

Running Head: USING VIDEO IN INTERACTIVE LEARNING PROGRAMS

Using Video in Interactive Learning Programs

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Abstract

Today's instructional designer should often consider the use of video in designing new classroom materials. This paper addresses recommendations about (a) when to use video in interactive learning programs and (b) how to use video in interactive learning programs.

Instructional designers should consider using video in interactive learning programs in order to motivate learners, convey important information, demonstrate procedures, display models and systems, promote active learning, promote problem-based learning, promote situated learning, promote metacognition, and assess student knowledge. Learning programs that incorporate video should use short clips, provide user controls, make sure to not overload working memory, use visual cues and signals, ask questions during and/or after video clips, and use good video and audio quality.

Using Video in Interactive Learning Programs

Video is everywhere today. Online viewers watched nearly 15 billion online videos in January 2009 (PC Magazine, 2009). A 2008 study found that over 75% of consumers have watched video on their PCs, and 32% have viewed video on a portable device or mobile phone (MediaPost News, 2008).

Because video is so ubiquitous, it stands to reason that video is also being utilized in today's classrooms. In fact, 60 percent of high school students are now creating videos as part of their schoolwork (Cable in the Classroom, 2008). Online resources such as Discovery Education provide thousands of streaming video clips for teachers to use in their lessons. Studies have shown that better learning outcomes can result from learning programs that contain video versus those that do not contain video (Romanov, 2007). Today's instructional designer should often consider the use of video in designing new classroom materials. In making the decision to use video, instructional designers should consider not just the video content but also the characteristics of the instructional program and the way that video is incorporated into the program.

This paper provides current recommendations regarding the use of video in interactive learning programs. Specifically, this paper addresses recommendations about (a) when to use video in interactive learning programs and (b) how to use video in interactive learning programs.

Recommendations

When to Use Video in Interactive Learning Programs

Use to motivate learners. Instructional designers can use video in learning programs as a motivational tool. Video is visually and auditorily stimulating, and watching video can be an engaging experience for people of all ages. Choi and Johnson (2005) found that learners had

higher attention spans for video-based instruction than text-based instruction. In addition, learners classified video-based instruction as more memorable than text-based instruction. Choi and Johnson (2007) also found that video contributes to learner satisfaction in an instructional program. Finally, students found a learning program that used video to be more useful than one without video (Montazemi, 2006). Because of the positive motivational effects of video, instructional designers should utilize video to engage learners and focus their attention on the learning material.

Use for important information. Because learning programs can use video to focus students' attention on specific subject matter, programs can use video to highlight important lesson information. Instructional designers should use video to emphasize and elaborate on specific points in a learning program (Alessi & Trollip, 2001; Ellis & Childs, 1999). Park and Hopkins (1993) noted that motion in video could be used to highlight critical features of the subject matter. However, poor video that uses indiscriminate motion can be detrimental to learning by misleading a student's attention focus (Park & Hopkins). Instruction designers need to ensure that the content of any video clip presented inside a learning program contains important information that is focused on learning objectives. Use of video helps students remember important learning information because video promotes simultaneous processing of both auditory and visual information (Choi & Johnson, 2007).

Use to demonstrate procedures. Because video contains both visual and auditory information and can display motion, the use of video can be effective in demonstrating the procedures of certain activities. For example, a video that shows a proper golf swing can be effective at demonstrating proper fundamentals to beginning golfers. Park and Hopkins (1993) noted the superiority of video for demonstrating procedures by comparing a video presentation to

static and live presentations of the same material. Video was found to be more effective than static presentations because static presentations could not show actual motions involved. Video was also deemed to be more effective than a live presentation because of the limited resource availability of experts and/or equipment for live demonstrations. Observation of a demonstration is an important first step in learning complex motor or cognitive skills (Wouters, Tabbers, & Paas, 2007).

Use to display models and systems. Instructional programs can also use video to effectively display information about a complex system. For example, in a program designed to show how an automobile engine works, a video can display the various components of an engine and how they work together to power the automobile. Park and Hopkins (1993) noted that video is effective at showing the workings of systems that are invisible or difficult to see (such as an automobile engine). In addition, compared to viewing an actual complex system, a video of the system is usually less risky and less expensive to show (Park & Hopkins).

