Now Streaming: Strategies That Improve Video Lectures

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Abstract

Recent trends in higher education, including online learning and the flipped classroom, have led to a large increase in the creation and use of video lectures in college teaching. Although the literature suggests that video lectures can be an essential pedagogical tool in 21st-century teaching, research is still emerging regarding best practices to maximize their effectiveness for student learning. The authors provide a broad overview of the research that is currently available and practical applications for these findings. They discuss common recording methods, as well as appropriate contexts for each, then synthesize the research to identify five strategies that increase the effectiveness of video lectures.

Keywords: Video(s), lecture(s), online learning, flipped classroom, teaching with technology

Two recent trends in higher education have spurred the creation and use of video lectures in college teaching. Enrollment in online courses has grown steadily over the past 15 years. In 2014, more than 5.8 million students were enrolled in at least one online course, and about half of those were taking classes exclusively online (Allen & Seaman, 2016). Additionally, the flipped classroom has become popular among many college instructors. EDUCAUSE defines the flipped classroom as a "pedagogical model in which the typical lecture and homework elements of a course are reversed. Short video lectures are viewed by students at home before the class session, whereas in-class time is devoted to exercises, projects, or discussions" (2012, p. 1). The 2016 Campus Technology report found that 55 percent of college instructors indicated that at least some of their classes were flipped (Schaffhauser, 2016).

Fortunately, research suggests that recorded video lectures can be an effective pedagogical tool. In 2012, a comprehensive review of research published between 2002 and 2011 identified several benefits, including improving students' study habits, test performance, perceptions of their courses, and overall learning (Kay, 2012). Although the literature suggests that video lectures are an important pedagogical tool in 21st-century learning, research is just beginning to emerge that identifies best practices to make them more successful.

What follows is a broad overview of the currently available research and practical applications for these findings. Common recording methods, as well as appropriate contexts for each are discussed, then the research is synthesized to identify five strategies for increasing the effectiveness of video lectures.

Common Types of Video Lectures

The most common video lecture formats are voice-over slideshows, screencasts, lecture captures, and standard recordings with a digital video camera or webcam. Before creating a video lecture, instructors should consider a few questions: Does the lecture require visual aids, such as photographs, charts, or graphs? Does it require showing the instructor's movements, such as drawing on a board or demonstrating a physical movement? What other props, animations, or software are needed to convey the lecture material? Answering these questions can help college instructors decide which recording methods will work best in their teaching context. Optimal uses for each of these formats are shown in Table 1.

Voice-Over Slideshows

Voice-over slideshows are a common choice for video lectures because many instructors already use slideshows in face-to-face lectures. In recent years, additional software plug-ins have made it possible to annotate slides and even embed quiz questions within a presentation. This format is ideal for lectures that do not require navigation beyond the slideshow and do not contain complex visual animations.

Screencasting

Another increasingly popular and versatile option is screencasting software, which allows users to record any items that are currently being presented on their computer screen. This makes it possible to toggle between, for

Table 1 • Optimal Uses for Types of Video Lecture Recordings

	Voice-over slideshow PowerPoint, Prezi, Keynote	**Screencast** TechSmith, Relay, Screencast-O-Matic, Camtasia, QuickTime	**Lecture capture** Echo360, Panopto, Mediasite, TechSmith, Relay	**Recording using a camera** smartphones, digital video cameras	**Recording using a webcam** QuickTime, Movie Maker, Photo Booth
Recording the instructor		X	X	X	X
Photographs, charts, graphs, or other still images	X	X		X	
Physical movement, demonstrations, or experiments			X	X	
Classroom discussions			X	X	
Writing on a whiteboard			X	X	
Software demonstrations		X			
Website or Learning Management System (LMS) navigation		X			
Writing on a virtual whiteboard or annotating a PDF		X			
Annotating slides	X				

example, a PowerPoint presentation and a Word document or online module. Many screencasting programs allow users to embed their webcam in the presentation, creating a small thumbnail video of the presenter.

Lecture Capture

Unlike a voice-over slideshow or screencast recording, lecture capture records an actual classroom space, often with the instructor at the front of the room or behind a podium. A mounted camera placed some distance from the instructor records most of the room, sometimes including students if the video is recorded during an actual class period. Although a 2014 study suggested that lecture-capture videos are less engaging for students than alternative formats (Guo, Kim, & Rubin, 2014), they remain a practical option for recording a demonstration or active discussion within a classroom.

