DOES SCREENCAST TEACHING SOFTWARE APPLICATION NEEDS NARRATION FOR EFFECTIVE LEARNING?

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ABSTRACT
The aim of this study was to investigate the effects of screencast with narration and without narration in enhancing learning performance. A series of screencast teaching Flash animation software was developed using screen capture software for the purpuse of this research. The screencast series were uploaded to specialized channels created in YouTube video sharing platform. The study was conducted under the online self-paced learning condition. A pre-test post-test experimental design was used involving two different groups that studied the two different strategies. Data collected were analyzed using one-way ANOVA test. The results indicate that screencast with narration was significantly more effective than screencast without narration in enhancing students' learning performance. Moreover, from the observation, it was revealed that screencast with narration, published and shared online, can be a potential strategy in reducing learning duration. Taken together, the findings provide evidence that screencast with narration can be used for online self-paced learning that is not only effective but also efficient.
Keywords: Digital video, learning, narration, online, screencast, screen capture, video sharing

INTRODUCTION

The emergence of video sharing technology in internet world is fascinating. The technology offers great choice for users throughout the world to share their videos online. The audience for online video sharing such as YouTube and Google Video shows continues growth across all demographic groups, far outpacing the adoption rate of many other internet activities (Madden, 2009). Furthermore, high speed broadband connectivity initiative enables fast uploading and downloading for smooth viewing experiences of these online video contents. Capitalizing on all of these advancements, efforts to harness the benefits of video sharing in online education are becoming more and more imperative as it has opened a new channel for teaching and learning process - benefiting both the educators and students.

Video technology is a rapidly evolving technology that continues to be used overzealously in education; however, there are relatively few empirical evaluations on the effective use of video for learning vis-a-vis other computer-aided instructions as shown in Table 1 (Schwartz & Hartman, 2007). Thus, the need for research to investigate the effectiveness of this technology in education especially on the instructional design issues and implementation methods is not only important, but also urgently needed (Snelson, 2008).

Table 1: Percentage of Journal abstracts that indicate research on video-aided and computer-aided instruction, as found in the ten issues prior 2005

Journal Title (Number of abstracts)	Video-aided learning	Computer-aided learning
Cognition and Instruction (n=31)	3.2%	25.8%
Educational Technology Research and Development (n=56)	3.6%	57.1%
Journal of Educational Psychology (n=159)	2.5%	9.4%
Journal of the Learning Sciences (n=31)	9.7%	61.3%
Learning and Instruction (n=48)	6.3%	16.6%

Source: (Schwartz & Hartman, 2007)

Digital Video

The meaning of video is the display of images on a television-type screen (Heinch, Molenda, Russel & Smaldino, 1996). Originally, the concept of video was synonymous with that of broadcast television, but the concept has

expanded tremendously with the presence of digital technology. Digital technology has allowed video to be created and viewed on devices such as laptop, personal computer and cell phone. Today, further development of streaming media technology and increasing number of people having access to high speed broadband services have made the internet a suitable and popular channel for distribution of video-based materials for learning purposes (So, Lossman, Lim & Jacobson, 2009).

Digital video content is easier to develop than traditional video production. There is no need of high-tech cameras and production studio with expensive equipment anymore. Nowadays, a small digital camcorder or even a cell phone camera is perfect for capturing quality live shoots. Through user-friendly video authoring software, editing, combining or rearranging multiple video clips are performed with ease on personal computers, laptops and even cell phones. Furthermore, animation software can easily create animation videos; and screen recorder software can easily transform screencast into 'know-how' videos.

In terms of user control, digital video players allow teachers and students to control video viewing through functions such as speed up, slow down, pause, reverse, and replay that help prompt review and analysis of the digital contents (Bell & Bull, 2010). As for learning, allowing user-control is essential for effective cognition and reasoning (Ahmad Zamzuri, 2007).