Use to promote active learning. Early television instructional programs tended to fail because the video did not mentally engage learners (Choi & Johnson, 2005). However, Choi and Johnson and Kreiner (1997) found that video could be an effective learning tool when learners are actively participating while viewing the video. Kamin, O'Sullivan, Deterding, and Younger (2003) found that (a) students who learned using digital video engaged in more critical thinking than those who did not and (b) video stimulated cognitive processes that helped facilitate active learning.

Use to promote problem-based learning. In problem-based learning, students learn by actively solving context-specific, open-ended problems. Choi and Johnson (2007) stated that, "video technology is believed to be particularly useful and suitable for problem-based learning

because it can convey setting, characters and action in a more interesting way and can portray more complex and interconnected problems” (p. 886). Problem-based learning lessons can effectively utilize video because of the ability of video to convey a large amount of information in a compelling and useful manner. An example of a problem-based lesson might be for students to come up with a possible alternative energy solution for the United States’ in the future. This lesson can integrate various video clips that describe alternative energy solutions, such as wind energy farms or solar cells. These video clips can be much more compelling and helpful to students than the same information presented in text or static picture forms.

Use to promote situated learning. In situated learning, learning occurs in authentic, real-world contexts. The focus in situated learning is on learning by doing. Video can help students “learn by doing” in a real-world situation by being able to effectively model or demonstrate concepts or procedures in complicated contexts (Choi & Johnson, 2005). For example, a situated learning exercise about computers could be to have students build a computer from scratch by assembling the various components. Video clips that demonstrate the proper procedures to install the components could help students learn how to assemble the computer. These video clips would be much more helpful than diagrams or text explanations because of the ability of video to effectively present complex information and procedural motion.

Use to promote metacognition. Video can promote metacognitive thinking by allowing viewers to compare themselves to experts or peers performing tasks in the video (Wouters et al., 2007). Video can also generate metacognition by presenting concrete examples that allow viewers to reflect on their own understanding of concepts or procedures (Choi & Johnson, 2005).

Use in assessments. Instructors today usually do not consider the use of video in assessment activities. However, because video is often used in knowledge acquisition, video

might also be effectively used in knowledge assessment. A 2008 study found that video-based questions assessed knowledge better than multiple-choice questions and helped students better understand subject material (Hertenstein & Wayand, 2008). Assessment that utilizes video may offer some advantages over traditional assessment methods. Hertenstein and Wayand noted that students pay attention to video clips during lessons when they know that video will be used in tests, and students who perceive themselves as “visual learners” may prefer video-based assessment. Using video to assess learning can allow instructors to create unique and more effective evaluation methods of students’ understanding.

How to Use Video in Interactive Learning Programs

Use short clips. Video in instructional lessons should be kept short so that learners do not lose focus of the subject matter. Ellis and Childs (1999) found that students lost interest while watching 15-minute video segments and recommended that shorter video clips be used in training. Alessi and Trollip (2001) recommended that video clips in most learning programs be limited to twenty to thirty seconds. Keeping video clip lengths short not only can keep students focused but also can lead to better learning. Gillespie (2007) noted that “students learn best from short segments that are directly related to the lesson” (p. 26). The optimal length for instructional video depends on a number of different factors, including video subject matter, video presentation style (animated, fast-moving, etc.), and characteristics of the viewers. For example, Wouters et al. (2007) noted that novice learners might learn better from shorter, segmented video clips.

Provide user controls. The amount of user video control in an interactive learning program is an important consideration for instructional designers. There are a number of issues related to video controls that are important to consider. The most obvious video controls relate to

controlling the pacing of the video. Controls such as playing, pausing, rewinding, forwarding, and stopping the video should be present at all times (Alessi & Trollip, 2001). Allowing users to control video pacing lets learners pause and repeat segments of the video in order to better learn the subject matter (Brecht & Ogilby, 2008). Users should also be able to adjust volume levels of the video. Wouters et al. (2007) recommended that programs give learners with low levels of expertise less control over video playback because novice learners might not know when to best apply the controls. Another video control is in regards to the appearance of the video. Some video applications allow users to adjust color, brightness, and even resolution. More advanced applications let users zoom and/or move the camera to focus on specific areas of the video. Similar to the recommendations for video playback, Wouters et al. also advised that learning programs limit the ability of novice learners to control appearance. Regarding control of video selection, Hannafin and Colamaio (1987) noted that allowing users to control which video to view in an interactive learning program could provide “greater individualization, an increased sense of personal responsibility for learning, and the potential to optimize learning efficiency” (p. 203). Finally, Alessi and Trollip recommended that during video playback learning programs should provide global controls of the overall learning program, such as buttons for going to the menu or exiting the program.

