# Instructor-Made Videos as a Learner Scaffolding Tool

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**Abstract**

Instructors have frequently found that some content, such as mathematical formulae, chemistry laboratory experiments, and business practices, are unusually difficult for students to comprehend through text-centered approaches, and that this is especially so for online students. In response, instructor-made videos (IMVs) of three to 10 minutes in length on problematic topics or subject matter areas were produced for business, chemistry, and mathematics courses. The IMVs were intended to scaffold student learning. Initial findings revealed that multimodal IMVs involving the demonstration, illustration, and presentation of key terms, knowledge, skills, and resources can help students understand important procedures, structures, or mechanisms in previously problematic content. Simply stated, IMVs can have a positive impact on student learning.

**Keywords:** instructor-made videos, scaffolding, zone of proximal development, online learning

## Introduction

Shared online videos have become quite popular. These streamed videos are so pervasive that 69% of Internet users and 52% of adults in the United States have watched or downloaded videos online (Purcell, 2010). It was predicted that videos would represent 50% of total data transfers on the Internet by 2012 (Madden, 2007). These statistics leave little doubt as to the rising importance of shared online videos for educational purposes.

Concomitant with the remarkable growth in streaming video is the significant growth in video recording of lectures and student–instructor discourses, driven primarily by the desire to provide traditional in-class students with replayable archives. Duke University, Stanford University, the University of California, Berkeley, the University of Michigan, and the University of Wisconsin-Madison, for example, are experimenting with various formats for streaming video. The experiments include capturing lectures and creating podcasts, webcasts, and screencasts that serve as additional learning resources or supplemental materials (see Duke University, n.d.; Stanford University, n.d.; University of California, Berkeley, n.d.; University of Michigan, n.d.; University of Wisconsin-Madison, n.d.).

Online video-based content is now expanding beyond simple lecture capture intended for students in a single class. Some professors use short YouTube videos to empower and motivate their students (Bonk, 2011). As early as 2007, Massachusetts Institute of Technology physics professor Walter H. G. Lewin put his lecture videos on iTunes University and other websites for anyone to freely view (Lewin, 2010). There is even a YouTube EDU website through which hundreds of colleges and universities maintain their own channels to reach their students.

The use of shared online video is ripe for exploitation by educators across educational settings. Today, 38% of adult Internet users watch educational videos online, and that number is expected to rise significantly (Purcell, 2010). Streaming video for education is predicted to grow through 2013, owing to its merits for teaching and learning (Riismandel, 2009). This streaming video phenomenon signals a likely paradigm shift in how students learn new course concepts and principles. This shift has immense societal implications including how learners read information and how they listen to and watch expert presentations.

### Videos for Teaching and Learning

Video incorporates multimedia resources, including text, images, sound, and speech, that when integrated effectively, form a powerful teaching and learning tool. When a student processes and later reprocesses information, each medium reinforces the others while adding to the authenticity and reality of the learning context (Brown, Collins, & Duguid, 1989). As a result of their visual and auditory messages, videos extend learning to visual or episodic memory and help foster students' dual coding of information (Bonk, 2011; Paivio, 1986). Dual coding of key information can improve and augment students' learning process as they see concepts in action (Klass, 2003; Michelich, 2002). Video is also believed to have a nurturing value for instruction and to serve as an effective way to motivate learners, maintain their attention, and provide learning satisfaction (Choi & Johnson, 2005, 2007; Koumi, 2006; Mackey & Ho, 2008). In essence, a (motion) picture is indeed worth at least a thousand words.

Another merit of video is learner control. Learners become active in the video learning environment, able to pause, stop, skip, and/or rewind sections to review problematic content until understanding is achieved. Stated another way, video delivery of content allows students to choose what to watch, when to watch, and where to watch. Kawka and Larkin (2011) incorporated a myriad of Web 2.0 tools while designing a blended course for first-year students. By enabling students to access and make use of the course content at their own pace, the online initiatives transformed the role of the instructors from that of demonstrators to a facilitative role in which they assisted the students in just-in-time learning. As such, video is an ideal vehicle for self-paced and self-directed learning. Hartsell and Yuen (2006), in fact, argue that learner control is the main advantage of incorporating streamed videos into distance learning courses. From this perspective, instructor-generated videos foster a sense of learning autonomy and choice within the learning environment.

Compared to traditional teaching environments that are bound by location and simultaneous presence of the students and the instructor, online courses emphasize just-in-time learning and a customer-oriented approach by assisting students in better organizing and managing knowledge (Keengwe & Kidd, 2010; Mason, 2001; Hall, 2000). Easy availability of online learning materials through portable devices like laptops, iPads, or iPods enables just-in-time learning for modern day students that often have to study in between work breaks or during commutes (Evan, 2008).

