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Student Perceptions on Watching Learners-produced Screencast Videos in Learning Mathematics

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Abstract

The purpose of this study was to examine the relationships of learners' perceived intention, strategies, design, learning platform and effectiveness of watching the learners-produced screencast videos. In addition, the predictors of screencast video as an effective learning tool were also explored in the present study. A survey was administered to engineering undergraduates who used learners-produced screencast videos to supplement their learning in mathematics. The findings indicated that learners mainly use screencast videos for understanding some difficult concepts, prefer to watch screencast individually, favour the feature of highlighting important concepts and able to clearly understand the explanation provided by peer through voice narration in screencast videos. Correlational analysis indicated high statistically significant relationships between learners' perceived intention and perceived effectiveness of screencast videos as well as between perceived learning platform and perceived effectiveness of screencast videos. In addition, learners' intention to use screencast videos was identified as the most critical factor which significantly predicted learners' perceived effectiveness of the approach. Potential implications of the findings and recommendations for future research were discussed in this study.

Keywords: Perceptions, Screencast, Videos, Undergraduates, Mathematics

Introduction

Education nowadays tends to shift rapidly towards the latest technological trends. More and more education institutions start to embrace the transformation of learning delivery by incorporating technology approaches into education. Thus, the concept of blended learning has been gaining popularity (Graham, 2006; Dziuban et al., 2006). Blended learning can be defined as the combination of face-to-face classroom instructions and online learning activities (Garrison & Kanuka, 2004; Osguthorpe & Graham, 2003). Effective use of blended learning offers the advantages such as increasing flexibility and accessibility to learners (Graham, 2006; Collopy & Arnold, 2009) engaging learners with high level autonomy (Osguthorpe & Graham, 2003) and potentially enhancing student learning outcomes (Boyle et al., 2003; Lim & Morris, 2009). Examples of instructional activities in blended learning

include online forum or discussions boards, video recordings, online quizzes and live streaming lecture. Nevertheless, the most common pedagogical approach used in the implementation of blended learning is using video as a tool of instruction. There are various instructional videos, applications and purposes of using videos in blended approach.

In this study, we focus on the medium of screencast videos. A screencast is a digital recordings of computer screen with the output of a digital video with audio narration (Green & Millunchick, 2012). The screencast videos uploaded in Learning Management System were used to supplement course materials. The videos were designed to explain or demonstrate the steps in solving mathematics problems to deepen the learners' understanding of the subject. Looking at the importance of screencast video as an instruction tool, this study aims to provide insights on how learners utilize screencast in their learning and their perceptions of the approach in learning mathematics.

Literature Review

Worked examples have been regarded as an effective medium of instruction in education over the years. Commonly, instructors perform and explain examples to learners before they could grasp the concepts especially in solving mathematics problems which involve procedural learning. Worked examples typically consist of a problem state and the goal state which demonstrates the steps-by-steps solutions for a problem (Atkinson et al., 2000). Although worked examples have advantage to enhance learning by directing learners to focus on the problem and solution steps, however it is important to design the worked example to optimize the learning process. Typical worked examples could be a product of problem formulation and full solution in the form of printed text in textbook or a digital document. However, text examples may not be effective when compared to examples presented with a simultaneous combination of text and pictures (Mayer, 2009). In addition, learners also learn better if spoken words are used rather than printed text as stated in modality principle (Mayer, 2009).

In the current study, screencast videos were used as a medium of worked examples. Prior research revealed that learners favour the use of screencast videos in learning (Mullamphy et al., 2010). Screencasts have been used in different subjects such as mathematics (Mullamphy et al., 2010), statistics (Lloyd & Robertson, 2012), engineering (Green & Millunchick, 2012; Falconer et al., 2009) and accounting (Wakefield et al., 2011). This instructional approach is student-centered as learners have full controls such as playing, rewinding and pausing the videos during their learning of the contents. In addition, learners can review the videos multiple times as needed (Mullamphy et al., 2010). As a result, it enhances learner's academic performance in the course (Green & Millunchick, 2012; Lloyd & Robertson, 2012). Previously, most of the screencast videos were produced by instructors instead of learners. In the recent years, the trend of screencast has shifted to student generated screencast (Wakefield et al., 2011; Esgi, 2014; Zhang, 2015). The research generally indicated that students who generate screencast videos perform better than their peers who do not generate screencast or those who use the screencast videos prepared by their instructors. In other words, screen casting by learners facilitate learners' academic performance and engagement with the course contents in the videos.

