ORIGINAL ARTICLE

ACTIVE VS. PASSIVE: WHICH IS THE BEST COMMAND INSTRUCTIONS FOR MACHINE'S VIDEO TUTORIAL?

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ABSTRACT

The application of video tutorial as educational pedagogy is a great learning method, especially for engineering students. Currently, in engineering field, there is no specific instruction on types of command used for machinery video tutorial. Hence, for this study the aim is to obtain the preferable type of command of instruction for learning engineering machinery. In order to achieve the aim, the following objectives need to be met: (i) To evaluate the effect of active and passive voice as the command of instruction of machine's video tutorial on overall hands-on learning performance and; (ii) To evaluate the effect of active and passive voice as the command of instruction of machine's video tutorial on hands-on learning performance on specific criteria – safety, equipment, procedure, and housekeeping. Thirty-two undergraduate students were recruited and randomly assigned into two groups – Active and Passive. Eight video tutorials embedded with active and passive voice were developed for the participants to watch and then four set of assessment test were designed to assess participant hands-on learning performance based on the tutorials. Overall, there was a significant different in the scores for Active group (M = 10.938, SD = 0.704) and Passive group (M = 9.281, SD = 1.110) conditions; t (16) = 5.040, p < 0.0001. Based on criteria - in housekeeping, there is a significant different between Active group (M = 2.875, SD = 0.289) and Passive group (M = 1.781, SD = 0.856) conditions; t (16) = 4.844, p < 0.0001. In safety, there is marginally significant different between Active group (M = 2.938, SD = 0.250) and Passive group (M = 2.688, SD = 0.479) conditions; t (16) = 1.852, p = 0.077. In equipment, there is no significant different between Active group (M = 2.875, SD = 0.342) and Passive group (M = 2.781, SD = 0.407) conditions; t (16) = 0.706, p = 0.486. In procedure, there is no significant different between Active group (M= 2.250, SD = 0.577) and Passive group (M = 2.031, SD = 0.427) conditions; t (16) = 1.219. p = 0.233. These findings show that, using active voice in video tutorial do improve the hands-on learning performance, especially in the housekeeping and safety aspect.

***Keywords**: Machine's tutorial, Active voice, Passive voice, Video tutorial, Hands-on, Learning performance*

INTRODUCTION

Nowadays, the use of video tutorial as method of learning has become popular among the millennial students. Based on studies by fellow researcher shows that, millennial has a different preference in learning styles, in which they prefer interactive learning with more practical applications, graphic over text, networking, games rather than serious type of learning (Ganster & Walsh, 2008; Thornes, 2012; Sachs, 2013). The popularity of video tutorial has outperformed the conventional way of teaching in classroom in which many studies had been conducted to compare between the effectiveness of video-based to paper-based tutorial (van der Miej, 2014). Some of the qualities of video tutorial that are difficult to be match on paper are the congruency between recorded demonstration and life task execution (Shippey et al., 2014), interactive way of teachings for practical skills (Donkor, 2010) and comprehension of a subject matter through the stimulation of visual and auditory system (Leahy & Sweller, 2011). In addition, a video tutorial that build for the purpose of educational teaching and practice can provide a greater experience than the conventional way of teaching (Mestre, 2012). Therefore, in order to make a quality-type video tutorial, numerous factors need to be taken into consideration. For instance the content of the video, compatibility and the accessibility. In the aspect of video accessibility, captioning and subtitling are among the important factors for video with narration (Mestre, 2012).

Besides that, types of command instruction also may influence the efficacy of video tutorial on learning performance. Thus, for this study, the types of voice command instructions is the focus. In engineering field, there is no specific instruction whether to use active or passive voice as instruction or command to operate a machine or to conduct an experiment. Since there is no prevalence study regarding this matter, it is

essential to study whether the different types of voice command in video tutorial affect the hands-on learning performance.

The aim of the project is to acquire the preferable type of command of instruction – either active or passive voice – for an optimal hands-on learning performance of engineering machinery. In order to obtain the aim, the following objectives need to be met: (i) To evaluate the effect of active and passive voice as the command of instruction of machine's video tutorial on overall hands-on learning performance and; (ii) To evaluate the effect of active and passive voice as the command of instruction of machine's video tutorial on hands-on learning performance on the specific criteria of the tutorial content – safety, equipment, procedure, and housekeeping.

METHODS

Participants

Thirty-two undergraduate students from Faculty of Engineering and Faculty of Information and Communication Technology at the International Islamic University Malaysia (IIUM) were recruited. The population of interest were the engineering and Information and Communication Technology (ICT) students that have never had taken the Workshop Technology course. This is to ensure that participants would have a similar level of knowledge in this area. Gender, ethnic background, first language and minority status were not taken into consideration.

