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Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness

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Abstract

Interactive video in an e-learning system allows proactive and random access to video content. Our empirical study examined the influence of interactive video on learning outcome and learner satisfaction in e-learning environments. Four different settings were studied: three were e-learning environments—with interactive video, with non-interactive video, and without video. The fourth was the traditional classroom environment. Results of the experiment showed that the value of video for learning effectiveness was contingent upon the provision of interactivity. Students in the e-learning environment that provided interactive video achieved significantly better learning performance and a higher level of learner satisfaction than those in other settings. However, students who used the e-learning environment that provided non-interactive video did not improve either. The findings suggest that it may be important to integrate interactive instructional video into e-learning systems.
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1. Introduction

Learning provides ''intellectual growth that leads to scientific reasoning, abstract thought, and formal operations'' [36]. As information technologies like virtual workspaces and digital libraries have evolved, they have added new environments for teaching and learning and have given rise to new areas for research.

Learning enhanced by information technologies is gaining momentum. This is partially in response to the demand for reduction in time-to-competency in the knowledge-based economy, spurred by intensive competition and globalization. Companies need to offer effective training to employees and business partners to ensure that they acquire new skills in a timely manner. In academia, education must be

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delivered to remote students who do not have physical access to the campus.

E-learning has recently become a promising alternative to the traditional classroom learning, helping society move toward a vision of lifelong and on-demand learning [56]. It has become one of the fastest-moving trends [51] and aims to provide a configurable infrastructure that integrates learning material, tools, and services into a single solution to create and deliver training or educational content quickly, effectively, and economically [37]. Thousands of online courses are now being offered. Not only can instructional material be made available on the Internet but online collaborative learning and discussions can also occur.

Video is a rich and powerful medium being used in e-learning. It can present information in an attractive and consistent manner. Prior studies have investigated the effect of instructional video on learning outcomes [47]. However, the instructional video used in early studies was primarily either broadcasted through TV programs or stored on CD-ROMs. The linear nature of such video instructions produced inconsistent results [24].

Recent advances in multimedia and communication technologies have resulted in powerful learning systems with instructional video components. The emergence of non-linear, interactive digital video technology allows students to interact with instructional video. This may enhance learner engagement, and so improve learning effectiveness. A major 'media attribute' of interactive video is random access to video content [45]—users can select or play a segment with minimal search time. The concept is not new but is taking on new forms. However, the effect of interactive video on e-learning is still not well understood.

In our research, we mainly focused on investigating the impact of interactive video on e-learning effectiveness through an empirical study. Learning by asking (LBA), a multimedia based e-learning system, integrates multimedia instructional material including video lectures, PowerPoint slides, and lecture notes. The LBA system promotes high levels of interaction by allowing learners to access individual video segments directly. In our empirical study, there were four different learning settings:

1. an e-learning environment with interactive video;
2. an e-learning environment with non-interactive video;
3. an e-learning environment without instructional video; and
4. the traditional classroom.

The learning outcomes and levels of learning satisfaction in each setting were collected and analyzed to yield a better understanding of how interactive video can be used to improve e-learning.

2. Theoretical foundation

2.1. Constructivist learning theory

Constructivists view learning as a formation of abstract concepts in the mind to represent reality. They posit that learning occurs when a learner constructs internal representations for his or her unique version of knowledge [50]. Constructivism argues that interactive activities in which learners play active roles can engage and motivate learning more effectively than activities where learners are passive. Individuals are assumed to learn better when they discover things by themselves and when they control the pace of learning [26]. Therefore, it is natural to expect that self-directed, interactive learning would improve learning outcome.

Constructivists put more emphasis on engaging students in the process of learning than on finding a correct answer. Many constructivists call for richer learning environments that contrast with the typical less interactive classroom environments relying on instructors, textbooks, and lectures. Graphics, video, and other media can help by interesting and engaging learners. Brandt [9] suggested that constructivism should be a basis for Web-based learning. Web-based education supported by the constructivist theory should thus enable learners to engage in interactive, creative, and collaborative activities during knowledge construction.

2.2. Cognitive information processing theory

Cognitive information processing theory is an extension of the constructivist model, based on a model of memory. It proposes processes and structures through which an individual receives and stores information and focuses on cognitive processes during learning; these involve processing instructional input

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