Online Video Sharing Platform

With today's online video sharing technology, users have tremendous opportunity to study virtually anything, anywhere. Users can now find an online video on any topic and learners are beginning to use this technology as a reference tool (Helft, 2009; Iskold, 2008). However, most of the video sharing sites available are not primarily educational (Snelson, 2008). Undeniably, there are millions of short video segments available online that can be tapped on, but allocating and identifying their educational properties pose many challenges to users. Therefore, the development of specialized video sharing sites with educational values is essential. Specialized video sharing sites can improve learning by eliminating any distractions from irrelevant contents. However, many obstacles lie ahead such as developing an online video sharing site from scratch is complex and outsourcing the development is costly. Therefore, open source products can be the potential substitutes for organisations lacking adequate funding. There are dozens of open source video sharing applications that can be downloaded from the internet, for instance phpMotion, ClipBucket, VidiScript and others. Furthermore, there are even free-hosted ready applications such as BoostCast that can be used. However, installing these products can be technically demanding – entailing expert advice or assistance. In addition, not many web-hosting services are video sharing compatible; thus, hosted ready video sharing sites such as YouTube and Google Video remains as preferable choice among users.

Digital Video and Cognition

The educational value of videos lies in its dynamic visual representation that can be used effectively to show screencast, places, implied processes, storytelling and many more benefits. They can be played silently or applied in combination with audio tracks. When used in a correct manner and combination, video's role as dynamic visual representation might be a powerful tool in enhancing teaching and learning outcome (Montazemi, 2006).

In developing digital video content for learning, teachers need to take into consideration the role and limitations of students' cognitive ability. They need to understand how videos can be used to foster learning, and they should design and develope the materials not from the teacher's perspective, which may risk losing learners' attention and engagement. Therefore, an understanding on how video presentation affects students' learning requires a depth analysis of how it is processed in the human memory structure.

Learning is a process of receiving, processing, coding, storing and retrieving information from memory structure (Lin & Dwyer, 2004). Human memory structure is divided into three processing categories namely sensory memory, short-term memory and long-term memory (Atkinson & Shiffrin, 1971; Mayer, 2001). These memories are limited in terms of capacity and duration. Therefore, not all the information entered the memory structure will be registered in long-term memory structure in schema form (Chandler, 1995). Information entered into the memory structure is processed through two different channels; visual channel that processes visual information such as picture, and verbal channel that processes verbal information such as narration and text (Paivio, 1986; Mayer, 2001). Since human memory is limited in terms of duration and capacity, placing a high cognitive load on one channel may reduce the effectiveness of presentation. By presenting material in a form that involves both channel will reduce the cognitive overload in each channel and the presentation will be more effective (Mayer, 2001). Based on this multimedia dual coding theory, video with adequate verbal support is supposed to be more effective in assisting students' cognition.

Notwithstanding the strong arguments and theoretical support, research findings on the effectiveness of digital video for learning remain inconsistent (DeVaney, 2009; Dupagne, Stacks & Giroux, 2006; Veronikas & Maushak, 2005). Some findings seem to suggest that video is only suitable as an additional tool to support students' understanding only on certain topics, and not across the entire curricula (DeVaney, 2009; Montazemi, 2006). Inconsistencies of the findings may be partly attributed to improper design of the video materials and the failures of the developers to take into consideration the limitations of human cognition in their design. For the latter, arguably many developers have failed to pay greater focus on the potential cognitive overload caused by information being presented too much and too quickly, or by the simultaneous appearance of moving elements, narration and on-screen texts in their design that may impede learning (Bell & Bull, 2010; Mayer, 2002).

Thus, this study was carried out to identify the design principles in presenting instructional video that would assist students' cognition in learning. Three main principles that were identified and employed in the design and implementation are as follows:

i. For effective pedagogy and avoiding distractions, the video segments are kept short and simple with not longer than 10 minutes (Vest, 2009a, 2009b).
ii. Utilizing user-control function that comes with the digital media players, which is essential for successive learning (Ahmad Zamzuri, 2007).
iii. Utilizing rehearsal with the replay function that comes with the digital media players for better registration of information in long-term memory (Klein, 1996; Gagne, 1985)

However, a pertinent question arises on the need of verbal support such as narration if the above-mentioned principles were to be employed in the video development and implementation. Even though the dual coding theory proposes that the inclusion of verbal element to support visual element is helpful in terms of reducing cognitive overload, the additional narration does not always support learning (Jeung, Chandler & Sweller, 1997; Fenrich, 1997). With short and simple video and utilization of user-control and rehearsal functions, the video might promote successful learning even without verbal support. Therefore, the primary objective of this study was to investigate the effectiveness of instructional video with narration and without narration in promoting and enhancing learning.

