Gauging Student Learning Attainment through Seven Variations of Instructional Screencast Video

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ABSTRACT

This paper aims to investigate the effectiveness and the efficiency of a series of instructional screencast videos to learn a 3D modeling software. Seven variations of screencast video were developed using screen capturing software for self-paced learning among students who were taking a modeling course in the Bachelor of Design in Animation programme. A quasi-experiment was conducted in December 2014 with 35 students in a Malaysian public university. In the pre-test, all students were given similar tasks on modeling with lighting. The purpose of the pre-test was to determine if the students had prior knowledge and skills in 3D modeling. The result showed that none of the students could complete the given task, meaning that they were all fit for the quasi-experiment. Next, the students were randomly assigned to seven groups and each group of the students was given a variation of the screencast videos as treatment, while the control group was given a non-manipulated screencast video. Upon the completion of the treatment, the students were instructed to complete a modeling with lighting task which was similar but not identical to the task given in the pre-test. All students were able to complete the given task after the treatment, thus the effectiveness of all instructional screencast videos was assured. However, in terms of learning attainment, the screencast video with caption was revealed as the least efficient variation since the students spent the most average time to complete the task. Simply put, screencast video can be developed for effective learning of 3D modeling software, in which its efficiency can be enhanced by adding appropriate narration and subtitling.

Keywords: screencast video, instructional screencast, 3D modelling, learning, captions, subtitles, narration

INTRODUCTION

The emergent scope of learning with the use of communication and information technology requires educators to develop their teaching and pedagogical approaches to enhance innovation in the classroom (Rocha & Coutinho, 2010). In this sense, educators often search for effective ways to create productive learning environments (Hartsell & Yuen, 2006). One of the most efficient and effective ways to improve learning performance is by using digital technology. Educators need to be aware of the needs of Generation Y and Z due to the extensive use of digital technologies like computers and internet among students. Screencast video is a type of digital technology that can be used as an alternative learning method. In general, screencast video can be utilized as digital recording to capture action on a computer screen. In addition, screencast video is also used in demonstrating specific software applications or operating systems because screencasts often contain narration. Therefore, students and teachers can engage with the video and discuss various topics by adapting this learning approach (Helft, 2009). The usage of screencast video in educational settings is shown in Table 1.

Table 1: Usage of Screencast Video in Educational Settings

Teachers	Learners
Deliver learning contents	Presentation
Deliver demonstration	Develop tutorials
Deliver feedback	

Pros and Cons of Using Video Technology in Educational Settings

Learning through digital technologies has reached new heights in education nowadays. Educational institutions, from primary to tertiary levels have evolved from the habit of using chalkboards, notebooks and textbooks in the classroom due to the access to technologies like laptops and smart boards. Video technology is one of the digital learning methods that is popular among educators.

Video is an important element in multimedia as it adds to the impact of multimedia applications (Rozinah, 2000). The video concept is basically very similar to television broadcast, but the concept has developed dramatically

over the past six decades (Smaldino, Lowther & Russell, 2008). According to Bell and Bull (2010), digital videos created by teachers can better engage students to observe, answer questions and interpret the messages conveyed.

Video can be found in many forms, for example, video tapes, DVDs, computer-based video and online video. Segments of video are suited for use in the classroom learning environment, particularly for small groups or individual learners to discuss various topics as a reference or as learning resources (Helft, 2009). In the educational environment, educators often use video technology in teaching and learning to introduce new topics, present learning contents, or provide remedial measures for students. Table 2 shows the pros and cons of learning by using the video method.

Table 2: Pros and Cons of Learning through Video

Pros	Cons
Easier for visual learners Video used for learning purposes mostly contain visual elements while audio narration can be added as an additional element. With regard to learning, the combination of audio and visual content may allow the learner to grasp information easily.	**Requires equipment** Learning through video requires equipment like speakers or headsets, computers or laptops, keyboards and mouse.
Flexible learning Video learning allows playback features which may help learners to pause, rewind and stop.	**Limited for editing** Video is normally linear and once created it will take a longer time to edit for corrections.
Portable Video technology makes learning materials portable, enabling learners to experience lessons anywhere and at any time they desire.	

Using Screencast as Educational Video Technology

Screencast video is a learning tool often used in the teaching and learning environment. Screencast can be defined as digital recording that records all activities demonstrated by the instructor on a computer screen (Betty, 2008). In addition to video, screencast is able to record audio track which consists of the output sound from the computer when the screen is

being recorded. Besides, external sources like music and audio narration may be used to replace the output audio track. According to Peterson (2007), the combination between screencast and audio track could explain the action demonstrated by the instructor.

Screencasting software is a tool for creating screencast video. It is necessary for an instructor to determine which screencasting software is suitable for creating instructional videos. There are various types of screencasting software which can be used in screencast development for example, Jing, Screencast-O-Matic, Camtasia, and Adobe Captivate. In this study, the free version of Screencast-O-Matic was chosen to produce seven screencast video with the playback length of less than 15 minutes. The screencast video can be published into certain file formats for example, Audio Video Interleaved (AVI), animated Graphics Interchange Format (GIF), Motion Picture Expert Group 4 (MP4) and Flash Video (FLV).

