

ORIGINAL ARTICLE**EFFECT OF DIFFERENT TYPE OF CAPTIONING IN VIDEO TUTORIAL ON USERS' LEARNING PERFORMANCE**

Mohd Farhan NAZMI¹, Ammar ADNAN¹, Radin Zaid RADIN UMAR², Siby SAMUEL³, Norhashimah MOHD SHAFFIAR¹, Mohd Hanafi ANI¹, Malek HAMID^{1,*}

¹Department of Manufacturing and Materials Engineering, Faculty of Engineering, International Islamic University Malaysia, Kuala Lumpur, Malaysia

²Faculty of Manufacturing Engineering, Universiti Teknikal Malaysia Melaka, Melaka, Malaysia

³Department of System Design Engineering, University of Waterloo, Ontario, N2L 3G1, Canada

* Corresponding Author: abdmalek@iium.edu.my

ABSTRACT

Captioning is a process of converting an audio portion of video production into text, which normally shown on a display screen. The use of video tutorial caption is one of the contributing factors for the success or failure of a video tutorial on learning performance. However, in the video tutorial for engineering machinery, it is still unclear how different type of captioning - full, partial, and no caption - may affect users' learning performance. The objectives of the study are: (i) to evaluate the effect of full caption, partial caption, and no caption of machine's video tutorial on users' learning performance; (ii) to evaluate the effect of full caption, partial caption, and no caption of machine's video tutorial based on particular part of the video - safety, equipment, procedure, and housekeeping - on users' learning performance. Twenty-four participants were randomly assigned into three different groups, namely Full Caption, Partial Caption, and No Caption, and they were stimulated with four video tutorials (of four engineering machinery - that used the full caption, partial caption, and no caption respectively). After the video tutorial session, participants were assessed with quizzes that covered the content of the tutorials. In overall, participants performed the best when partial caption video was used ($M = 38.25$, $SD = 2.96$) than when the full caption video ($M = 33.88$, $SD = 2.99$) or no caption video ($M = 28.5$, $SD = 4.99$). The differences are significant different at $p < 0.001$ [$F(2, 21) = 13.4$, $p < 0.001$]. Comparing the performance by criteria (safety, equipment, procedure, and housekeeping), the results reveal that there are significant differences in all conditions except for safety criteria. In safety criteria; partial caption video ($M = 7.38$, $SD = 1.06$), full caption video ($M = 7.00$, $SD = 0.93$) and no caption video ($M = 6.38$, $SD = 1.06$) are not significant different [$F(2, 21) = 1.971$, $p < 0.0164$]. This is due to the caption used, which included captions that were too short or contain only one word, thus make no different despite the type of captioning. The results from this study provide additional information regarding the use of partial caption in the video tutorial for engineering machinery, in which it improves the users' learning performance.

Keywords: Captioning, Video Tutorial, Learning Performance

INTRODUCTION

It is known that listening is an important capability of social interaction, people receive new message more efficiently via listening than reading. However, videos embedded with captions or subtitle are helpful for users in the learning process. Video tutorial is a visual recording of step by step instructions that can be referred by users to complete a certain designated task. Using videos or films as a learning resource has received a great deal of attention from researchers and has been successfully applied to various educational applications (Yang et al., 2009). Previous studies have shown that such videos are highly accepted by learners during the learning process (Choi & Johnson, 2005; Choi & Johnson, 2007).

Researchers have indicated that multimedia learning materials are more useful than traditional paper-based instruction (Rose, 2003; Mayer & Moreno, 2002). Users can benefit a lot from the video because of the easier video sequence and spoken at a slower rate, that can

match to the users need. Besides that, the huge advantages a video have is the visual dimension, that makes understanding easier via gesture and context (Talavan, 2007). A combination of imagery(visual) and verbal information(audio) improves information processing (Sydorenko, 2010). In addition, Sherman (2003) stated that the great value of a video lies in the combination of the sounds, images and sometimes text in the form of subtitles. The used of subtitles can be beneficial as an information processing aid (Kellerman, 1985). There are numerous advantages of captioning. Based on Hsu (1994), captions have been perceived as the most useful and efficient supporting for watching videos. Caption help learners segment the speech stream and distinguish separate words (Danan, 2004). Moreover, in the recent pedagogical theory, captioning has been proven to have a significant effect on learning performance. The study conducted by Boras and Lafayette (1994) demonstrated that users working with caption had a much more positive attitude than those who did not have access to it. In addition, according to Vanderplank (1988), caption helped

to relieve some of the anxiety experienced by users who think they missed an important part and give up watching because they feel lost. It allows learners to relax and become more confident in their ability to understand and focus their mental energy in learning. Besides that, it provides instant feedback that reinforces the positive learning experience.