The screencast videos in this study were developed by learners and were used as the worked examples to their peers in learning new mathematics concepts. The audio narration acted as

an instructional explanation where the producer of screencast explains the underlying concept of step by step solution while recording the writing of the working solution. In this way, learners could be directed to focus on the steps while listening to the explanation which enhance their understanding. Screencast video was designed with a duration of not more than five minutes to cope with the learners' short attention span and inability to process too much information due to limited working memory capacity (Miller, 1956). Moreover, screencast video in fact fulfils the cognitive theory of multimedia learning (Mayer, 2009). According to the theory, people learn better from dual-channel (visual and audio form) and due to the limited capacity in each channel, learners actively learn by selecting, organizing and integrating information from the multimedia with their existing knowledge.

On the other hand, social presence or the sense of being connected with others might be a crucial factor to enhance learning. In fact, there was a correlation between social presence and student perceived learning (Richardson & Swan, 2003). In addition, multimedia with narration spoken in human voice was considered more effective when compared to explanation in machine voice as stated in voice principle in multimedia learning (Atkinson et al., 2005). Learners might feel the sense of belonging while hearing the explanation by their peers in videos. Furthermore, listening to peers' audio narration in video may lead to better understanding as the learners have similar level of mathematics background. In this way, engaging expert learners to teach novice learners through screencast videos might be a potential way to enhance learning for both explainer and listener.

Students can learn through multiple ways and their learning styles may influence their intention and strategies in using screencast videos as their learning tools. For instance, screencast videos could accommodate students who are visual and auditory learners (Mayer, 2009). In contrast, some learners prefer not to watch screencast videos as they perceive the approach requiring commitment of time (Green & Millunchick, 2012). In addition, some other learners may prefer to personalize their learning by watching screencast videos individually when learning. In summary, screencast videos could assist learners with diverse needs, learning background, skills and learning styles despite their preferences in learning.

Research Questions

As to date, there is a lack of studies on learners' perceptions in connection with the effectiveness of using learners-produced videos. As a result, this study aims to investigate constructs related to the mentioned approach in terms of perceived intention, strategies, design, learning platform and effectiveness. The present study examines how students' perceptions toward the constructs are related. It also identifies the factors which contribute to the effectiveness of using learners-produced videos as a learning tool. The research questions for the study are stated below:

1. What are the students' perceptions in watching learners-produced screencast videos from the perspectives of intention, strategies, design, learning platform and effectiveness?
2. What are the relationships among students' perceived intention, strategies, design, learning platform and effectiveness?
3. What are the factors contributing to students' perceived effectiveness by watching learners-produced screencast videos?

Methodology

The population in the study comprised of 82 undergraduates enrolled in Engineering Mathematics 1 in Semester 2 of year 2016. All participants were exposed to three learners-

produced screencast videos regarding mathematics concepts. The screencast videos explained the step by step solutions on how to solve some mathematics concepts with human voice narration. At the end of the semester, each participant was invited to fill in an anonymous survey form to express their preferences and opinions regarding learners-produced screencast videos. The survey had a total of 24 questions with a 5-point Likert scale (ranging from 1 strongly disagree to 5 strongly agree). Response with a higher score indicated more satisfaction to a certain survey item. The five constructs in the survey included intention, strategies, design, learning platform and effectiveness of learners–produced screencast videos. The survey items comprised of items adopted from prior study (Green & Millunchick, 2012; Okwori et al., (2013); Juhmani (2018) and customized items sourced from various literature.