Recording With a Digital Video Camera or Webcam

Recording with a digital video camera is another simple but effective way to create a video lecture. This method allows the freedom to capture a short lecture anywhere, from a classroom to an off-site location such as a museum or library. This format is also ideal for any lecture in which the instructor needs to demonstrate working through a process. Equations, experiments, and artistic practice are all areas in which a video camera provides a significant benefit. Similarly, recording with a webcam allows instructors to be on-camera, but usually focuses on only their faces. This format works well for welcome videos or lectures that do not require any visual aids.

Five Strategies to Increase the Effectiveness of Video Lectures

In addition to choosing an optimal format for video lectures, the effective presentation of course content is essential for student learning. Many available resources highlight the factors that characterize effective video lectures; however, few pull together the research and literature in order to provide a practical application for instructors. This section synthesizes this research and offers specific strategies that have been shown to increase students' learning. Practical applications for each strategy appear in Table 2.

1. Divide Large Lectures Into Smaller Segments

There is a popular notion that students today have shorter attention spans than previous generations. However, there is little evidence to support this claim. In 1976, Johnstone and Percival found lapses in student attention during the first 5 minutes of a lecture, again 10 to 18 minutes into the lecture, and more frequently thereafter. Based on their study, they recommended interspersing a lecture with different teaching methods and claimed that "deliberate variations had the effect of postponing or even eliminating the occurrence of an attention break" (p. 50). Later publications, including Bligh's

What's the Use of Lectures? (2000), McKeachie's *Teaching Tips* (2002), and Sousa's *How the Brain Learns* (2006), all advise that students' attention spans decrease after a short time and recommend breaking up lectures into 10-to-15-minute sections.

Nevertheless, Wilson and Korn (2007) criticized authors of previous studies for drawing upon secondary sources based on only anecdotal evidence, as well for as the lack of empirical methods applied when observing attention. They concluded that in order to make a greater impact on student attention, instructors must also consider the needs of individual students.

Although research on student interactions with video lectures is limited, recent studies suggest that students' attention spans while watching online videos may be shorter than during face-to-face lectures (Szpunar, Moulton, & Schacter, 2013; J. Kim et al., 2014; Guo et al., 2014). However, shorter videos may result in a lower incidence of students' minds wandering, for several reasons. One study found that students are less attentive during the second half of 55-minute video lectures (Szpunar, Moulton, & Schacter, 2013). Another found a dramatic increase in video "dropouts" during the first five minutes of most video lectures produced for Massive Open Online Courses (MOOCs) (J. Kim et al., 2014). A third study showed that student engagement dropped significantly with videos longer than 9 to 12 minutes (Guo et al., 2014). Consequently, edX now recommends that video lectures not exceed six minutes.

Although one could argue that participants in MOOCs have less motivation to complete video lectures than do matriculated college students, shorter videos still have practical benefits. For one thing, shorter videos increase the likelihood that instructors will update them to make improvements, add new research findings, or reference current events. Simply stated, a 60-minute video is much harder to rerecord than a 10-minute one. Shorter videos also generate smaller file sizes. This consideration improves playback and download times for students who view video lectures on mobile devices or download them prior to viewing.

For most college instructors, the idea of creating a lecture of only six minutes on even the most insignificant topic is incomprehensible. However, the construction and delivery of a video lecture is quite different from that of its face-to-face counterpart. First, if students don't hear the speaker clearly or have a momentary lapse in attention, they can pause and rewind videos, eliminating the time normally used in live lectures to repeat comments or answer redundant questions. Additionally, longer lectures can be broken down strategically into shorter segments, which potentially helps students better organize information and identify connections across concepts. Shorter segments also provide an opportunity for students to regain focus or replay an entire video if necessary.

2. Use Visuals Strategically

Visual materials can complement verbal instruction. The key word here is *complement*. The challenge is to use visuals strategically without creating excessive distractions. A potential problem in multimedia learning is cognitive overload, which occurs when "the processing demands evoked by the learning task may exceed the processing capacity of the cognitive system" (Mayer & Moreno, 2003, p. 45). However, techniques to reduce cognitive load in multimedia learning include simple strategies such as reducing on-screen text, removing all extraneous content, and including only keywords or images that reinforce the lecture content. Instructors are also advised not to read on-screen text word-for-word. Additionally, cognitive load is reduced when the presentation provides cues to the learner that introduce the content and explain the organization of the material—a technique called signaling (Mayer & Moreno, 2003).

