Usability Design for Video Lectures

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ABSTRACT
There is a growing number and variety of educational video lectures online, but there is limited understanding of their effectiveness in terms of learning and usability. Although there is significant research literature within the individual domains of usability and of video learning, there is limited understanding of their integrated design. In particular, there is limited research on guidelines for usable video lecture design, such as the presence of humans in the video and navigation support through the video. For example, it is established that learners benefit from highly structured learning material, but the manual editing of video is not feasible for most learning organizations and instructors. In order to accommodate this emerging instruction medium we are drawing design principles and models from the research literature on educational technology and video interaction. Moreover, we provide a comprehensive approach to the design of usable video lecture systems and content. Finally, we suggest that learning organizations and instructors should invest additional effort in video systems that support an integrated approach to editing, sharing, and controlling of video lectures.

Categories and Subject Descriptors
K.3.1 [**Computer Uses in Education**] Computer-assisted instruction; J.1 [**Administrative Data Processing**] Education

Keywords
Video Lectures, MOOCs, Learning, Usability Design.

1. VIDEO LECTURES
The usage of web-videos for learning purposes has been increasing over the last years. The number of institutions and business organizations providing their content using web-videos is increasing rapidly. Furthermore, there are many video search engines where someone can find educational videos and there are learning-oriented search engines for educational videos (e.g., youtube.com/edu, my learningtube.com). In addition, most of the universities offering lectures on iTunes and elsewhere. On the top of that, Massive Online Open Courses (MOOCs) are becoming an increasingly important part of education. For instance, students access academic content via digital libraries, discuss with tutors by email and attend courses from their home.

Our focus is on web-videos because this type of advanced Internet-based technology enhances the teaching and learning experience. Learners can access and download teaching materials directly. Like other information objects such as books, notes, and documentaries, web-videos may be reused to support both formal and informal learning. Whether recorded for distribution to students or for use internally by employees, these recordings have the potential to be useful for browsing and searching at a later date. Web-videos can also be integrated in an online learning system (portal, e-class, etc) and combine several services. For instance, learners can use in parallel of web-video an online chat room, video conferencing to communicate with their instructors.

There is no single format for video lectures, so there is no simple choice between the available options. Firstly, the traditional video format consists of a video frame that depicts the instructor and the board. It has been the most popular video lecture format, because it is familiar, as it resembles teaching in a real classroom. Nevertheless, there are other popular formats such as the Khan style of video lecture, which depicts only the writing pen of the instructor, but not his face. Between, these two extremes there are hybrid video formats (figure 1), which combine the main characteristics of the two (instructor face, instructor pen). Moreover, the videos are usually embedded in a distance learning system that may include several other features, such as video navigation, quiz-style questions, discussion forum, peer grading, etc. Although any modern distance instructional consists of many elements, there are no guidelines for aligning those elements in the most effective way for a given audience and course. The most popular and basic video lecture formats are: 1) Video capturing of classroom teaching that includes the whiteboard and the instructor, 2) a close-up of the whiteboard that provides a live view of the main course topics, and 3) simple slides or more elaborate animations with a voice-over, which are also known as webcasts. Besides the above basic formats, there are variations of them, such as the Picture-in-Picture technique that combines a close-up of the instructor, which is overlayed to the slides.

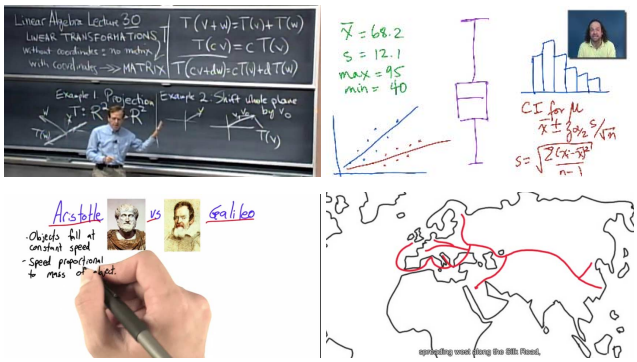

Figure 1. There are many styles of presenting a video lecture, each one with benefits and shortcomings that have to be evaluated against the type of course, the audience, the instructional design, and the technical resources

Web-video technology has many pedagogical affordances and great potential for transforming the teaching and learning environment when it is employed in a suitable way. Thus, the issue is no longer whether instructors should integrate technology in their courses, but how to use technology to transform their courses and create new opportunities for learning. Developing a video lecture is a complex process that requires thorough planning

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and an implementation procedure. Knowledge of learning theories and instructional implications (e.g., [3]) is a prerequisite for successful realization of the learning content with the most appropriate delivery components. According to Scutter et al., [4], the continuous watching of the lectures has the advantage that information could get "into students heads". Re-listening the courses and taking additional information from the video would also appear to encourage the usability of this medium.