Do not overload working memory. Watching video in a learning program can increase the cognitive load experienced by learners (Homer, Plass, & Blake, 2008). Cognitive load increase puts a strain on working memory and can lead to lower levels of learning. Alessi and Trollip (2001) advised that learning programs evaluate the use of text and other information that are presented simultaneously with video. Too much extraneous information presented together with video can easily overload working memory. The limited capacity of working memory, however,

may be expanded by video because of video's dual modality presentation (Balslev, de Grave, Muijtjens, & Scherpbier, 2005). Choi and Johnson (2007) reported that "the simultaneous processing of both auditory and visual information increases learner comprehension and retention" (p. 886). Therefore, the use of video can help students learn by expanding the capacity of working memory, just as long as the video content and other simultaneously presented information do not overload the cognitive processes of the learner.

Use visual cues and signals. Using visual or auditory cues inside video content can focus the learner's attention on key instructional materials. Wouters et al. (2007) suggested adding arrows in the video to highlight important content and stressing key words in the audio portion of the video to emphasize key information. Providing visual overlays or automatically zooming in on key elements are other visual signals that can be used in video to help focus learner attention.

Ask questions during and/or after video clips. Using thought-provoking questions together with video clips can benefit the learning experience in a few different ways depending on the nature of the questions. Questions that immediately follow video segments can encourage active thinking and help build on a learner's existing knowledge base (Ellis & Childs, 1999). Also, students may learn better if they are required to answer guiding questions during the videos because the questions force students to be more active while viewing the videos (Lawson, Bodle, Houlette, & Haubner, 2006) The guiding questions, however, should not be too long or complicated or else might interfere with students' ability to concentrate on the video (Lawson et al.). Answering questions after video segments can lead to better learning of facts and problem-solving skills (Hannafin & Colomaio, 1987; Cennamo, Savenye, & Smith, 1991). Wouters et al. (2007) reported that asking predictive questions after video segments has a beneficial effect on

learning. Wouters et al. also noted that reflective questions following video segments could have positive effects on the metacognition of the learner.

Use good video and audio quality. Both visual and auditory quality contributes to the overall perceived quality of the video (Winkler & Faller, 2006). Hands (2004) found that for video content that displays a person talking, both visual and auditory modalities contribute significantly to the overall quality of the video, although audio quality is weighted slightly higher. Hands also found that for high-motion content, visual quality is a more significant factor than auditory quality in terms of overall video quality. For visual quality, video content creators should evaluate various video attributes, such as resolution, frame rate, color bit depth, and video codec (Hooper, Miller, Rose, & Veletsianos, 2007). In addition, the visual content of the video should contain smooth motion and good light balance. For auditory quality, video content creators should make sure to use high-quality microphones or audio source files and to evaluate audio attributes, such as sample rates, bit depth, audio channels, audio compression, and recording levels (Oral History Association, n.d.).

Conclusion

This paper has presented various recommendations about the use of video in interactive learning programs. The recommendations covered in this paper can hopefully help an instructional designer decide whether or not to include video in an interactive learning program. If the designer decides to include video, the second part of the recommendations can help the designer determine the best ways to incorporate video into the learning program.

The recommendations presented in this paper are relevant for an indefinite period of time because of the changing landscape of both video technology and interactive learning programs. Video can no longer be thought of as simply moving images that people passively observe. Users

can now have some control over video presentation, including the ability to move camera angles, zoom in and out, and adjust video appearance. New, clickable videos introduce another potential type of video for instructional designers to use in learning programs. For example, an educational video clip showing the Amazon rainforest might have various animal, plant, or environmental areas as clickable elements that pause the video and bring up a window that provides detailed information about that element. Instructional programs will also evolve over time and will require reconsideration about when and how to use video. For example, learning programs are now being made for mobile devices, and so instructional designers need to consider factors such as using lower resolution video in these mobile programs. A final thought about the future of video and interactive learning programs is in regards to new blended video-animations. Recently, 3-D graphics and animation tools have improved so much that videos can be made that seamlessly include computer-generated animations integrated into the video footage. Combine these new video-animations with clickable elements, and there is the potential to create an entire interactive learning program inside of a video. The potential and application for this new type of learning video can be the subject of future research.

