods. Reasons for preferring L-only were similar in the two cohorts. The top four reasons were 1) students appreciated interactions with the instructor, 2) it was easier to focus and pay attention, 3) the information presented was easier to retain, and 4) students would procrastinate if given the option of a recorded lecture (**Table 7**). Students indicated the top four reasons they preferred R-only were the abilities to 1) pause, rewind or change the pace of the recording, 2) add details of missed concepts to their notes, 3) review or repeat concepts they missed, and 4) watch the lecture on their own time and at their own pace (Table 7).

Discussion

As stated previously, many institutions of higher learning have adopted the recording of lectures to supplement their live lectures. Some institutions are even discussing a move to recorded lectures only. For example, the University of Vermont Robert Larner College of Medicine set a goal for eliminating live lectures by the end of 2019.¹⁵ It will be interesting to observe whether the University of Vermont's new model will be successful. Until then, it is important to examine the current live/recorded lecture structure and attempt to answer several questions including: how does the presence of recordings affect attendance, is attendance significant to student outcomes, what are student and faculty perceptions of the use of recorded lectures, what factors go into a student deciding to use recordings or attend a live lecture, and how do students and faculty perceive performance from the use of recordings?

Does student attendance to live lectures affect outcomes?

In my study, three different lecture styles were delivered to students enrolled in a first-year didactic basic science course while attending optometry school: live lectures that were recorded for later viewing, live lectures that were not recorded, and recorded-only lectures. Students were encouraged to attend the live lectures, and absences were held to a minimum resulting in no significant change in the data analysis

(96.74% attendance rate). The R-only lectures served as an artificial absence, which could be “made up” by viewing the electronic version of the lecture.

My data suggested that the same lecture content given in different lecture styles showed no significant difference in student outcomes when examining the cohorts as a whole. These results were similar to what others have observed.^{2,16-26} This lack of a significant difference in outcomes was especially true when results from the top-performing students in the cohorts were observed.

McNulty et al. (2011) found an inverse relationship in that students who used recorded lectures more were also the poor-performing students in their basic science medical course.²⁷ This raises the question: Is the poor performance the result of the increased use of recorded lectures or is the increased use of recorded lectures required for weaker students to be somewhat successful? My data suggested that the poor performance was not the result of an increase in recorded lecture viewership as suggested by the different results of the same lecture style between the two cohorts of bottom-performing students. The bottom 10% of cohort 1 only scored on average 49.3% on questions related to its recorded lecture while cohort 2 scored on average 69.3%. Again, this would suggest that it was not the requirement of recorded viewership but rather the content of the two recorded lectures that resulted in significantly different scores.

A better comparison was one of the same lecture material but delivered in different styles. I found no significant difference in scores between any comparison of lecture styles involving the same lecture material when examining the whole cohorts or the top performers in those cohorts. However, I observed a difference when looking at the scores of the bottom-performing students. There was a statistically significant difference between a recorded lecture and a live lecture of the same material (Lecture 3). Poorer-performing students did much better with questions about the material when it was presented live. This was in better agreement with the findings of McNulty et al.²⁷ I also expanded the definition of the bottom percentage of students to see when this difference was no longer significant. I still observed a significantly better performance on material presented from a live lecture as compared to a recorded lecture for the bottom 27% of the class.

I observed a significant difference in student performances between L-only and R-only in the bottom-performing students. I might have expected to see a difference in student performances when a lecture that was live and recorded was compared to a recorded-only lecture. However, this was not the case. I hypothesize that this is the result of the difficulty of the material presented in the two lectures. In other words, it appeared that the bottom-performing students benefited from watching live lectures but not necessarily for all lectures presented. Assessment outcomes for a specific lecture style became content dependent. Another explanation comes from the results of Zureick et al., who found that students who consistently viewed L-only or R-only lectures performed better than students who viewed the lectures with both methods.⁶

One possible limitation to this section of the study was the assumption that students who attended live lectures were engaged in the lectures. Just because a student was present in the room does not mean he or she participated in the lecture. While lecturing, I have observed students whose focus is elsewhere. A lack of participation might have negatively affected their assessment outcomes.

What instructional style do students prefer?