Apparatus & Stimuli

Machines: The four selected machines used in the study were Lathe machine, Arc welding machine, Benchwork (worktable, classified as a machine in this report for an ease reporting wording) and CNC machine. These machines were used to assess participant hands-on performance during the assessment test. Each machine represent different functions of machining operation among the experiments in the Workshop Technology course; (i) Lathe machine – for material removal operation – the experiment cover most procedure's techniques among other similar experiments (ii) Arc welding machine – for joining material operation – the experiment has more complicated procedures than the gas welding experiment (procedure in gas welding experiment is too simple which does not required comprehensive understanding); (iii) Benchwork – for hand tool operation – it involves more hand tools in the experiment procedures compared to other similar experiment and; (iv) CNC machine – for programming and software-based operation – the experiment has more tasks to be done (i.e. more tool changes are required) than CNC Turning experiment.

Video Tutorials: Eight video tutorials - two for each machine – were developed by Ergonomics Laboratory, Faculty of Engineering, IIUM – with Active and Passive command of instruction. Several IIUM staff – Workshop Demonstrator, Workshop Technician, Workshop Engineer, and Workshop Coordinator, have verified the video tutorials. Each video was divided into several sections based on the criteria considered in the study – safety precautions of the experiment, equipment used in the experiment, procedure of the experiment and housekeeping. As explained above, four of the video tutorials were embedded with active voice command and another four video tutorials were with passive voice. It is important to note that the captions that appear on the video were the same as instruction's voice of the video. Figure 1 and Figure 2 below illustrates a sample frame of the video tutorial with an Active and Passive voice respectively.

Figure 1 A sample frame of Active voice video tutorial

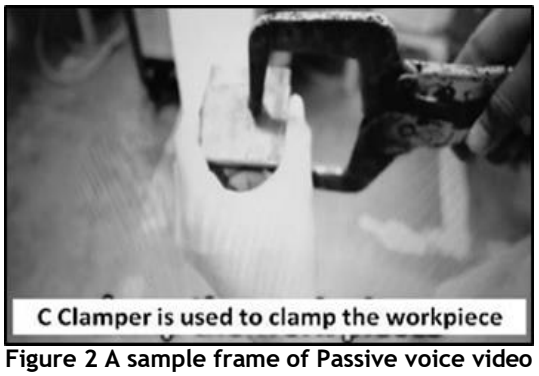

Figure 2 A sample frame of Passive voice video tutorial

Assessment Test: Four sets of assessment test were designed – one set for each machine – to evaluate participants hands-on performance. Each set contain four assessment questions – one for each criterion; safety, equipment, experiment procedure, and housekeeping. The type of task performed for each machine - (i) Lathe machine (Table 1); (ii) Arc Welding machine (Table 2); (iii) Benchwork machine (Table 3) and; (iv) CNC machine (Table 4) can be seen in table below. Three students from the Ergonomics Laboratory have been asked to serve as pilot participants for the test. This was done to ensure the instructions was clearly understood

by the participant. The design process of the assessment tests was as follow; firstly, the content of the video tutorial – all possible tasks – that can be assessed by each machine was listed. Secondly, from the content listed, one assessment test – that consists of four questions (i.e. one for each criteria) – was designed for each machine. It is important to note that all assessment tasks were designed such that no potential harm were exposed to the participant. In addition, participant was monitored closely by the experimenter at all time for safety purposes. Finally, the answer scheme and scoring method for the assessment test was prepared. The scoring method was designed such that, each criteria – safety, equipment, procedure, and housekeeping – will carry the same weightage towards the final score, that is three marks each. Thus, the overall score for the assessment test is twelve mark.

Table 1 Assessment test of Lathe machine

	Lathe machine
Safety	Remove any personal items that cannot be worn, and pick tow PPEs that must be worn during operating lathe machine beside the green jacket
Equipment	Pick a Vernier caliper and use it to measure the length and diameter of the workpiece
Procedure	Perform the machine setup operation as shown in the video
Housekeeping	Arrange the tail stock and tool post back to its original places at the right of the machine

Table 2 Assessment test of Arc welding machine

	Arc welding machine
Safety	Choose three PPEs beside for green jacket and safety shoes
Equipment	Pick a C clamp and a chipping hammer. Then, clamp the two workpieces together and remove unused solidified material from the workpiece
Procedure	Prepare the equipment for the welding operation, and acting the welding operation according to the procedure in the video
Housekeeping	Remove access electrode from the electrode holder into the worktable, and put the equipment and PPEs back to its original places

Table 3 Assessment test of Benchwork machine

	Benchwork machine
Safety	Pick three PPEs items need to be worn during benchwork operation
Equipment	Pick a high Vernier caliper. Then adjust it to 5mm length and mark the workpiece
Procedure	Perform the marking operation exactly as you have watched in the video
Housekeeping	Perform the whole housekeeping exactly as you have watched in the video