Adhering to basic principles of graphic design and visual literacy can also be helpful when creating visual aids to accompany a video lecture. There are some indications that the visual design of multimedia learning materials directly impacts student learning (Kumi, Conway, Limayem, & Goyal, 2013; Plass, Heidig, Hayward, Homer, & Um, 2014). Any slide presentation created for a video lecture should incorporate the same best practices that apply to slide presentations for face-to-face lectures. For example, a background and font color that have high-value contrast increases readability. A solid color or a white background is preferable to a pattern. Likewise, larger font sizes are key. Whereas no font smaller than 28 points is recommended for a face-to-face classroom, even larger font sizes are recommended for videos that will be viewed on a mobile device (Schwabish, 2016). Overall, a careful selection of fonts, colors, and images creates a professional, credible, and readable visual. Using the same fonts and colors throughout a slideshow also creates a sense of unity within the video.

Another common question that instructors ask when creating their first video lecture is "Do I have to record my face?" Although some research indicates that students prefer video lectures that include their teachers' faces (Kizilcec, Papadopoulos, & Sritanyaratana, 2014), there is no empirical evidence that it directly impacts their learning. However, depending on the content of the video, an instructor's face may be more or less important. In video lectures that contain high emotional content or require minimal visual aids, the presence of the instructor may enhance the presentation. In a video lecture with complex charts, graphs, or elaborate visual components, an instructor's face could be a distraction.

Because research in this area is still emerging, college instructors may also want to take into consideration the course format when making this decision. There may be no need for the instructor to appear in a video lecture that accompanies a flipped classroom, because the students will

have the opportunity to interact with the instructor in class. However, there may be a benefit to including the instructor's face in a video made for an asynchronous online course in which students may not see their instructor otherwise such as promoting instructor social presence, which has been linked to increased retention, motivation, and learning in online courses (Borup, West, & Graham, 2012; Lowenthal, 2015; Minor & Swanson, 2014).

3. Incorporate Active-Learning Techniques

Over the years, college instructors and educational designers have developed strategies for creating interactive lectures and engaging students in active learning in face-to-face courses. The benefits of active-learning techniques are described throughout the research on college teaching and include increased conceptual understanding, increased retention of information, higher exam scores, and an overall increase in performance (Prince, 2004; Freeman et. al., 2014). Research also supports the benefits of teaching students reading strategies and active-reading skills (McGuire, 2015). Video lectures are no different. Although students may watch online videos quite regularly, they may not have learned how to interact with video content in an academic environment. Using active-learning techniques within videos or as an accompaniment to the videos encourages students to intentionally engage with video lecture content and may help them develop self-regulated learning strategies and positive academic habits.

Several strategies to promote active learning from video lectures have developed in response to the need to hold students accountable for viewing them. Methods include assigning students homework or discussion questions to complete while watching a video lecture (M. Kim, Kim, Khera, & Getman, 2014). Note taking during lectures also significantly improves student achievement, even if students never use their notes to study (Kiewra, 1985). To help hold students accountable for note taking while watching video lectures, some instructors require students to submit their notes or a written summary of the lecture (Bergmann & Sams, 2012).

A similar strategy, often referred to as "skeleton notes," has been employed by many instructors for decades in face-to-face lectures. "Skeleton" or "skeletal" notes are partial-lecture-note handouts that require students to fill in gaps, sketch models, or write down key information that is missing (Klemm, 1976). This technique helps students maintain focus, highlights key information as a lecture progresses, and can easily be implemented with video lectures. One study found that when students used a specific form of skeleton notes (a table format), they performed better on both recall and synthesis tests when compared to those using other note-taking methods (Kiewra et al., 1991).

Another method, more commonly implemented in a flipped classroom, allows students to create a "cheat" or "crib" sheet from the video lecture. Students use these notes in either a follow-up class activity or for an exam. Limiting students' note taking to a single sheet of paper or index card forces them to synthesize key points and encourages good study habits (Erbe, 2007). In fact, this assignment was found to improve students' performance on tests even when they were not allowed to access the cheat sheet (Dickson & Bauer, 2008).

4. Assess Student Understanding

Students often lack the ability to properly evaluate their comprehension or predict their performance on exams (Glenberg, Sanoki, Epstein, & Morris, 1987; Horgan, Hacker, & Huffman, 1997). Similarly, students are often overconfident in their perception of how much they understand after watching lecture videos. By embedding videos with questions or quizzing students after they watch video lectures, both students and instructors obtain a better idea of what students learned (Szpunar, Jing, & Schacter, 2014). In addition, a 2012 Harvard University study analyzing cumulative exams found that students who viewed online lectures with embedded quiz questions outperformed students who viewed online lectures without them (Szpunar, Khan, & Schacter, 2013). This supports a body of research indicating the benefits of retrieval practice in aiding retention of information (Agarwal, Bain, & Chamberlain, 2012; Brown, Roediger, & McDaniel, 2014).