Results and Discussions

The findings were shown in the following descriptive statistics tables, in response to the first research question. Table 1 to Table 5 displayed the mean and standard deviations for the five constructs in the survey. The italicized number indicated the highest mean in the respective construct. The item with the highest mean among all survey items was presented in Table 3 where learners strongly agreed that "highlight important concepts" is an essential element in the design of screencast videos. On the other hand, the item with the lowest mean among all survey items was from Table 2 where learners disagreed that they will "watch all screencast videos" as a strategy to learn. In line with the literature (Mullamphy et al., 2010; Ronoh (2018), most learners will only choose to watch relevant topics or target specific sections which they find them more challenging in screencast videos.

The findings in Table 1 indicated that most of the participants agreed that their main intention to use screencast videos was to understand difficult concept (*M*=3.95; *SD*=1.06). In addition, majority of the participants also intended to use screencast as a supplement to study (*M*=3.80; *SD*=0.91). In contrast, the item with lowest mean in Table 1 was "test/exam study tool" (*M*=3.45; *SD*=1.15). This indicated that learners favoured the use of screencast videos for the purpose of learning more than improving their grades in test or examination. This was evidenced with higher perception scores for items in the construct of intention such as "understand difficult concept", "supplement to study" and "quick revision" and lower perception scores of intention items of "solving assignment problems" and "test/exam study tool".

Table 1:
Descriptive Statistics for Intention

Items	Mean(SD)
1. Quick revision	3.77(1.13
2. Test/exam study tool	3.45(1.15
3. Solving assignment problems	3.60(1.03
4. Supplement to study	3.80(0.91
5. Understand difficult concept	*3.95*(1.06
The overall average score	3.72(1.06

Table 2 showed the strategies that students used to watch screencast videos. The findings revealed that most of the participants preferred to watch screencast videos by themselves (*M*=3.98; *SD*=0.95) followed by watching screencast while studying (*M*=3.86; *SD*=1.01). Screencast video provides a high level of learner control, thus participants benefited from the flexibility and accessibility to view the videos at their own time and pace (Mullamphy et al., 2010). Hence, this instructional approach encouraged the participants to personalize their learning. Learners gained deeper understanding about the concept while studying via watching the screencast repeatedly by themselves (Mullamphy et al., 2010). However, students did not prefer to watch all the screencast videos provided to them (*M*=3.17; *SD*=1.12). This might due to lack of time to watch all the videos or did not have the needs to watch screencast videos if they already understood the concept or problem (Green & Millunchick, 2012).

Table 2:
Descriptive Statistics for Strategies

Items	Mean(SD
1. Watch all screencast videos	3.17(1.1
2. Watch certain sections repeatedly	3.50(1.0
3. Target on specific part for viewing	3.81(0.8
4. Try the problem after watching	3.74(1.0
5. Watch screencast by myself	*3.98*(0.9
6. Watch screencast when studying	3.86(1.0
The overall average score	3.68(1.0

Table 3 indicated that majority of the participants favoured the feature of “highlight important concepts” (*M*=4.31; *SD*=0.82) followed by the “digital handwriting solutions” (*M*=3.94; *SD*=0.94) in the design of screencast videos. These two features could be explained according to signaling principle (De Koning et al., 2009). Signaling or cueing intended to capture learners’ attention to essential component rather than irrelevant information in multimedia resource. In this way, learners could devote lesser cognitive load to process the information and allow learners to internalize the content knowledge. On the other hand, the lowest mean score for the design of screencast was the item of “length of screencast videos” (*M*=3.33; *SD*=0.99). As expected, results revealed that shorter screencast videos were more engaging to learners. In addition, learners preferred to watch short videos due to their attention span is short.

Table 3:
Descriptive Statistics for Design

Items	Mean(SD
1. Visual elements	3.70(0.8
2. Voice narration of explanation	3.66(1.0
3. Digital handwriting solutions	3.94(0.9
4. Highlight important concepts	*4.31*(0.8
5. Length of screencast videos	3.33(0.9
The overall average score	3.79(0.9

Table 4 showed the descriptive statistics for using learners-produced screencast video as a learning platform. Beyond our expectations, the item of "motivating to learn through peer constructed videos" had the lowest mean (*M*=3.43; *SD*=0.90). Contrarily, prior research (Deci, 1992) revealed that supportive relationships with peers motivate learners to engage in learning and thus facilitate academic achievement. This could be explained that the degree of peer influence through watching screencast video was somewhat not strong when compared to face-to-face interactions. Learners might not sense the peer interaction or social support as they could not obtain live feedback and engage with the explainer from the video. In spite of this, the effect of watching peer produced screencast videos could not be ignored as learners claimed that they were able to learn from the explanation conveyed to them through narration in videos. This was evidenced from the highest mean score from the item "clearly understand what peers trying to explain" (*M*=3.77; *SD*=0.79). The rationale is that the more capable peer scaffolded their less capable peer by elaborating learning concepts which aligned with learner's existing knowledge.