The survey of students in the first-year basic science optometry course indicated that 53.4% preferred L-only, 40.1% preferred R-only and, despite it not being an answer option, 6.5% indicated they preferred both. It is also important to point out that in the free response portion of the survey, many other students indicated they used both despite choosing only one choice as instructed. These numbers did not differ greatly from those reported by Cardall et al. (2008), who surveyed first- and second-year students at

Harvard Medical School and found that 57.2% of students watched live lectures, 29.4% watched recorded lectures, and 3.8% watched both.²⁸

Perhaps the more important data collected in this study on instruction style preferences by students was obtained from the top 10% and bottom 10% of the students. It is interesting that 72% of the top 10% of the cohorts indicated they preferred L-only despite the data that show assessment outcomes were no different for information delivered L-only or R-only. However, while the bottom 10% of the students showed an equal preference for L-only or R-only, they showed improved performances with L-only, as indicated by their assessment outcomes. These results were similar to Owston et al. (2011), who examined student perceptions of recorded lectures and academic outcomes in a large undergraduate course. They found higher-performing students did not view recorded lectures as frequently as lower-performing students. When higher-performing students viewed a recorded lecture, they viewed only sections of the lecture they needed to review and often only viewed these sections once. The lower-performing students viewed the recorded lecture several times and in its entirety.¹⁶

The question posed to students about their lecture preference was designed so they answered either L-only or R-only. This was perhaps limiting since some students indicated they liked both methods of instruction. I hypothesize that more students would have chosen “both” had they been given the option.

Why do students prefer live or recorded lectures?

The reasons students use recorded lectures have been investigated by several studies. The lecturer, the subject and availability of other learning resources are key determining factors as to whether a student attends a live lecture or uses a recording.¹² Some students who watch recorded lectures see these recordings as a useful tool.^{11,17,19,23,29,30} They feel the recordings are helpful in their studies and use them as a resource similar to textbooks and online resources.

There are many reasons students use recordings:

- Recordings provide flexibility to view or review content at their own pace
- Recordings allow them to use other resources at the same time they view the recordings^{31,32}
- Students clarify material after attending lectures or before an assessment^{5,31}
- Recordings are used to relearn difficult material and rewrite class notes³²
- Recordings allow repeating or reviewing concepts^{29,32}
- Recordings permit students to complete other assignments or address outside commitments⁷
- Missing class necessitates the use of recorded lectures⁵

Eisen et al. found several reasons second-year medical students attend live lectures. Their primary reason to attend live lectures (96% of students reporting) was the social expectation. However, only 26% of students disclosed that they preferred to learn outside of the classroom.³³ This was by no means the only research to show that social expectations are one of the driving forces behind students attending live lectures. The participants in the Eisen et al. study also suggested that the presence of online material was one of the motivating factors that stopped them from attending the live lectures as well as, the “inconvenience of traveling to class.”³³ In this study, no students indicated social expectations as a rationale to attend live lecture and only two found that the time used to travel to class could be used for something else.

Another reason students use recordings is because they find it more efficient. Students have indicated they obtain this “efficiency” by increasing the recorded lecture’s playback speed. The students suggested that the use of video recorded lectures increased the speed of acquiring the information presented. The top two activities they did as a result of recorded lectures giving them more perceived time in their day were to study other material and sleep/rest. More than half of the participants in a study by Cardall et al.

also claimed that they learned more and were able to stay focused when using the video recorded lectures.²⁸ Several subjects in this study indicated that the ability to change the pace of the lecture was one of the benefits of recorded lectures. However, they did not state if they preferred to increase or decrease the pace of the lecture.

It is of interest to note that increasing the recording speed might not actually be beneficial. Song et al. had two cohorts of medical school volunteers watch the same video on ultrasonography artifacts, a topic that was novel to them. The first cohort watched the video at a speed of 1.5X while the second cohort watched it at a speed of 1.0X. The students were then given a written assessment. The results indicated that the cohort who watched the video at 1.5X speed had a statistically significant lower score on the assessment than the cohort who watched the video at 1.0X speed. Contrary to students' perceptions that they learned more and were able to stay better focused with recorded lectures, the study concluded that an increase in speed did not help, but might actually hinder, their performances.³⁴

Not every student gave a free response to explain his or her lecture style preference. However, this section of the study did receive approximately equal representation of reasons from students who preferred L-only (250 responses) and those who preferred R-only (276 responses). I am confident these responses represented the cohorts as a whole because little difference in reasoning existed between the two cohorts.

Future work

Many aspects of this study could yield additional and interesting results. For example, this study involved a basic science course taken by first-year optometry students. I have found that some students erroneously consider this material unrelated to the optometric profession. It would be interesting to examine student assessment outcomes from a course, such as ocular disease, that has a more direct involvement in optometry. Because poorer-performing students showed a difference in assessment outcomes when watching L-only vs. R-only lectures, I would like to examine the impact of timing of lecture availability on assessment outcomes. Finally, many recording platforms, including Panopto, allow for live streaming of lectures as they are given. It would be interesting to examine the assessment outcomes of students who view the live lecture remotely vs. students who are in class.

Conclusion

To my knowledge, this is the first study to examine the assessment outcomes of optometry students who were exposed to lectures delivered live or recorded. I found that high-achieving students, despite preferring L-only, did equally well on questions from live and recorded lectures. In contrast, lower-performing students benefited from viewing live lectures, despite their equal preference for L-only and R-only. In the end, students should be encouraged to attend live lectures. The advantages of attending the live lectures outweigh the disadvantages.

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