Screencast Teaching Software

It is not uncommon to hear an instructor complaining that a software application is not working or a student commenting on how an instructor does not know how to use the software (Folkestad & De Miranda, 2002), which explains why many instructors avoid using computer applications for teaching or demonstrating their lessons (Zhao & Cziko, 2001). Thus, the short video tutorials developed and shared online may be useful additional resource for teachers and students in learning software functions. Screen capture software is a perfect tool for creating these short video segments. Screen capture software such as Camstudio, Camtasia, Robodemo and others have the capability to capture movements appearing on the computer screen. Furthermore, it has the capability to include narration and text for verbal explanation of the processes involved. The compelling capabilities afforded by the software serve as a potent tool to create video segments showing critical software functions (Wulf, Kafala, Waldrop et. al., 2005; Folkestad & De Miranda, 2002). Taking cognizance of the educational potentials of the visual and verbal representations, this study was carried out that focused on examining the effects of screencast on students' learning achievement through the teaching of software functions with and without narration support.

METHOD

Research question

Based on the discussion above, the primary research question of this study is as follows:

Is there a significant difference between screencast with narration and screencast without narration on students' online learning performance?

Learning Materials

Two groups of videos consisting of six screencast series were created with Camtasia Studio screen capture software for the research. The screencast series were used for teaching Flash animation software functions which consists setting the screen properties, introduction to timeline, drawing tools, creating keyframe and frame, creating motion tween and saving the output (Figure 1). The first group comprised a screencast series without narration and the second group was the same screencast series, but included with narration. The screencast series duration ranged from one to two seconds.

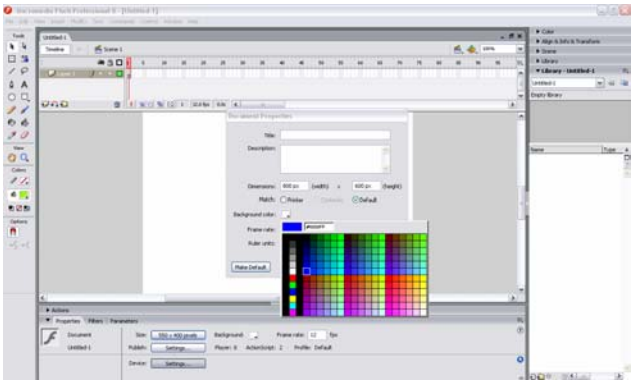

Figure 1: Screencast teaching Flash software

The screencast series developed was uploaded to two separate channels namely MOVIEDU1 and MOVIEDU2 created in YouTube (Figure 2). Two new channels were created to avoid any distraction from any unrelated videos throughout the study that may influence the learning outcome. The first channel contains screencast series without narration and the second channel contains screencast series with narration.