Table 4:
Descriptive Statistics for Learning Platform

Items	Mean(SD
1. Like to watch peer constructed video	3.52(0.9
2. Clearly understand what peers trying to explain	*3.77*(0.7
3. Opportunities to explore my thinking	3.51(0.7
4. Motivating to learn through peer constructed	3.43(0.9
The overall average score	3.56(0.8

Table 5 illustrated the analysis of the items for the construct of effectiveness in watching learners-produced screencast videos. The lowest mean score for effectiveness of screencast videos was for the item of "build my confidence in solving relevant topic" (*M*=3.52; *SD*=1.03). Self-confidence is defined as a person's perceived capability to perform a certain task. In fact, self-confidence was said to be correlated with learners' motivation and learning performance (Bandura, 1986). One way to induce self-confidence among learners is through the observation of how other people with various characteristics successfully demonstrated proficiency with the task (Bandura, 1986). In particular, learners will have the conviction to perform the similar task from observational learning and subsequently boost their self-confidence. In line with our predictions, it was found that learners highly perceived that screencast videos help them to understand the concepts clearly (*M*=3.98; *SD*=0.78) and

enhance their competency in solving relevant topic (*M*=3.78; *SD*=0.86). However, it seems that the modelling effects exhibited through watching learners-produced screencast videos did not apparently contribute to the learners' confidence.

Table 5.
Descriptive Statistics for Effectiveness

Items	Mean(SD
1. Enhance my competency in solving relevant	3.78(0.8
2. Build my confidence in solving relevant topic	3.52(1.0
3. Improve my retention of the topic	3.71(0.9
4. Help me to understand concepts clearly	*3.98*(0.7
The overall average score	3.75(0.9

In order to address the second research question, correlation coefficients were calculated to find the relationships among students' perceived intention, strategies, design, learning platform and effectiveness in watching screencast videos. Table 6 revealed that all the variables were significant correlated with each other. The highest correlations (r = 0.74, p < 0.001) arose between intention and effectiveness, implying that students who reported high intention to use screencast videos tended to perceive the approach as effective. In addition, learners' response on learning platform was also highly correlated with the effectiveness of screencast video in learning (r = 0.72, p < 0.001). This correlation indicated that participants with high agreement about screencast videos as a learning platform tended to perceive the approach as effective. The lowest Pearson correlation coefficient value was found between intention and design (r = 0.52, p < 0.001), indicating that participants' intention to use screencast videos was not highly associated with their perceptions regarding the design of the videos.

Table 6:
Correlation Analysis among the Variables

Variables	Strategie	Design	Learning	Effectiveness
1. Intention	0.66*	0.52*	0.63*	0.74*
2. Strategies		0.57*	0.66*	0.65*
3. Design			0.63*	0.57*
4. Learning				0.72*

**p < 0.001*

The results of the regression analysis in Table 7 were used to answer the third research question. All the independent variables were significantly contributed to the effectiveness of screencast videos. Intention (F(1, 84) = 99.78, p < 0.0001) to use screencast videos was the most significant predictor which contributed a 54% of the variance (R^2 = 0.54) in the effectiveness of screencast videos. This was followed by the learning platform which accounted for approximately 52% of the variance in the effectiveness of screencast video. On the other hand, strategies (F(1, 84) = 63.07, p < 0.0001, R^2 = 0.43) and design (F(1, 84) = 40.00, p < 0.0001, R^2 = 0.32) also moderately contributed in predicting the effectiveness of screencast videos.