Table 1 Overview of the benefits and shortcoming of the available video lecture presentation styles

Video lecture style	Benefits and shortcomings
Talking head and board	**Simple to capture and share but less usable by the students** *Example*: iTunes U, MIT Open Courseware
Picture-In-Picture (Hybrid style)	**Provides usable cuts between the instructor video feed and the slides or drawing board, but it requires elaborate post-production** *Example*: Coursera
Drawing board	**Video capture of the drawing board with instructor voice over simulates private tutoring** *Example*: Udacity, Khan Academy
Slides and animations	**Includes voice-over and screen cast, so it is simple to capture but might be less friendly without the video feed of the instructor** *Example:* TED Ed, Webcasts, How-to videos

2. USABILITY DESIGN

Besides the video style, there is a need to provide navigation support through the content and connect it to the rest of the instructional design, such as quiz questions, and peer-support in the forum. Thus, the navigation support for video depends mostly on the instructional design and on the video capturing system. Most video lecture systems provide basic video navigation, such as play, pause, and random seek. Depending on the availability of video segments, annotations, extra video (viewing angles, instructor, slides) a video lecturing system might also provide an additional user interface for connecting the video to the rest of the instructional design. For example, Udacity and Khan Academy employ a highly segmented video capturing approach.

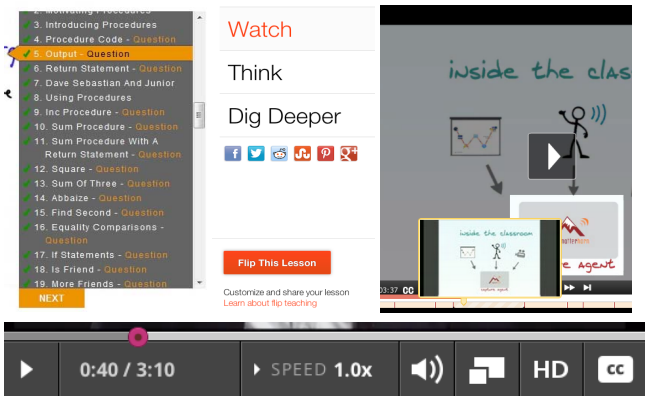

Figure 2. The combination of the video lecture with a user interface has been performed according to the resources of each organization, but there are no guidelines for the integration and automation across video editing, sharing, and controlling

In order to support video learning, various technological tools have been developed. For example, matterhorn, centra, edx are just few of them. These tools provide an easy way for a learner who has missed a lecture, the opportunity to catch up, but also enable other, especially slow learners, to review difficult concepts. Despite the widely usage of video lectures and the amount of studies have been conducted upon them (e.g., [1, 2]), usability design principles have not developed.

Although the design of user interfaces for video navigation have been extensively explored in research communities such as interactive TV (EuroITV) and multimedia (MM), the educational context of video lectures raises novel research issues. In addition, it is also not clear how findings from EuroITV and MM communities can be used to improve video lectures for learning. On the one hand, it is obvious that a carefully authored video lecture that includes multiple annotated video segments is beneficial for the learner, but, on the other hand, the majority of instructors and organizations who choose to upload their video online, they do not have the resources to go through this elaborate post-editing.

Table 2. Overview of the properties for each one of the three basic components of a video lecture system

Video lecture system components	Description
Controlling	**Students control video lectures at their pace and the system collects information for video analytics** *Example*: Video topics and quiz index, player buttons (e.g., speed, camera, seek, pause)
Sharing	**Instructors and students are empowered to remix and create mash-ups of video lectures based on existing material** *Example*: TED Ed
Editing	**Capturing and post-processing systems are employed by instructors and editors to produce new content** *Example*: iTunes U Course Manager, Opencast Matterhorn

In conclusion, the basic guidelines for usable video lectures are:

- Video style and video navigation should be designed according to the topic and the learner.
- Video editing, sharing, and controlling should be integrated with instructional design.
- Video analytics should be employed for assessing the effectiveness of the video lecture and the navigation system.

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