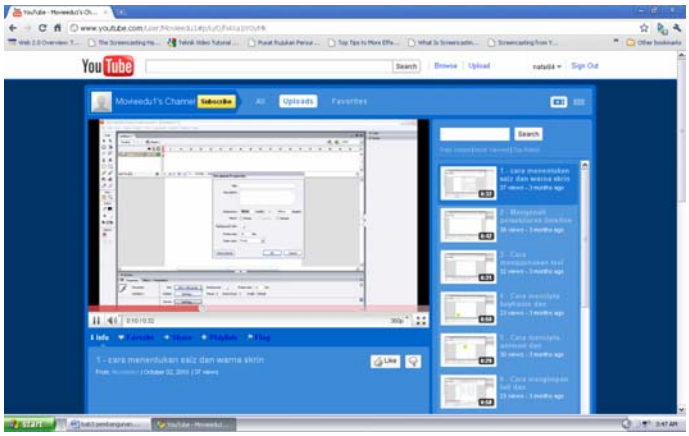

Figure 2: MOVIEDU1 channel

Test Instruments

Pre-test and post-test were used on the two groups that studied the two different screencast presentation strategies respectively. Pre-test and post-test were hands on test that required students to create an animation of bouncing ball by following the specific properties assigned. Grades were given based on how accurate students employ the required properties in their design. The pre-test was conducted before the learning process and the post-test was conducted immediately after the learning process.

Procedures

The research sample comprised 45 undergraduates drawn from two intact classes, whose ages ranged from 21 to 25 years and, enrolled in a Diploma in Education course. The study was conducted separately for both groups. Pre-test to identify students' prior knowledge consistency of the content was conducted before the study. Fifteen minutes were given for them to complete the task. Immediately after the pre-test, the two groups explored the two different screencast presentation methods that were with and without narration. They were first briefed on how to access and use the materials in the respective channels. Students were also encouraged to utilize the user-control elements in the video player throughout the study. Approximately, 30 minutes were allocated for them to complete the study. Four research assistants helped the researchers monitor the students to ensure that the latter comply with the procedures of the study. Upon the completion of the tasks, a post-test was conducted that lasted for fifteen minutes. One-way ANOVA test was used to analyze the data collected from the pre-test and post-test.

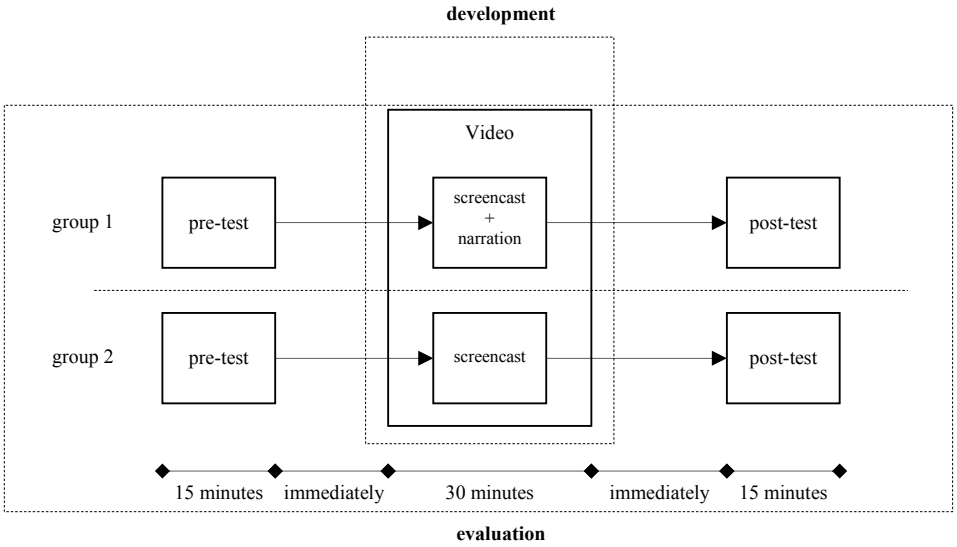

Figure 3: Research Framework

RESULTS

Consistency of prior knowledge was determined through the pre-test results. From the one-way ANOVA test, Levene's test for homogeneity of variances is not significant ($p>0.05$) and therefore the population variances for each group are approximately equal. The output shows that there is no significant difference in the pre-test achievement of students in screencast without narration and with narration strategies $F(1,43)=0.15$, $p>0.05$. This result further assured that there is no pre-existing difference in prior knowledge by group. Total mean scores of prior knowledge are also obviously low ($M=7.22$, $SD=8.57$), which is necessary for the study.

Students' achievement was determined through the post-test results. From the one-way ANOVA test, Levene's test for homogeneity of variances is not significant ($p>0.05$) and therefore the population variances for each group are approximately equal. The output shows that there is significant difference in the post-test achievement of students in screencast without narration and with narration strategies $F(1,43)=16.62$, $p<0.05$.