As stated by Guillory (1998), there are three levels of captioning, which are full-text caption, partial caption and no caption. Full-text captions mean that 100% of the script is taken from an audio message. While partial caption means the words to be captioned were determined by a primary study on keywords in the script. Keyword caption basically represents only 14% of the total script which not provided enough information.

Studies mentioned above have shown that video tutorial is highly accepted by learners during the learning process. Besides that, caption has been seeming like the most useful and efficient supporting tools for watching a video. When the caption is provided, it gives a better understanding to the user regarding the material or knowledge to be transferred. As a result, learning performance is affected directly in a positive way. However, the effect of different types of captioning towards an individual learning performance is still unclear.

Thus, the objectives of the study are: (i) to evaluate the effect of full caption, partial caption, and no caption of machine's video tutorial on users' learning performance; (ii) to evaluate the effect of full caption, partial caption, and no caption of machine's video tutorial based on particular part of the video - safety, equipment, procedure, and housekeeping - on users' learning performance.

METHODS

Participants

Twenty-four participants between 19-20 years of age completed the study. They were undergraduate students from the Faculty of Engineering at the International Islamic University Malaysia (IIUM). Only engineering students were considered in this study. This was to ensure that they have similar basic knowledge on machining operations. Besides that, the chosen participants also have never taken the Workshop Technology courses offered by the faculty - to control the level of familiarity among participants. Ethnic background, first language, and minority status were not considered in the study.

Apparatus and Stimuli

Video Tutorial: Four video tutorials were developed. Each video tutorial covers different aspect of machining operation, namely: (i)

Materials Remover; (ii) Joining Materials; (iii) Programming-based Machinery, and (iv) Hand Tools Operations. Each video tutorial cover instruction for one experiment. For Material Removal category, Turning experiment (using the Lathe Machine) was chosen because it has more procedures and can be considered as the most complicated experiment compared to other experiments in term of procedure and handling machinery. Thus, it is safe to assume that by considering the most complex experiment, the learning process of other experiments would subset under it. With a similar reason, for Joining Material category, Arc Welding experiment was chosen (using Arc Welding machine). In the Programming-based Machining, the experiment chosen was the CNC Milling (using CNC Milling machine) and in the Hand Tools Operations category, Bench Work experiment was selected (using the Bench Work Workspace).

Each video consists of four sections, in order: (i) safety precautions, (ii) equipment, (iii) procedure, and (iv) housekeeping. In safety precaution section, all the safety aspects of the experiment chosen were addressed. For instance, the instruction to wear safety goggles, mask, and safety shoe while conducting the experiment were included. In the equipment section, all the apparatus involved in the experiment were introduced. The procedure section covered step-by-step instruction on how to do the experiment, while in the housekeeping section, instruction on how to clean up the experiment workspace to the original condition was explained.

During the shooting process, the video was shot at different angles, so that it can be edited wisely (i.e. some part of the video requires a close-up video, while some other parts require full coverage of the operation). DSLR Nikon D90 camera was used for a high-quality video. Besides that, a tripod stand was used to stabilize the camera to avoid unnecessary movements. Then, for the video editing, Sony Vegas Pro software was used. The software was used to compile part of the video and to include caption and audio into the video. For the caption part, the font style and size used was Tahoma 35point. In total, there are twelve videos were prepared - four for each type of captioning.

All the prepared videos were verified by some personnel who are working at the Faculty of Engineering to make sure that the content of the video is similar with the manual handbook of the machining operations involved in this study. In addition, the script of the captions was also verified by proof-reader in term of the languages and sentences used in the videos. The final version of the video was made based on the comments and recommendations during the verification process.

Quizzes: A quiz related to the content of each experiment- safety precaution, equipment, procedure, and housekeeping - was designed and administrated at the end of the video tutorial session. Example questions for each section are as follows: (i) safety precaution (List two safety precaution that you need to follow during the Lathe operation; (ii) equipment (Figure below shows the apparatus that are used in this experiment, please label each figure with the correct answer); (iii) Procedure (Statements below show the procedure step-by-step which is facing process in this experiment. Please arrange the steps in the correct order); and (iv) housekeeping (Please fill in the blank with the correct answer based on the housekeeping procedure of the experiment).