Screencast video is a form of digital learning that enhances learners' achievement. Pinder-Grover, Millunchick and Bierwert (2008) used a screencast video to enhance students' learning performance in science and engineering, in which the majority of the participants agreed that the use of screencast video in their study helped them to understand certain concepts. Participants also reported that they learned more and had a better understanding as compared to other forms of teaching materials.

In addition, a survey conducted by Mullamphy, Higgins, Belward and Ward (2010) found that more than half the respondents in their study, agreed that screencast video was a very useful learning tool, compared to only 1% of respondents who felt that screencast video was less useful or useless to them. This is a significant positive change compared to 15 years before that when Folkestad and DeMiranda (2002) revealed only a slight increase in terms of understanding, when compared to students who used the textbook. Apart from the technological change over time, the increment of positive attitude towards the use of screencast video could have resulted from the heightened consideration for students' cognitive ability in the design of a multimedia application, which was an issue raised by Sweller (2010) in the past. To address this issue, Mayer (2001) presented a theory of multimedia learning for creating effective multimedia presentations that combine visual and verbal information.

Meanwhile, with reference to Mayer's theory, Veronikas and Maushak (2005) carried out a study to examine the effectiveness of using audio narration in instructional screencasts. They claimed that there are no significant differences between students who use screencast with both text and narration and students who use screencast that only contains either text or narration. Likewise, DeVaney (2009) who studied the effects of online video tutorials discovered no significant differences in terms of students' academic performance after using various types of instructional video. Nevertheless, both studies claimed that students showed a positive attitude towards instructional video screencasts. In contrast, Ahmad et. al's study (2011) indicated a significant difference between screencast with narration and without narration. Moreover, this study revealed that screencast with narration is not only effective but also efficient for enhancing students' learning performance. This study intends to examine the effectiveness and efficiency of using screencast video in learning 3D modeling software, in order to uncover any statistically significant difference among seven types of instructional screencasts.

METHODS

A quasi-experimental study was conducted to compare the effectiveness and efficiency of seven variations of screencast video on student learning attainment. This study involved 35 undergraduates who were taking MMG3083 Modeling course during Semester 1 of the 2014/2015 Session in the Animation Laboratory of the Faculty of Art, Computing and Creative Industry in Universiti Pendidikan Sultan Idris (UPSI). The students were in their fifth semester of the Bachelor of Design in Animation with honours programme. The participants comprised 22 female and 13 male students, ranging between 22 to 27 years old.

Two measurements for successful use of the screencast video were used in this study, i.e. if the students knew how to complete the given modeling task, and the time consumed by individual participants in the post-test in completing the task. The total duration of the quasi-experiment was around 120 minutes.

In the pre-test, all participants were given a task to set up lighting for a 3D model in half an hour. The test was carried out to verify whether the participants had prior knowledge and skills in modeling and lighting. None of the 35 participants demonstrated possession of prior knowledge or skills, thus qualifying them to take part in this study. Next, the participants were randomly assigned into seven groups of five people, i.e. one control group and six experimental groups.

In the treatment, each group was given one out of seven types of screencast video: screencast with captions, screencast with narration, screencast with subtitles, screencast with captions and subtitles, screencast with captions and narration, screencast with narration and subtitles, and screencast with narration, captions and subtitles (see Figure 1). All participants were required to watch the screencast video for 30 minutes through intranet to ensure there was no lagging of video screening.

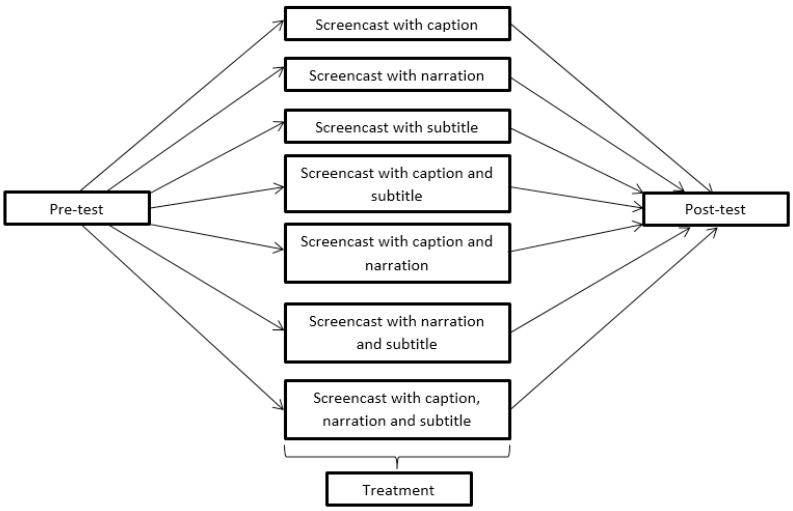

Figure 1: Pre-Test, Treatment and Post-Test

In the post-test, the participants were given half an hour to complete a modeling with lighting task that required the same level of knowledge and skills as the task given in the pre-test. After that, participants were given a post-test within 35 minutes. The task provided to the participants during the post-test differed slightly from that given during the pre-test. The duration

of time used by every participant to finish the post-test task was recorded. The data collected from this study were analyzed using SPSS.