While web-based video sharing is relatively new, there is already much speculation about how video instruction might improve student performance. Videos are believed to capture a student's attention more effectively than other media. In part, videos accomplish this by displaying information-rich and high-quality content. The beneficial aspects of videos also include attention-grabbing moving images, easy and repeated access to content, and the capability of modeling different ways to explain the same content (Branigan, 2005; Rose, 2009).

Educational research is beginning to bear this out. In fact, Hove and Corcoran (2008) reported that students with unlimited access to video capture of lectures performed significantly better than those without such access. In a study on streaming video of captured lectures, Veeramani and Bradley (2008) found that 82% of more than 7,000 students preferred courses with an online lecture option because the captured lectures were deemed either "very important" or "somewhat important" for improving the retention of class content (78%) and improving their test scores (76%). In an algebra-based introductory physics class, students having access to pre-lecture videos scored higher on conceptual exercises and homework than those who did not (Kim & Chen, 2011). The videos, however, failed to increase student understanding of scores on the Conceptual Survey of Electricity and Magnetism. Survey feedback indicated that students valued and used the pre-lecture videos and were hopeful that other instructors would begin to adopt them as well. Across these three initial studies of the use of the Web for sharing course videos, much potential is apparent.

Despite all the above benefits, videos, especially streamed course videos, have a number of disadvantages. A key problem is that streamed videos used for teaching and learning are often 40 minutes or longer. These relatively lengthy sequences can be difficult for online users to patiently sit, view, and remember due to the capacity and duration of their working memory (Baddeley, 1992; Goldstein, 2010; Ormrod, 2008). Internet traffic, bandwidth limitations, or connection-speed issues can compound the problem (Zhu & Kaplan, 2011). Even with high-speed broadband (e.g., cable or digital subscriber line (DSL)) Internet connections, learners may face difficulties retrieving or playing an entire streamed video. Users may experience playback delays and long buffering intervals because of network congestion. Poorly designed videos may not align well with course objectives or explicitly delineate key course concepts and principles (Williams, 2007). Students will quickly notice and perhaps complain about the limited relevancy and appropriateness of the video content.

Streaming videos for teaching and learning are usually captured live in traditional classroom settings where many common classroom events occur, including socialization at the start of class, task management and class announcements for upcoming sessions, content reviews of previous sections, revisitations of previous assignments and activities, testing and examinations, small-group review tasks, and other pedagogical activities that are difficult to capture as video. Making sense of all these events is not easy for many viewers. In addition, videos produced on educational budgets rarely approximate the quality that students are accustomed to viewing on television or in motion pictures. Regarding subject matter content, lecture-capture videos typically attend to the generic needs of the class, not to the specific needs of students watching remotely or at some later point in time. In addition, much of the content covered in lecture-capture videos can often be found by reading related textbook chapters, supplemental materials, and other resources.

Online course videos can suffer from inappropriate utilization. Suppose, for example, online learners are capable of learning introductory vocabulary and basic concepts from text-based resources, but encounter difficulties when more advanced content is also presented in plain text. In this case, video might be a richer and more effective learning format (Pan, Sen, & Starrett, 2010). Of course, there is not much pedagogical value in lengthy videos that repeat the more readily grasped content already learned from the text and lecture resources before addressing the more complex and difficult-to-understand content. Students may "zone out" before arriving at the segment of the video that they need. Such students would be better served by videos specifically tailored to the more challenging course content.

In response to this issue, IMVs may be helpful. IMVs are videos that offer introductions to the instructor and other aspects of the course. In an IMV, the instructor might discuss weekly topics, detail course assignments, highlight aspects of the syllabus, offer test reviews, address discussion forum questions, or model difficult procedures and skills (Rose, 2009). Myriad course events and activities can be enhanced through timely and relevant video content from the instructor.

IMVs are brief and concise, typically less than 10 minutes in length. What makes IMVs stand out is their scaffolding role – addressing those concepts that are the most difficult and typically cannot be resolved independently when students first encounter them. Scaffolding is a supporting structure, base, or outline for learning. It is the "process through which learning efforts are supported" (Hannafin, Land, & Oliver, 1999, p. 131) by various means. The effort expended by learners and teachers is greatest when the subject is new and unfamiliar. At such times, "conceptual scaffolding" can be provided to help learners identify key conceptual knowledge related to a problem. It can also help create structures that reveal the subject's conceptual organization (Dennen & Burner, 2008; Hannafin et al., 1999). With conceptual scaffolding, students may find that some tools are recommended for addressing the problem at a particular time. In addition, hints are often provided to more effectively access available resources. If problems persist, the learning content's structure may also be provided. Scaffolding is usually provided in the early stages and at difficult points in student learning. For many students, scaffolding is critically important for persistence in learning.