Administrative forms: Participant form and payment voucher form were designed and used in the experiment. The participant form was used to record the demographic data of participant - age, gender, and nationality, while the payment voucher was used to record the compensation given to participants.

Design of the Study

The experiment was conducted on weekdays (Monday to Friday). The weekend was excluded to avoid any potential factoring effect on the participant performance (i.e. the lifestyle of the participants would be different. Thus, a different performance may be shown). The experiment was conducted between 2:00 p.m. to 5:00 p.m. to ensure that the level of comprehension among participants is similar.

Video Tutorial Counterbalancing: Table 1 shows the distribution of participants for Full Caption, Partial Caption and No Caption group using the Latin Square method. Each participant was stimulated with a different order of video tutorial. For instance, 1st participant for each group was stimulated with Lathe experiment video tutorial, follow by Arc Welding experiment, CNC Milling experiment and end with Bench Work experiment. Utilization of the Latin Square method to arrange the order of the videos will reduce the ordering effect that may have on the experiment.

Randomization of the group assignment: Whenever a participant approach to participate in the study, they were randomly assigned either into Full Caption, Partial Caption, or No Caption group. However, they were pseudorandom so that the number of completed participant for each group will remain similar.

Procedure

The procedures for the experimental session were classified into two phases: (i) Video tutoring session and (ii) Quiz session.

At the beginning of the experiment, participants were asked to fill up the demographic information. After that, they were pseudo randomly assigned to a group - either Full Caption, Partial Caption, or No Caption. Then, they were briefed on the experimental details that include the purpose and procedure of the experiment. After that, participants were given a video tutoring session and their performance in comprehending the content were evaluated with the quiz session.

Video tutoring session: The time allocated for watching the videos is 40 minutes. A participant was equipped with a headphone. Then, he or she was administrated to watch the videos according to the arrangement of the experimental design. This completed the first phase of the experiment.

Quizzes session

Immediately after the first phase was completed (video tutoring session), a participant was given a set of quizzes. The time allocated to answer all the questions is 20 minutes. After the quizzes session, participant filled out a payment voucher and was compensated MYR 15 for completing the experiment.

Table 1 Distribution of participants for Full Caption, Partial Caption and No Caption video tutorial

Group	Pax	Lathe	Weld	Bench	CNC
Full Caption	A	1	2	4	3
	B	2	3	1	4
	C	3	4	2	1
	D	4	1	3	2
	E	1	2	4	3
	F	2	3	1	4
	G	3	4	2	1
	H	4	1	3	2
Partial Caption	I	1	2	4	3
	J	2	3	1	4
	K	3	4	2	1
	L	4	1	3	2
	M	1	2	4	3
	N	2	3	1	4
	O	3	4	2	1
	P	4	1	3	2
No Caption	Q	1	2	4	3
	R	2	3	1	4
	S	3	4	2	1
	T	4	1	3	2
	U	1	2	4	3
	V	2	3	1	4
	W	3	4	2	1
	X	4	1	3	2

Variables and Hypotheses

Dependent Variable 1: Percentage of the score on the quizzes (overall). The quizzes consist of four sections - one section for each machine. In each section, four parts of criteria - safety, equipment, procedure, and housekeeping - were evaluated. The total mark for the quizzes was 336 points.

Hypothesis 1: Partial Caption group will score the highest mark on the quizzes compared to Full Caption and No Caption group. Partial Caption presents learners with less to read information and not weakening their understanding of information in the spoken message. By reducing the sentence instruction and applying the partial caption, it helps the participant to watch, understand and relate to the tutorial better through the keywords provided (Chang & Yang, 2014).

Dependent Variable 2: Percentage of the score on the quizzes (by criteria; safety, equipment, procedure, and housekeeping). The maximum score for each criterion, safety, equipment, procedure, and housekeeping was 64, 96, 120, and 56 points respectively.

Hypothesis 2: There will be no differences in performance between the groups for safety and equipment criteria because in this part of the video, only one word or short sentences were used in the video, thus make no different despite the type of captioning. However, for the procedure and housekeeping criteria, there will be significant differences between the groups because there are several steps need to be remembered.

RESULTS

The effect of different types of captioning of video tutorial on learning performance (overall). Figure 1 below shows the comparison on percentage score of Full Caption, Partial Caption, and No Caption group in overall as well as by criteria of the video tutorials on participants' learning performance.