FINDINGS

The results of the post-test were analyzed using Kruskal-Wallis tests and Mann-Whitney U tests to compare the medians of seven variations of screencast video, i.e. to identify significant differences if any, in the participants' performance based on the seven variations of screencast video used. The findings of this study were divided into four sections i.e. difference in terms of median among the seven variations of screencast video, difference between screencast with captions and screencast without captions, difference between screencast with narration and screencast without narration and difference between screencast with subtitles and screencast without subtitles. The data collected in the post-test was tested using Kruskal-Wallis and Mann-Whitney U tests.

Difference between Seven Variations of Screencast Video

The average time spent by 35 participants in the post-test to complete the given task was 17 minutes and 29 seconds, in which the median score was 17 minutes across all seven variations of screencast video. The differences between the efficiency of participants in completing the given task using seven variations of screencast video were compared in Table 3. The comparison was further analyzed using Kruskal-Wallis tests, but no significant difference was found in the medians, $X^2(6, N=35) = 6.69, p = .35$.

Table 3: Time Spent by Each Group of Participants to Complete the Given Task

Type of Screencast Video	N = 35	*Median* (minute)	*Mean* (minute: second)	*Standard Deviation* (minute: second)
With narration (control group)	5	15	16:36	10:29
With captions	5	20	18:12	7.07
With subtitles	5	11	14:24	7:04
With captions and subtitles	5	15	18:36	10:23
With captions and narration	5	18	20:36	6:50
With narration and subtitles	5	11	11:36	5:47
With captions, narration and subtitles	5	23	22:24	4:02

Differences between Screencast with Captions and Screencast without Captions

Four of the seven variations of screencast video were created with captions (screencast with captions only, screencast with captions and subtitles, screencast with captions and narration, and screencast with captions, narration and subtitles), while the other three were prepared without captions (screencast with narration only; screencast with subtitles only, and screencast with narration and subtitles). A Mann-Whitney U test revealed a significant difference in the duration of time spent to complete the given task between screencast with captions (Md = 20; Mean = 19:57; n = 20) and screencast without captions (Md = 11; Mean = 14:12; n = 15), U = 85.0, z = -2.170, p = .03, r = .37.

Difference between Screencast with Narration and Screencast without Narration

Four of the seven variations of screencast video were created with narration (screencast with narration only, screencast with narration and

subtitles, screencast with captions and narration, and screencast with captions, narration and subtitles), while the other three were prepared without narration (screencast with captions only; screencast with subtitles only; and screencast with captions and subtitles). A Mann-Whitney U test revealed no significant difference in the duration of time spent to complete the given task between screencast with narration (Md = 17; Mean = 17:48; n = 20) and screencast without narration (Md = 19; Mean = 17:04; n = 15), U = 139.5, z = -.350, p = .726, r = .06.

Difference between Screencast with Subtitles and Screencast without Subtitles

Four of the seven variations of screencast video were created with subtitles (screencast with subtitles only, screencast with narration and subtitles, screencast with captions and subtitles, and screencast with captions, narration and subtitles), while the other three were prepared without subtitles (screencast with captions only, screencast with narration only, and screencast with captions and narration). A Mann-Whitney U test revealed no significant difference in the duration of time spent to complete the given task between screencast with subtitles (Md = 15; Mean = 16.45; n = 20) and screencast without subtitles (Md = 18; Mean = 18:28; n = 15), U = 136.00, z = -.350, p = .64, r = .08.

DISCUSSION

The pre-test of this study showed that students were not able to complete the modelling with lighting setup task for a 3D model. In other words, none of the students were able to complete the given task before going through the formal learning session. Therefore, knowledge and skills are essential for students to set up lighting for any 3D model. This means any variation of screencast video would be useful to enhance learners' learning outcomes in 3D modeling lessons, although no statistical significant difference was found across the seven types of screencast video in terms of efficiency.

However, when a comparison was made between screencast with captions and screencast without captions, the findings showed that captions

superimposed on the screencast video actually decreased the efficiency of learning 3D modeling software, particularly in setting up lighting for the 3D model. This could be an example of multimedia overload, in which the short-term memory of learners became overloaded with captions, leading to counter-efficiency in completing the given task.

CONCLUSION

In this study, all seven variations of screencast video were found to be effective for learners who had no prior knowledge and skills to complete a 3D modeling with lighting task. The participants' knowledge and skills transformed from incapable to capable of completing the task after using the seven variations of screencast video. In conclusion, the use of screencast video is effective for learning 3D modeling software, with or without narration, captions and subtitles.

In terms of efficiency, the screencast video with captions was found to be less efficient in getting learners to complete a 3D modelling task, as compared to screencast video without captions. Thus, captions should be only used when it is necessary to avoid multimedia overload.

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