The term "scaffolding" has its roots in Vygotsky's (1978) sociocultural theory, and, in particular, his concept of the zone of proximal development (ZPD). ZPD is the distance between what a learner can do independently and what he or she can potentially achieve with individualized support from more capable others, such as a teacher or someone who has greater expertise. In instructional situations, scaffolding is embodied in the interactional support and the process by which a more capable other mediates a learner's attempts to take on new learning. Most commonly, this scaffolded support occurs when the learner's understanding and interpretation of the knowledge and skills are either unstable or incomplete (Choi & Hannafin, 1995).

The *Adventures of Jasper Woodbury* (video) series produced by John Bransford and the Cognition and Technology Group at Vanderbilt (CTGV, 1990, 1991) was an early attempt to use videos as scaffolding tools. In the *Jasper Woodbury* series, students were provided with multiple opportunities to solve complex mathematical problems as well as communicate their thinking strategies and findings. Controllable variables (also called "crucial factors") were embedded in the series for students to reflect on and change (Chen & Hung, 2002). By solving these problems, students learned to manipulate the variables, observed how each variable interacted with the others, and gained an understanding of the relationships between the variables and outcomes (Chen & Hung, 2002). Student learning was facilitated through the process of scaffolding where the students' control of the number of variables was "systematically reduced in order to increase the complexity" and, consequently, student problem-solving capability (Chen & Hung, 2002, p. 151). To foster interdisciplinary thinking and more richly connected learning, students in the *Jasper Woodbury* project were also encouraged to make connections to other content areas and domains such as science, social studies, literature, and history (Vanderbilt University Peabody College, 1992).

Models of specific approaches to problems were available in the embedded "teaching episodes" of *Jasper Woodbury* such that students could revisit them on demand to solve mathematical problems. This anchored instructional approach was intended to help students "understand the kinds of problems and opportunities that experts in various areas encounter" and "how experts use knowledge as tools to ... solve problems" (CTGV, 2000, p. 35).

More recently, Bonk (2011) used short YouTube videos in his courses to present behavioral concepts, motivation, cognitive theory, and other related course concepts. Situating learning in context, modeling certain skills and procedures, and accompanying instruction with visual and auditory messages, he found that web-based videos enable instructors and students to "personalize learning and make ideas come to life" (p. 153). With video additions, students can see and hear how ideas or theories evolve at a macro level, as well as what can be done to resolve an issue or perform a task at a more micro or application level. Provided at the right time and right place, online videos represent helpful interactions between novice students and a more capable other. In effect, they provide the "process through which learning efforts are supported" (Hannafin et al., 1999, p. 131). As a result of such scaffolded support, students become capable of doing something beyond their independent efforts (CTGV, 1992).

IMVs can scaffold learning when they present topics or subject matter content that is problematic for learners, forcing them to seek new information. Without more capable others such as tutors or instructors to support online students' understanding of complex or easily misunderstood concepts through such forms of assistance as modeling, questioning, and cognitive structuring, learners would find the problematic cases extremely difficult to address. Instructors appearing in IMVs model appropriate decision-making or thinking pathways that scaffold student learning. What the instructors provide for learners is beyond the learners' existing level and helps them to identify key conceptual knowledge related to the problematic cases, as well as build structures that reveal the problematic cases' conceptual organization (CTGV, 1992; Hannafin et al., 1999). Furthermore, the instructors, through IMVs, recommend tools for learners to use in order to address the problematic cases, offer hints about readily available resources, and provide a sense of structure for content. This "right kind" of help at the right time equips learners with necessary thinking paths, knowledge, tools, and resources to immediately deal with problematic cases while spending minimal time on irrelevant matters, thereby enabling students to focus on and solve such cases and learn content that was previously deemed too complex or difficult.

Although web-based videos are increasingly used for teaching and learning, there are only limited empirical studies on the impact of the use of videos, particularly IMVs, on the learning of online students. Given the scant research on IMVs for learning, it is not too surprising that there is considerable apprehension and speculation about the effectiveness of streaming video for academic discourses (Hartsell, & Yuen, 2006). The present study intends to address this gap in the literature.