References

- Alessi, S. M. & Trollip, S. R. (2001). *Multimedia For Learning: Methods And Development*. Needham Heights, MA: Allyn & Bacon.
- Balslev, T., de Grave, W., Muijtjens, A., & Scherpbier, A. (2005). Comparison of text and video cases in a postgraduate problem-based learning format. *Medical Education, 39*(11), 1086-1092.
- Brecht, H. D., & Ogilby, S. M. (2008). Enabling a comprehensive teaching strategy: Video lectures. *Journal of Information Technology Education, 7*, IIP 71- IIP 86.
- Cable in the Classroom (2008, October 24). *Survey says: Schools are responding to students' increasing use of technology*. Retrieved April 9, 2009, from <http://www.ciconline.org/grunwald2008>
- Cennamo, K., Savenye, W., & Smith, P. (1991). Mental effort and video-based learning: The relationship of preconceptions and the effects of interactive and covert practice. *Educational Technology Research and Development, 39*(1), 5-16.
- Choi, H. J., & Johnson, S. D. (2005). The effect of context-based video instruction on learning and motivation in online courses. *The American Journal of Distance Education, 19*(4), 215-227.
- Choi, H. J., & Johnson, S. D. (2007). The effect of problem-based video instruction on learner satisfaction, comprehension and retention in college courses. *British Journal of Educational Technology, 38*(5), 885-895.
- Ellis, R., & Childs, M. (1999). The effectiveness of video as a learning tool in on-line multimedia modules. *Journal of Educational Media, 24*(3), 217-223.

- Gillespie, D. (2007). On-demand video system enhances visual learning. *District Administration*, 43(9), 25-26.
- Hands D.S. (2004). A basic multimedia quality model. *IEEE Transactions on Multimedia*, 6(6), 806-816.
- Hannafin, M., & Colamaio, M. (1987). The effects of variations in lesson control and practice on learning from interactive video. *Educational Communication and Technology Journal*, 35(4), 203-212.
- Hertenstein, M., & Wayand, J. (2008). Video-based test questions: A novel means of evaluation. *Journal of Instructional Psychology*, 35(2), 188-191.
- Homer, B., Plass, J., & Blake, L. (2008). The effects of video on cognitive load and social presence in multimedia-learning. *Computers in Human Behavior*, 24(3), 786-797.
- Hooper, S., Miller, C., Rose, S., & Veletsianos, G. (2007). The effects of digital video quality on learner comprehension in an American sign language assessment environment. *Sign Language Studies*, 8(1), 42-58.
- Kamin, C., O'Sullivan, P., Deterding, R., & Younger, M. (2003). A comparison of critical thinking in groups of third-year medical students in text, video, and virtual PBL case modalities. *Academic Medicine*, 78(2), 204-211.
- Kreiner, D. S. (1997). Guided notes and interactive methods for teaching with videotapes. *Teaching of Psychology*, 24(3), 183-185.
- Lawson, T., Bodle, J., Houlette, M., & Haubner, R. (2006). Guiding questions enhance student learning from educational videos. *Teaching of Psychology*, 33(1), 31-33.

- MediaPost News (2008, November 17). *IBM study finds adoption of online, mobile content doubling*. Retrieved April 9, 2009, from http://www.mediapost.com/publications/?fa=Articles.showArticle&art_aid=94890
- Montazemi, A. R. (2006). The effect of video presentation in a CBT environment. *Educational Technology & Society, 9*(4), 123-138.
- Oral History Association (n.d.). *Digital audio and portable recorders: The basics*. Retrieved April 11, 2009, from http://www.oralhistory.org/technology/audio_basics
- Park, O., & Hopkins, R. (1993). Instructional conditions for using dynamic visual displays: A review. *Instructional Science, 21*(6), 427-449.
- PC Magazine (2009, March 5). *Jan. YouTube viewers exceed 100M for first time*. Retrieved April 9, 2009, from <http://www.pcmag.com/article2/0,2817,2342533,00.asp>
- Romanov, K., & Nevgi, A. (2007). Do medical students watch video clips in eLearning and do these facilitate learning? *Medical Teacher, 29*(5), 490-494.
- Winkler S., Faller C. (2006). Perceived audiovisual quality of low-bitrate multimedia content. *IEEE Transactions on Multimedia, 8*(5), 973-980.
- Wouters, P., Tabbers, H. K., & Paas, F. (2007). Interactivity in video-based models. *Educational Psychology Review, 19*(3), 327-342.