Table 7:
Regression Results of Predicted Relationships among Variables

Dependent variable	Independent variables	R^2	*p*
Effectiveness	Intention	0.5429	<0.0001
	Strategies	0.4289	<0.0001
	Design	0.3226	<0.0001
	Learning platform	0.5204	<0.0001

The internal reliability of the five variables were presented in Table 8. The results indicated that Cronbach's coefficient alpha value for the variables generally was about 0.70 with the three variables (intention, learning platform and effectiveness) scoring higher than 0.80. This revealed a general satisfactory of the reliability for the variables in the study.

Table 8:
The Reliability Analysis Table

Variables	Cronbach coefficient
1. Intention	0.893
2. Strategies	0.741
3. Design	0.684
4. Learning	0.843
5. Effectiveness	0.870

Conclusions

The findings in this study extended our knowledge regarding learners' perceptions of the variables (intention, strategies, design and learning platform) on the effectiveness of learners-produced screencast videos in learning mathematics. To be specific, the findings revealed that majority of the learners use screencast videos to learn difficult concepts, prefer to watch screencast individually, favour the feature of highlight important concepts and able to understand the explanation provided in the learners-produced screencast videos. Besides, the results revealed that all the variables were significantly correlated with each other. Most notably, there was a high and significant correlation between intention with the effectiveness of screencast videos as well as the learning platform with the effectiveness of screencast videos. Moreover, all independent variables were identified as significant predictors of the effectiveness of screencast videos with intention appeared to be the strongest predictor.

In general, it is safe for us to assume that learners' intentions to use certain instructional approach were mainly driven by their motivation to enhance their academic achievement. In fact, intrinsic motivation played a significant role in academic performance (Richard & Deci, 1985). The rationale is that learners demonstrate high level of satisfaction when they accomplish performance goals in academic.

This study contributed to the literature by providing new information on how students learn mathematics through peer explanation with worked examples created through screencast technology. From another point of view, the findings revealed that most learners acknowledged that this new technological approach suits their learning styles (visual and audio) as indicated by their preferences. This awareness of learning styles could help students

to develop the ability to learn. In short, the learners will have the potential to improve their mathematics learning by using this new technology approach. The understanding of this learning process is crucial to improve instructional decisions in future.
The findings also revealed that despite learners strive to succeed academically through watching screencast videos, they also demonstrated their appreciation towards the learning process more than just achieving better grades. This implied that learners might prefer other learning strategies which lead them to achieve better grades academically. Thus, this information has a particular value for educators to identify learners' needs and employ differentiated instructional methods at different stages of learning to support learning.

In future, further studies are needed to enhance the learners' motivation, peer influence and design of screencast videos to promote learners' engagement. This can be achieved through interventions such as designing interactive screencast videos by integrating questions and practice exercise, involving learners to participate in the creation of videos, demonstrating how the concept in videos are relevant to learners' real life situation, enhancing learners' self-confidence through positive reinforcement from peers and breaking the learning tasks in videos into chunks to sustain learners' attention. Insights from these areas might have significant implications to improve education practice.

In conclusion, this study would be beneficial to mathematics educators who would like to reflect and improve their teaching pedagogy by using technology in their subject. To the future researchers, this study can provide baseline information on the acceptance and preferences of undergraduate students in using peers created screencast videos in learning mathematics locally in Malaysia and also internationally. Moreover, future research could lead to evaluate the effectiveness of the approach in other disciplines throughout different level of studies and nations.

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References

Atkinson, R. K., Derry, S. J., Renkl, A., & Wortham, D. (2000). Learning from examples: Instructional principles from the worked examples research. *Review of educational research*, *70*(2), 181-214.

Atkinson, R. K., Mayer, R. E., & Merrill, M. M. (2005). Fostering social agency in multimedia learning: Examining the impact of an animated agent's voice. *Contemporary Educational Psychology*, *30*(1), 117-139.

Bandura, A. (1986). *Social foundations of thought and action*. Englewood Cliffs, NJ, US: Prentice-Hall, Inc.

Boyle, T., Bradley, C., Chalk, P., Jones, R., & Pickard, P. (2003). Using blended learning to improve student success rates in learning to program. *Journal of educational Media*, *28*(2-3), 165-178.