**Purpose of Study**

A project was initiated at Southeast Missouri State University in which brief instructor-made videos (IMVs) were developed to scaffold online student learning, especially on topics and subject matter areas identified as potentially problematic to many online students. This study investigated the effectiveness of IMVs in terms of scaffolding student learning in the online environment. It was an expansion on an earlier pilot study (Pan et al., 2010) that also sought to ascertain how effective IMVs were in terms of scaffolding student learning in an online instructional environment. In the present study, students from four online courses were surveyed to answer questions about the effectiveness of IMVs that were intended to function as key resources in the courses. Interviews were administered to determine how the course instructors characterized the IMVs' impact on their students' learning.

Through analysis and interpretation of the data collected from students and instructors, the present study attempted to address the following research questions:

1) What are the students' experiences with IMVs in an online course, particularly with regard to the IMVs' topics, quality, and length?

2) How effectively do IMVs scaffold student learning?

3) How might scaffolding of student learning through the use of IMVs be improved?

**Method**

In the Summer 2009 semester, a pilot study was conducted to examine the effects of a streaming video component on student learning during an online course (Pan et al., 2010). Expanding on the pilot study, a streaming video component was introduced to scaffold student learning in four online courses in the Spring 2010 and Summer 2010 semesters. The streaming videos were IMVs on business, chemistry, and mathematics. In each IMV, an instructor demonstrated, illustrated, or presented a topic, key concept, idea, or other subject matter. Each IMV topic, concept, or subject matter area had been previously identified as potentially problematic for students taking the course, based on the instructor's years of teaching experience in the course.

Every student in these courses was invited to complete an online survey after receiving the final course grade. All four courses used the Online Instructor Suite, the University's in-house learning management system, as the delivery platform. IMVs were linked to the related learning activities in different sections of the courses.

Altogether, 32 of 91 students completed a 19-question Likert-scale survey, which included one open-ended question. The students were from online courses in business (two courses), chemistry (one course), and mathematics (one course). All students in the chemistry and mathematics courses were undergraduates, while the business courses included a mixture of both undergraduate and graduate students.

The survey used a 5-point rating scale from 1 (strongly disagree) to 5 (strongly agree), with 3 representing the neutral position. In one question, students were asked for their general impression of watching the video clips for each chapter, using a slightly different 5-point rating system: 1 for "very favorable," 2 for "favorable," 3 for "neutral," 4 for "somewhat negative," and 5 for "negative." In addition, an open-ended survey question asked for students' thoughts about including IMVs in their online courses and the effectiveness of the IMVs in improving their learning. A narrative approach was used to analyze and present data.

The online course instructors were also invited to complete a questionnaire after final grades had been submitted. The questions were sent as a Microsoft Word file via e-mail attachments to the three instructors who taught the four courses. The instructors responded to 10 interview questions, eight of which were open-ended questions, on their experience with the videos and their perceptions of the student performance when using them.

**The Instructor-Made Videos**

Having identified a set of problematic cases, an instructional designer worked with the business, mathematics, and chemistry instructors to plot out and subsequently record the videos. The focus of the videos, as had been agreed upon by the instructional designer and course instructors, was on scaffolding students' learning – that is, facilitating student efforts to acquire related knowledge, skills, and resources to address the problematic cases independently. It had also been agreed that the IMVs must closely approximate live instruction (i.e., resemble what happens in a similar face-to-face environment) and consist of brief sequences, ideally of three to five minutes but no longer than 10 minutes in length. Each course had different requirements related to the use of the IMVs.

The chemistry IMVs, for example, were around five minutes in length and focused on problematic cases associated with laboratory (lab) procedures. The instructor demonstrated the essential steps of several lab experiments, verbally sharing his procedural knowledge. In addition, written cues were sometimes displayed in IMVs to activate the students' prior knowledge. Through demonstration, explanation, and visual cues, the instructor modeled an expert performance for students to follow to complete similar tasks.

Existing research has classified scaffolding into several categories: soft and hard (Saye & Brush, 2002), contingent (van Lier, 1996), expert (Holton & Clarke, 2006), reciprocal (Holton & Clarke, 2006), and technical (Yelland & Masters, 2007). The IMVs for business courses used advanced planning by the instructor to identify key topic areas that have historically posed challenges in student learning. These videos were intended to address specific problematic areas through tips and relevant examples (Saye & Brush, 2002). These business videos also directed students' attention to key sections or paragraphs in the textbook, as well as to business forms, charts, graphs, and financial statements. The instructor scaffolded or "nudged" student learning as an expert guide when and where appropriate. The instructor often began with an explanation of key terms and background information. The business videos also included the instructor's interpretations of the assigned content. Because the course was taught online, the traditional face-to-face interactions between instructor and students were replaced by technical scaffolding (i.e., an online interface that included a website), embedded links to PowerPoint slides, and instructional materials including the IMVs (Yelland & Masters, 2007).