Other benefits of integrating quiz questions into online lectures include a reduction in mind wandering and an increase in student note taking (Szpunar, Khan, & Schacter, 2013). Additionally, embedded questions encourage students to revisit areas of the lesson based on questions that they miss. Some video technology even prevents learners from continuing with new material until they have successfully answered review questions. Either method gives students immediate feedback so that they can gauge which concepts or problems they may need to review. Furthermore, multiple opportunities for self-testing can facilitate metacognition and cultivate self-assessment, reflective thinking, and adjustments to feedback, which are all key attributes of self-regulated learning (Gurung, n.d.; Nicol & Macfarlane-Dick, 2006; Zimmerman, 1990).

5. Avoid Common Pitfalls

Video lectures can be time intensive to develop; however, they do not need to be complex productions to be effective pedagogical tools. In fact, a 2014 study evaluating 6.9 million video-watching sessions across four courses on the edX MOOC platform found that informal talking-head videos were more engaging for students than big-budget studio production videos (Guo et al., 2014). Nevertheless, a few preproduction considerations and a little planning can go a long way toward improving the quality of video lectures. Before jumping straight to the recording phase, instructors should develop a script, outline, or storyboard. As mentioned previously, they should select key images, plan the timing of animations, and determine an overall organization of the material prior to recording.

One of the most important characteristics of an engaging video is an authentic speaker who acts naturally. A common mistake instructors make is speaking too slowly or over-enunciating their speech in video recordings. Research suggests that students are more engaged when instructors maintain a normal speaking pace and display enthusiasm for the content (Guo et al., 2014). Being relaxed on camera may take some practice, but this quality allows students to connect with the content and the instructor, which is one of the aforementioned benefits of using video, especially in an online course.

Another common pitfall in videos recorded on webcams or in classroom spaces is poor lighting or distracting backgrounds. In particular, backlighting (a light source behind a subject) is a problem that can affect the quality of a video recording, especially when only the instructor's face is being displayed. Instructors should avoid sitting directly in front of a window or other light source while recording lectures. Similarly, using low lighting can lead to poor-quality recordings. Placing one or two lamps lit by soft warm bulbs at a slight angle about five feet from the subject is recommended (Lyver & Swainson, 2012). Additionally, recording in a location with a simple background and avoiding bold-patterned clothing can prevent the distractions and visual noise that can compete with lecture content.

Just as it is important to avoid visual distractions, it is also a best practice to avoid auditory distractions. Audio should be clear and free of distortion. Instructors should consider recording videos in a quiet space and using a USB microphone to improve sound quality.

Finally, a great way to ensure overall quality is to record a test video, watch it, and evaluate it. If instructors are novices at recording or are trying a new tool in their video lectures, asking a colleague or a student to review a test video is a great way to get feedback for improvement. Once instructors have gained confidence from a testing phase, they can record a final version.

A Note About Closed Captioning

When creating academic content, accessibility considerations are critical. For video lectures, it is important to add closed captioning for students who have hearing impairments. However, the option of turning on captions for lecture videos may help other students as well. A recent study found that 71% of students without hearing difficulties used captions at least some of the time, primarily to help them focus and better retain information (Linder, 2016). Instructors may also want to add closed captioning to video lectures that include challenging terminology or for students for whom English is not their first language.

The steps instructors take to caption a video may vary depending on the college or university where they teach. Instructors should review their institution's policy or speak with someone familiar with this process to determine the recommended protocol for video captioning. Some institutions send their videos to an outside vendor; however, a common solution is for instructors to caption videos themselves. Instructors can use either video-sharing websites such as YouTube, which has a captioning tool available, or captioning-specific sites, such as Amara. In either case, lecture videos are uploaded to a site where captions can be automatically generated or manually created and then edited. If using an auto-caption feature, review the captions once they have been created to ensure that they are accurate.

Table 2 • Strategies in Review

- Consider content and context when choosing the format of a video lecture
- Keep videos short by organizing longer lectures into smaller, more meaningful segments
- Apply basic principles of graphic design to lecture slides
- Use active-learning strategies that hold students accountable
- Assess students' understanding of lecture contect
- Select a recording environment that provides optimal sound, lighting, and background
- Prepare and practice using lecture notes or a script
- Review institutional policies and resources for closed captioning

Conclusion

Current trends in higher education have created a significant role for video lectures in both face-to-face and online courses. As key pedagogical tools, video lectures should be intentionally created to support student learning and should include dynamic components that research suggests are effective. Although studies on this topic are still emerging, much of what has been identified as best practices for video lectures are also recommended in a variety of other teaching contexts. Creating a successful video lecture requires instructors to adapt these best practices to a new medium. When careful consideration is given to the format, content, and accompanying activities, video lectures have the potential to effectively deliver course content and help students learn.

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