Collopy, R., & Arnold, J. M. (2009). To blend or not to blend: Online-only and blended learning environments. *Issues in Teacher Education*, *18*(2), 85-101.

De Koning, B. B., Tabbers, H. K., Rikers, R. M., & Paas, F. (2009). Towards a framework for attention cueing in instructional animations: Guidelines for research and design. *Educational Psychology Review*, *21*(2), 113-140.

Deci, E. L. (1992). *The relation of interest to the motivation of behavior: A self-determination theory perspective.* Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Dziuban, C., Hartman, J., Juge, F., Moskal, P., & Sorg, S. (2006). Blended learning enters the mainstream. In *The handbook of blended learning: Global perspectives, local designs* (195, pp. 206). San Francisco.

Esgi, N. (2014). Comparisons of effects of student and teacher prepared screencasts on student achievement. *European Scientific Journal*, *10*(22), 1-6.

Falconer, J. L., deGrazia, J., Medlin, J. W., & Holmberg, M. P. (2009). Using screencasts in ChE courses. *Chemical Engineering Education* (*CEE*), *43*(4), 302-305.

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The internet and higher education*, *7*(2), 95-105.

Graham, C. R. (2006). Blended learning systems. In *The handbook of blended learning: Global perspectives, local designs* (pp. 3-21). San Francisco.

Green, K. R., Pinder-grover, T., & Millunchick, J. M. (2012). Impact of screencast technology: Connecting the perception of usefulness and the reality of performance. *Journal of Engineering Education*, *101*(4), 717-737.

Juhmani, O.I. (2018). The Effectiveness of Audit Committee on Curbing Earnings Management Practices - pre and post - BCGC 2011: Further Look, International Journal of Academic Research in Accounting, Finance and Management Sciences 8 (2): 250-258.

Lim, D. H., & Morris, M. L. (2009). Learner and instructional factors influencing learning outcomes within a blended learning environment. *Journal of Educational Technology & Society*, *12*(4), 282-293.

Lloyd, S. A., & Robertson, C. L. (2012). Screencast tutorials enhance student learning of statistics. *Teaching of Psychology*, *39*(1), 67-71.

Mayer, R. E. (2009). *Multimedia learning (2nd ed.)*. New York, Cambridge University Press.

Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological review*, *63*(2), 81.

Mullamphy, D. F., Higgins, P. J., Belward, S. R., & Ward, L. M. (2010). To screencast or not to screencast. *Anziam Journal*, *51*, C446-C460.

Osguthorpe, R. T., & Graham, C. R. (2003). Blended learning environments: Definitions and directions. *Quarterly review of distance education*, *4*(3), 227-33.

Richard, M. R., & Deci, E. (1985). *Intrinsic motivation and self determination in human behaviour*. New York, Plenum.

Richardson, J., & Swan, K. (2003). Examing social presence in online courses in relation to students' perceived learning and satisfaction. *Journal of Asynchronous Learning Networks*, *7*(1), 68-88.

Ronoh, R. K. (2018). Adequacy of Safety Procedures and Infrastructure for School Safety in Kenya. International Journal of Academic Research in Progressive Education and Development, 7(3), 401– 413.

Wakefield, J. A., Frawley, J. K., Dyson, L. E., Tyler, J. V., & Litchfield, A. J. (2011). Increasing student engagement and performance in introductory accounting through student-generated screencasts. In *Accounting and Finance Association of Australia and New Zealand Conference*. *AFAANZ*.

Okwori, R. O., Adamu, M. M., & Moses, O. I. (2013). Evaluation of Practical Skills Possessed by Woodwork Graduates of Technical Colleges in Niger State, Nigeria. *Multilingual Academic Journal of Education and Social Sciences*, *1*(2), 73–82.

Yang, I., & Theng, L. B. (2020). Student Perceptions on Watching Learners-produced Screencast Videos in Learning Mathematics. *International Journal of Acdemic Research in Progressive Education and Development*, *9*(1), 39–51.

Zhang, D. (2015). Exploring the impact of peer-generated screencast tutorials on computer-aided design education. *age*, *26*, 1.