In the case of the IMVs for the mathematics (college algebra) course, important ideas (e.g., those dealing with horizontal and vertical translations, stretching, compression, and reflection) were incorporated into a five-minute video. By breaking a complex task into easier, "doable" steps and working out the task aloud in explicit steps, the instructor demonstrated his heuristics and procedural knowledge as an expert. Specifically, the instructor highlighted a small part of the formula and verbally explained it, including its meaning, connotation, relation to the rest of the formula, and the role it played. With such a video explanation, the students could recognize connections among different mathematical ideas, such as geometric meanings and theoretical formulae.

After simple editing, the IMVs were uploaded to a streaming video server on campus. Such videos were also linked to the appropriate website in the online courses for student use.

**Impact on Teaching and Learning**

In accordance with prevailing ideas about effective teaching and learning (Hannafin, Land, & Oliver, 1999; Vygotsky, 1978), the IMVs were intended to work within the students' ZPDs. In this way, the shared online videos could provide students with relevant and timely knowledge, skills, and resources that were just beyond their existing independent level of performance. The students could access the videos as needed. As such, they might address learner problems and inner states of dissonance, common as well as less common misconceptions, and situations where learning was inhibited or impaired in some way.

The 32 students who participated in the online survey were positive about their experience with IMVs. In fact, 18 of 32 participating students were "very favorable" and 12 were "favorable" about the IMVs' impact on learning; the remaining two were neutral. Not a single student reported a negative experience with the supplemental use of IMVs in the courses.

Various factors contributed to the students' favorable experience with IMVs. Perhaps most importantly, the videos appeared to have been tailored to their specific needs – focusing on those situations, problems, or concepts that the students felt were too difficult to learn simply by reading the textbook, handouts, or supplemental materials. The information in the IMVs, therefore, provided students with key terms and relevant knowledge, skills, and resources as required. When combined with other online resources, the IMVs offered timely support mechanisms complete with gestures, tones, facial expressions, and body language that enabled students to attack and resolve those specific problematic cases.

A chemistry student participant, for example, was *"a little intimidated"* by the chemistry lab kit delivered to her home at the beginning of the semester containing the necessary supplies for all course lab activities. She was overwhelmed by the task and wondered what to do with the kit. Nevertheless, according to the survey responses, the instructor's IMVs demonstrated appropriate use of the kit for each lab. By emphasizing details and special skills needed to conduct the labs successfully, they helped this student *"better understand concepts and apply them"* when performing the labs.

In effect, the instructor's interpretations and illustrations focused on things that students felt were difficult to understand. Moreover, the interpretations and illustrations were accompanied by related resources, hints, and background information. Consequently, a business student offered an analogy between watching the IMVs and having one-on-one discussions with the instructor over the problematic cases when she (the student) needed such discussion.

When asked if there was any relationship between IMVs and student understanding, a chemistry student asserted that she *"was able to better understand concepts"* thanks to the videos. The student further stated that *"the more of them* [the videos] *you can make the better understanding I feel students will have."* Most students (29 of 32) agreed or strongly agreed that IMVs improved understanding of related topics or subject matter areas. The videos' visual element provided insight into why watching IMVs improved understanding: the instructor's demonstrations, interpretations, and illustrations of subject content were complete with accompanying facial expressions, body language, and changing tones, communicating much more information than could be gained from text-based sources. According to one student, the instructor in an IMV *"*[gave] *a little more clarification and in-depth information about the course than could just be written out."* The visual element added something that no other medium could and helped to clarify otherwise confusing concepts. As one student testified, the instructor offered his viewpoint on the problematic cases, which lent *"extra insight to certain topics that were important to the professor."*

For some students, IMVs were able to scaffold their learning because they were, to some extent, a replication of the classroom setting. As one student pointed out, students felt themselves to be more a part of a dynamic, face-to-face class when the students saw the instructor's physical appearance and heard the instructor's speech. Another could more easily understand what she was learning by hearing the instructor directly. This situation was deemed a vast improvement over repeatedly reading the text alone, as often occurred in other online courses.