Mean scores indicate that students in the screencast with narration strategy ($n=22$, $M=76.14$, $SD=16.25$) obtained better mean score than those students in the screencast without narrataion strategy ($n=23$, $M=52.09$, $SD=22.65$). The results indicate that screencast with narration was better than screencast without narration in enhancing learning performance.

DISCUSSION

With the emergence of online video sharing technology, learners can have the opportunity to learn in conducive learning environments that are both visually appealing and cognitively compelling. When used appropriately and judiciously, video being a dynamic visual representation plays a potential role in assisting learning. However, it appears that research findings with regard to the effectiveness of digital video on learning have been inconsistent (DeVaney, 2009; Dupagne, Stacks & Giroux, 2006; Veronikas & Maushak, 2005). The main reason of these inconsistencies may be attributed to the design limitations particularly due to some of the developers' poor grasp on the theoretical underpinnings that may impact learners' cognition (Bell & Bull, 2010; Mayer, 2002). Keeping the video short and simple, and encouraging learners to fully utilize the control functions in the digital video player may have a positive impact; learners' cognitive overload can be minimized throughout the learning process, which is essential for successive learning. However, question arises on the need of verbal element to support the visual display of video that employs these development and implementation principles. Thus, this study has investigated the effectiveness of digital video, specifically instructional screencast teaching software with and without narration on students' achievement. The finding shows that students in the instructional screencast with narration strategy obtained better mean scores than students in the instructional screencast without narration strategy. This suggests that narration supported in the instructional screencast had been very helpful for successful learning, especially for learners with low prior knowledge in this study, which concurs with Mayer's (2001) dual-coding assumption. Screencast with narration that utilize both visual and verbal channel in the memory structure can attenuate cognitive overload resulting in effective learning as pointed out by Mayer (2001). Since this study only focused on narration as a verbal element, further study is warranted to

investigate the effectiveness of text as verbal element on learning as informed by the dual-coding assumption, specifically in the instructional screencast design.

The finding of this study that involved the learning of software functions also suggests that screencast with narration can reduce the learning duration. In the conventional condition, instructors usually needed three to four hours lab sessions to ensure the students master the respective skills. However, in this study the students were able to complete the task given within 15 minutes even with 30 minutes exploration in self-paced online learning condition. This particular finding indicates that short and simple instructional screencast, specifically with narration can be an ideal tool to support online self-paced learning, notwithstanding some of the research findings that suggest that video is only suitable as an additional tool to support students as pointed out in DeVaney (2009) and Montazemi (2006),

Another highlight of this research is that the students were able to complete the entire basic tasks as requested. However, based on the observation, they seem have some difficulty in completing motion tweening task, especially students in screencast without narration strategy. Motion tweening can be considered as complex task in learning Flash animation software, especially for students with low prior knowledge. Therefore, further study in finding design solutions in presenting complex contents in learning software also seems important.

CONCLUSION

Development of instructional screencast is relatively time-consuming. Therefore, to ensure that instructional screencast used in learning to be effective, instructional designers should ground their designs based on current research findings and theories. They should not base their designs on their own preferences, which may or may not work well. Thus, the findings from this research suggests that short and simple screencast with narration support has an advantage in promoting better learning, especially for students with low prior knowledge. This category of students is mostly not highly competent in encoding rich and complex information, as they may arguably lack refined and highly networked mental schemas that can lead to cognitive overload. Carefully crafted visual and verbal representations through narrative video serve as a cognitively compelling mechanism as complex and dynamic learning concepts can be dually represented on two complementary channels, which increase better integration with their existing mental schemas leading to meaningful learning experience – thus, a better understanding and knowledge. Further study is warranted to explore the impacts of other multimedia elements on learning particularly on the effects of text as verbal information via the promising instructional screencast design strategy. Another focus that may interest researchers is the examination of this learning tool on higher taxonomic level of cognition.

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