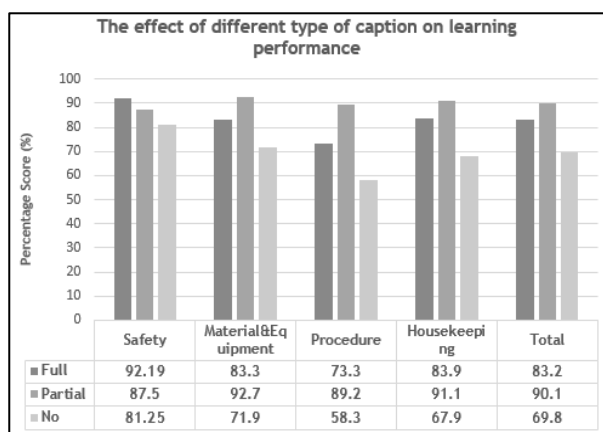


Fig. 1 Comparison of percentage score of Full Caption, Partial Caption, and No Caption group on learning performance

In overall, by comparing the percentage score of the quizzes between Full Caption, Partial Caption, and No Caption group, the finding shows that Partial Caption group have the highest percentage score (90.1%) rather than the Full Caption (83.2%) and No Caption (69.8%). The

result was further analysed by utilized one-way ANOVA model of SPSS software (version 23). This model was utilized because it can compare more than two groups of mean (Park, 2009). From the output, the differences were significant at $p < 0.001$, condition [$F(2,21) = 13.4, p < 0.001$]. The result suggests that the participants performed the best when partial caption video was used, rather than when the full caption video or no caption video was used.

The effect of different types of captioning of video tutorial on learning performance based on criteria (safety, equipment, procedure, and housekeeping).

Referring to Figure 1, in safety criteria, Partial Caption group showed the highest percentage score with 92.19% compared to Full Caption (87.50%) and No Caption group (81.25%). In equipment, Partial Caption group performed the best (92.71%) rather than the Full Caption (83.33%) and No Caption group (71.88%). In the procedure, Partial Caption group also scored the highest percentage score with 89.17%, followed by Full Caption (73.33%) and No Caption group (58.33%). Lastly, for the housekeeping criteria, Partial Caption group achieved the most score with 91.07% in comparison to Full Caption (83.93%) and No Caption group (67.86%). The result was further analysed by utilized one-way ANOVA model of SPSS software (version 23). This model was utilized because it can compare more than two groups of mean (Park, 2009). From the output, it reveals that all the comparisons between groups were significant (Equipment [$F(2, 21) = 7.17, p = 0.004$]; Procedure [$F(2, 21) = 4.75, p = 0.02$]; and Housekeeping [$F(2, 21) = 5.74, p = 0.01$]) except for Safety criteria [$F(2, 21) = 1.9, p = 0.164$]. The findings indicate that for all the criteria compared except for safety criteria, a different type of caption in the video tutoring does have an effect on learning performance of the participant. Specifically, the results suggest that when a partial caption was used in the video, the learning performance about the machine's video tutoring increased.

DISCUSSION

In overall the Partial Caption group performed the best compared to the Full Caption and No Caption. The main reason why the Partial Caption group performed the best is because of the sentences that were used in partial captioning is short and specific to the video instruction. This makes it easy for the participant to read the captions and listening to the audio of the tutorial. Therefore, it is better to use partial caption in a video tutorial as it gives a positive effect on the learning performance. The results obtained is congruent with the findings by Yang and Chang (2014) where the partial or keywords caption is more helpful than the full caption. Using partial caption may enhance the learner's

visual memory and retain their knowledge resulting in better learning performance (Yang & Chang, 2014). By reducing the sentence instruction and applying the partial caption, it helps the participant to watch, understand, and relate to the tutorial better through the keywords provided (Yang & Chang, 2014).

Comparing between partial caption and full caption, partial caption is an effective method for transmitting content in video tutorial compared to full caption. It requires less reading for learners, and the appearance of individual keywords in caption calls particular attention to specific content in the video. Partial or keywords caption enhance multichannel processing and encourage learners to listen more and read less. Selected partial captions can help learners to attain the ultimate goal of adequate comprehension of native speakers without having a read word after word on the screen hence, make the full caption or script not be all beneficial. Chang et al. (2011) stated that, while textual help stimulated better performance, the effect was short-term, once it is over; the users had difficulty in the actual learning task. Preparing users with keyword caption aids in facilitating the learning process and ease the transitional phase to real listening task. (Yang & Chang, 2014)

Generally, the Partial Caption group performed the best in comparison to the Full Caption and No Caption group. As mention before, these results are in parallel with findings by Yang and Chang (2014) in which partial caption aid in increasing the learning performance of the participants. Guillory (1998) also suggests that partial caption have better potential to focus learners not only on reading the caption but also on listening. However, in the safety category, the analysis shows no significant difference. The reason why the results are not significant may be due to the sentence used in the full caption or partial caption is too short or contains only one word, thus make no different to other types of caption. Using sentences that are too short may make the instructions not understandable by the participant. Based on Rooney (2014), implementing partial caption was effective in which learners performed better with 50% than 10% of the scripts, the recommendations that they made is to use even fewer caption which is 30% of the total scripts (Rooney, 2014).