The attempt to replicate aspects of the classroom setting, nevertheless, was more than simple substitution of PowerPoint slides, handouts, worksheets, and other lecture notes that are often used in online settings. Rather, the IMVs added something that no PowerPoint file, summary sheet, written advice, or job aid could offer. Unlike such text-based content, the instructional videos made extensive use of instructor gestures, tone of voice, and facial expressions. Such gestures and expressions accompanied the instructors' use of key information, hints, and resources within the assorted problematic cases. Adding to the mix of resources, as one student noted, *"helps you learn things that you might be confused about."* She then added that the video content *"helps an awful lot."*

For some students, the creation of visual aspects of classroom-based learning helped to scaffold learning because the instructors were able to transform abstract ideas into concrete ones, and augment generic examples with specific stories that illustrated abstract situations too often found in textbooks or other course reading materials. During a discussion of international marketing practice, for instance, the instructor accompanied text descriptions with an example of a failed business endeavor to illustrate why certain practices should be avoided, while other practices should be closely followed. One business student proclaimed that *"having a teacher give real examples, and his opinion helps put the information into perspective ... and make[s] the course and learning more effective."*

Self-paced learning afforded by the IMVs was another factor that contributed to scaffolding. The survey participants were overwhelmingly positive about the control they had over the IMVs. Of the 32 student respondents, 29 agreed or strongly agreed that the ability to return to a video clip at will and review what they neglected or failed to understand when they watched it previously was an important feature.

Students liked being able to pause, stop, or restart the clips based on their needs, which afforded them the ability to undertake self-paced learning. The remaining three students were neutral about the benefits of learner control over the IMVs, but no student registered a negative response.

Students were asked for their opinions concerning the length of IMVs. Initially, length was thought as a key factor in forging a positive experience with IMVs in online courses. Nevertheless, opinions varied regarding length. In contrast to students in the pilot study who were unanimously in favor of shorter videos, these respondents were more open to longer videos. Specifically, only half of the respondents (16 students) favored IMVs of three minutes or less, while the other half either did not favor shorter videos (three students) or were neutral (13 students). It had been anticipated that students would not value IMVs longer than 10 minutes. Yet, only 13 of the 32 students did not favor IMVs of 10 minutes or more, while the remaining 19 either favored long IMVs (eight students) or were neutral (11 students). Nearly all IMVs in this study were shorter than 10 minutes. Most chemistry IMVs were around five minutes long, whereas all mathematics IMVs were two to three minutes in length.

There were many benefits from the scaffolding effect of IMVs. For instance, several students noted that they would like to have IMVs in all online courses. According to the open-ended question data, students felt the IMVs were *"a great idea"* and that *"the video clips* [were] *priceless."* More broadly, one student said that she *"would not have made it through an online course without the aid of the videos."*

In spite of the generally positive experience, however, some students did not enjoy certain parts of the IMVs because of conflicting learning styles. One student, for example, expressed that she did not always benefit from the audio since she learned better by reading, while another noted that she *"learned more by reading the materials in the book rather than by watching the videos."* Still another student felt the IMVs were *"not absolutely necessary"* while acknowledging, nevertheless, that they were somewhat helpful.

In addition to issues related to scaffolded instruction and support with student ZPDs, it was important to understand instructor as well as student perceptions of the IMVs. Instructor interview data collected in the Winter and Spring of 2010 came from written interviews of the three online course instructors who taught with locally streamed IMVs. Data in the form of conversations between an investigator and the three instructors regarding the videos' effect on student learning were also collected while the courses were in progress. The three instructors validated transcripts of the casual conversations.

One interview question asked the faculty participants about their goals for introducing IMVs into their courses. Although it was agreed in advance that IMVs would focus on problematic cases and that the instructors in the IMVs were to scaffold student learning through their demonstrations, illustrations, and presentations, faculty approaches to scaffolding of student learning through IMVs were somewhat varied. Different disciplines had different issues to address and varying approaches for accomplishing those goals. The chemistry faculty member attempted to scaffold student learning through his demonstration of lab procedures and key skills, in order to *"reduce confusion over lab procedures."* He intended to connect the lab activities to the class content through his lab demonstrations, accompanying practice exercises of important skills, and utilization of key resources. He also wanted to *"assert"* his presence in the course as a means to build a relationship with the students.

The business faculty wanted to gain *"a captive audience"* through his analysis of key business issues and practices in IMVs. By sharing his respective analyses and perspectives, he wished to motivate students to *"jump in bidirectional communication"* and interaction about each problem and situation presented. More specifically, he hoped that such videos would foster more spirited and active discussion of each of the problematic cases in the course's online discussion forum. The mathematics faculty member's response was clear and concise: he wanted his videos to *"capture the attention of a student regarding important concepts in the subject matter of the course"* and help her understand the relationship between concepts.

Had these instructors achieved their goals? When questioned about what they had accomplished from the use of the relatively short web-based videos, the overall tone for each one was firm and positive and included specific examples from their respective courses. The chemistry instructor stated that several students e-mailed him about the value of IMVs and appreciated his extended *"presence"* through the course videos with related hints and emphasis to illustrate lab procedures. The business instructor experienced more frequent communications with the students, which consequently led to active *"contributions to the discussion forum,"* rich with student course connections and ideas. He received numerous e-mails from his students after the course had ended commending his efforts to *"add a personality to an online course."* The mathematics instructor shared his videos with colleagues in the mathematics department and stated that his colleagues truly liked the idea. In addition, there were no negative comments from his students. As a result, he intended to encourage more active student participation in any follow-up study.

Another important indicator of the effectiveness of IMVs on learning was student participation in learning activities. Evidence of effectiveness in the form of faculty' insights was abundant. For instance, one faculty member noted, *"The students frequently comment on how the videos present the information in a way that textbooks do not ... in a way that they never would with just a discussion in class or response to a survey."* According to another instructor, these videos prompted students *"to identify with the hidden rules of"* a procedure, concept, or theory. Yet another stated that *"Student lab data seemed to be at a higher level of quality than in the past, and more students completed their lab work on time."* Finally, one faculty member mentioned that his students were *"more interested in grasping the course material, contributing to the forum discussions, and also coming up with creative business ideas."*

One question in the faculty survey concerned the merits of IMVs in terms of scaffolding student learning when compared to other media. Responses to this question were varied according to each respondent's experiences. One of the instructors argued that the IMVs made the course *"more animated and interesting,"* which not only caught the students' attention but also kept it. As a result, more students were able to *"understand key course content."*

For some faculty, the IMVs enabled them to direct students to related resources, summarize course material, and *"add their personal touch through their opinions."* Others claimed that the IMVs provoked students to think and work harder with "real-world examples" that they would not have been able to easily identify on their own. They also noted that such course specific video content added *"a level of authenticity that underscore*[d] *the importance of the issue or position at hand."* For another faculty member, the verbal explanations, perspective sharing, illustration of skills, and visual display of solution procedures for various problems in the IMVs mimicked a face-to-face classroom setting. Such contextualized learning was highly familiar to the students. As a result, it was more conducive to learning. Moreover, verbal explanations and visual demonstrations accommodated different learning styles and added *"action to an otherwise largely static website."*

Despite the many positive experiences and learning outcomes, the faculty members in this study felt that there was room for improvement in the use of IMVs to scaffold student learning. In particular, they felt a need to better prepare the content displayed in the videos. For example, one instructor wanted to produce more meticulous and in-depth explanations of key concepts so that the videos could be even more effective in terms of helping students understand crucial content.

The necessity for a storyboard or a script for the plot for each video was another element that at least one instructor would incorporate if he were to create more IMVs. Less extemporaneous, more scripted videos, he argued, would help make the process of producing and watching the videos more efficient and effective.

Another instructor found that his reservations about the effectiveness of the IMVs were unwarranted. Interestingly, he had already identified additional problematic cases that would be appropriate for IMVs. In effect, the videos not only impacted the learning of students in these four classes, but the pedagogical practices of course instructors, and, as indicated earlier, their department colleagues.

**Discussion and Conclusion**

Based on findings from both students and faculty, the IMVs appeared to play a highly positive role in terms of scaffolding student learning as well as instructor reflection on their own pedagogical practices. IMVs enabled students to see and hear their instructors. Such direct connections immediately bridged the gap that exists between students and their instructors in many online courses.

More important for students was the facilitation of learning by demonstrating, illustrating, and presenting ideas and concepts. Such facilitation allowed students to see and hear examples that were difficult, if not impossible, for them to *"see," "hear,"* or *"comprehend"* by simply reading text, browsing through PowerPoint slides and lecture notes, or viewing static graphics or photos found online or in the course resources. The instructors' demonstration, illustration, and presentation in the IMVs consisted of key terms, knowledge, skills, and resources that helped reveal related procedures, structures, or mechanisms for coping with and resolving problematic cases that the students encountered. Each modality of information served to complement and consolidate the information students received from other modalities, thereby increasing retention. Consequently, more students were able to grasp content that previously was beyond their reach.

Perhaps the key factor that contributed to students' positive experience with IMVs was the timeliness of help an instructor was able to provide. In most cases, such support was made available at the critical moment of learning a new domain or in the middle of coping with seemingly insurmountable tasks. Not too surprisingly, such just-in-time learning support was highly valued and long remembered. Learner emotions (i.e., high degree of satisfaction) and cognitions (i.e., enhanced conceptual learning) were intertwined. Stated another way, affect was tied to cognition. This is also in line with the findings of Evan's (2008) study, wherein students valued the flexibility available from the podcasts, which enabled them to study whenever and wherever they wanted.