CONCLUSION

To conclude, the use of partial caption in a video tutorial for engineering machinery increase users' learning performance when compared to full caption and no caption. As a whole, there was a significant difference in the learning performance between the groups [$F(2, 21) = 13.4, p < 0.001$]. By criteria (safety, equipment,

procedure, and housekeeping), it was shown that performances of the users are significantly different between the groups in all criteria except for safety part of the video, in which captions in this part are too short or contain only one word, thus, make no different to other types of caption.

Contribution: The results from this research provide additional information regarding the machine's video tutorial in general, more particularly, the use of suitable type of captioning as a caption in preparing a video tutorial for engineering machinery, in which the partial captioning is preferable (more effective) to be used to develop machine's video tutorial. Moreover, finding from this study also could lead to other similar research studies in deeper approaches.

ACKNOWLEDGEMENTS

The research was supported by the Malaysian Ministry of Higher Education through the RAGS15-066-0129 grant to International Islamic University Malaysia (Malek Hamid, PI) and the FRGS17-035-0601 grant to International Islamic University (Mohd Hanafi Ani, PI). This study was also supported by the Department of Manufacturing and Materials Engineering, International Islamic University Malaysia, Malaysia.

REFERENCES

- Borrás, I., & Lafayette, R. C. (1994). Effects of multimedia courseware subtitling on the speaking performance of college students of French. *The Modern Language Journal*, 78(1), 61-75.
- Choi, H. J., & Johnson, S. D. (2005). The effect of context-based video instruction on learning and motivation in online courses. *The American Journal of Distance Education*, 19(4), 215-227.
- Choi, H. J., & Johnson, S. D. (2007). The effect of problem-based video instruction on learner satisfaction, comprehension and retention in college courses. *British Journal of Educational Technology*, 38(5), 885-895.
- Danan, M. (2004). Captioning and subtitling: Undervalued language learning strategies. *Meta: Journal des traducteurs/Meta: Translators' Journal*, 49(1), 67-77.
- Guillory, H. G. (1998). The effects of keyword captions to authentic French video on learner comprehension. *Calico Journal*, 89-108.
- Hsu, J. F. J. (1994). Computer assisted language learning (CALL): The effect of ESL students' use of interactional modifications on listening comprehension.

- Kellerman, E. (1985). If at first you do succeed. *Input in second language acquisition*, 345-353.
- Mayer, R. E., & Moreno, R. (2002). Animation as an aid to multimedia learning. *Educational psychology review*, 14(1), 87-99.
- Park, H. M. (2009). Comparing group means: t-tests and one-way ANOVA using Stata, SAS, R, and SPSS.
- Yang, J. C., Huang, Y. T., Tsai, C. C., Chung, C. I., & Wu, Y. C. (2009). An automatic multimedia content summarization system for video recommendation. *Journal of Educational Technology & Society*, 12(1), 49.
- Rooney, K. (2014). The impact of keyword caption ratio on foreign language listening comprehension. *International Journal of Computer-Assisted Language Learning and Teaching (IJCALLT)*, 4(2), 11-28.
- Rose, C. (2003). How to teach biology using the movie science of cloning people, resurrecting the dead, and combining flies and humans. *Public Understanding of Science*, 12(3), 289-296.
- Sherman, J. (2003). *Using authentic video in the language classroom*. Ernst Klett Sprachen.
- Syodorenko, T. (2010). Modality of input and vocabulary acquisition. *Language learning & technology*, 14(2), 50-73.
- Talavan, N. (2007). Using subtitles in a multimedia environment to enhance listening comprehension for foreign language students of English. In *Proceedings VI International AELFE Conference. Lisboa: ISCAL* (pp. 452-458).
- Vanderplank, R. (1988). The value of teletext sub-titles in language learning. *ELT journal*, 42(4), 272-281.
- Yang, J. C., & Chang, P. (2014). Captions and reduced forms instruction: The impact on EFL students' listening comprehension. *ReCALL*, 26(1), 44-61.