The topics or subject matter presented in the IMVs were identified by the faculty as problematic based on many years of teaching experience. Anticipating possible hurdles, the IMVs provided the students with clear expectations of activities to be performed. They also offered direct instruction, prompts, cues, hints, partial solutions, and think-aloud modeling. Previous research indicates that such support mechanisms serve as a scaffold to help learners overcome key challenges at critical moments (Bransford, Brown, & Cocking, 2000; Hartman, 2002). The students might not have known what scaffolding meant, but their testimonials revealed deep appreciation for it. In fact, many stated that the instructor demonstrations, illustrations, and presentations in the IMVs offered *"more clarification and in-depth information"* about the topics and subject matter areas in question. In addition, these videos *"added to the mix"* of resources in their learning environment and helped them to *"learn things that* [they] *might be confused about."* As a result, with timely scaffolding from the IMVs, students were able to complete labs and comprehend readings that might otherwise have seemed impossible.

The findings show that the length of IMVs was not a decisive factor in student satisfaction. In contrast to expectations arising from the pilot study, whose findings suggest videos of 10 minutes or less are ideal, short videos were not necessarily the most popular. The responses from students show that sometimes it took longer than 10 minutes to clearly present an idea. When the concepts were clear, many of the students did not mind how long it took. Yet, it is always recommended to effectively portray an idea within the student's attention span.

To a large extent, class success could be predicted by how actively students participated in learning activities, regardless of whether the class was delivered face-to-face or online. Testimonials from faculty indicated that they were satisfied with the various communications they had with their students. Interactions were frequent and conceptually focused on problems or situations illustrated or demonstrated in the videos.

Interestingly, during the courses that used IMVs, many students engaged in bidirectional communication with the faculty. Active participation was displayed in many ways, including contributions to the forum discussions and e-mails from students with questions about course content. As such active participation persisted, student performance improved in terms of quality and completion rates.

As with many new initiatives, there are ways that the instructor-created videos might be enhanced. First, more topics might be addressed. Initial hesitation on the part of the instructors has now given way to personal as well as departmental understanding of the benefits, and there is much enthusiasm to create additional problematic case videos. In addition, faculty members expressed interest in making use of other Web technologies such as web conferencing that might create more dynamic online learning activities and courses. Specifically, Skype could be used as a venue for virtual office hours during which an instructor could meet and have conversations with the students while simultaneously watching and discussing the concepts in the problematic cases displayed on their respective computer screens. At such moments, the instructor could provide insightful advice to the students in real time, just as might occur in a physical classroom.

As with any educational research project on emerging technologies for learning, there were several limitations in this study that must be pointed out to those seeking to replicate or extend the present work. A critical limitation was the uneven student participation in the online survey from class to class. Perhaps students simply needed clearer directions for the survey and better understanding of the study's purpose. A higher participation rate should lead to improved insight into the effectiveness of IMVs on student learning. A second key limitation was the lack of systemic quantitative data related to student performance. Anecdotal data indicate improvement in student learning of course concepts, but the study lacks empirical data that might reveal improvements in performance directly related to the videos. Third, it was unlikely that the IMVs met the needs of all the students in a particular class. Even an experienced instructor cannot anticipate what the students will require in terms of supplemental video content because they may have vastly different needs from the ones the instructor has taught previously. Consequently, it is necessary for the instructor to adjust the number of controllable variables afforded in the IMVs while the semester is underway such that student needs are addressed and instruction continually refined. The instructor might accomplish this goal by adjusting the video length as deemed needed. For instance, tools like TubeChop might be used to focus students' attention on short sections of a particular IMV. Other web-based tools specific to shared online video content, such as Vialogues and Grockit Answers, might help with discussion of said videos instead of relying on the discussion forums in a particular course management system.

Clearly, there are many opportunities for future studies to seek greater insight into the benefits of instructor-created course videos. For instance, it would be interesting to investigate the impact IMVs have on student learning after one or more of the student or instructor suggestions in the present study were implemented. It would be equally interesting to compare student performance, satisfaction, and retention rates in online courses utilizing IMVs with those taking online courses without IMVs, as well as those in face-to-face settings with and without such video support. In addition, adding technological support such as wikis, podcasts, virtual worlds, groupware, and digital textbooks might create entirely new course frameworks and learning worlds. Understanding how shared online video might be effectively used in conjunction with such technologies should prove highly valuable in years to come as technologies converge and instructors continue to make better use of them.

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