Table 4 Assessment test of CNC machine

	CNC machine
Safety	Pick two PPEs that must be worn during operating the CNC machine
Equipment	Pick a wrench key and mallet. Then, grip the workpiece tightly between the vises and use the mallet to hit the surface of the workpiece
Procedure	Perform the 'Power On' operation as shown in the video
Housekeeping	1. Close the safety cover 2. Release the emergency button and switch of the red button 3. Turn off the switch at the back of the machine

Administrative Forms: Four types of administrative forms – (i) informed consent form; (ii) participant form; (iii) data form and; (iv) payment voucher – were used. Firstly, for informed consent form, it guides potential participants – systematically – about the study. It was handed to participant - to obtain his or her permission for the experiment. In general, the form addresses the: (i) eligibility of participant; (ii) detail information of the study – researcher, purpose, procedure and benefit; (iii) risk and confidentiality of the study; (iv) voluntary circumstances in participating and completing the study; (v) compensation and; (vi) exchange of signature between researcher and participant. Secondly, for participant form, it consists of two sections: (i) demographic information and; (ii) questionnaire. It was used to collect data of gender, age, race, nationality, daily use of language and hearing ability. Thirdly, for data form, it consists of experimental details and assessment scores. It was used by the researcher to record all the data collected during the study. Lastly, for payment voucher, participant was asked to fill in the voucher at the end of the experiment session to receive RM5 as a token of appreciation for taking part in the study.

Experimental Design

The experiment was conducted on Tuesday, Wednesday, and Thursday only. Mondays were excluded as the Workshop was fully occupied and

no experiment could be run. Friday and weekends were excluded to avoid any potential factoring effect on participants performance (i.e. participant's lifestyle between the weekdays and weekends. Thus, a different performance may be shown). The experiment was conducted between 12:00 p.m. to 1:00 p.m. and 2:00 p.m. to 5:00 p.m. The time of the experiment conducted is based on the availability of the Engineering Workshop. In order to avoid the effect of gender on the result, half of the participants were males and the other half were females. The arrangement of the randomly assigned group is shown in Table 5 below (number in bracket allocates the number of participants).

Table 5 Arrangement of the randomly assigned group

Gender	Type of Voice	Machine
Male (16)	Active (8)	Lathe (2) Welding (2) Benchwork (2) CNC (2)
	Passive (8)	Lathe (2) Welding (2) Benchwork (2) CNC (2)
Female (16)	Active (8)	Lathe (2) Welding (2) Benchwork (2) CNC (2)
	Passive (8)	Lathe (2) Welding (2) Benchwork (2) CNC (2)

As can be seen in Table 5 above, the number of male and female participants were distributed evenly in each group – types of voice and machine used. A pseudo-random arrangement of the participants was used in the experiment. When participant arrived for the experiment, he or she was assigned to: (i) either video tutorial with active or passive voice and; (ii) either to Lathe, Welding, Benchwork or CNC machine. In pseudo-random arrangement, the set of combination was predetermined. The only randomization condition in this experimental design was the arrival of the participants. The advantage of this is that, if there is a case that the experiment needed to be stop early (e.g. cannot recruit enough participant up to thirty-two or machine breakdown), it can be stop in the multiple of sixteen participants, yet still maintaining the balance of the participant's distribution in each group.

Procedure

The procedure of the study was classified into three phases - (i) pre-experiment session; (ii) video tutorial session and; (iii) assessment session.

Pre-experiment Session: Before the experiment started, participant was informed to read the consent form for a better understanding of the experiment, in general, so that he or she can have his or her consent before taking part in it. Then, participant need to sign the form that given his or her consent. Next, participant was asked to complete the participant form. All the data obtained were recorded in a participant file and was kept in the locked cabinet in the laboratory for future use. After completed both form, participant was pseudo-randomly assigned either into the Active or Passive group.

Lastly, participant was briefed on the experiment purpose (in general) and procedure during the experiment conducted. Participant was informed that he or she will have to watch video tutorial of machine on a laptop (video tutorial session) and he or she will be assessed (hands-on assessment session) to complete the experiment. Participant was told that he or she will be place in the experimental room equipped with a headphone during the video tutorial session. In addition, they were informed to not touch any keys on the laptop during the video tutoring session – i.e. a participant should only watch the video without controlling the video's stream. Participant was given only one time to watch the video tutorial without taking any notes. For experimental control purposes, participants were asked to turn off his or her phone at all times during the experiment.

Video Tutorial Session: During the video session, participant was asked to watch the assigned video tutorial (based on the group and machine type assigned) for 15 minutes.

Assessment Session: After the video tutorial session completed, participant was assessed with the hands-on tasks (based on the group and machine type assigned) for 15 minutes. Participants was scored accordingly based on the scoring schemes and the score were recorded in the participant's data form. Upon completing the session, participant was asked to fill out a payment voucher and was paid RM 5 for completing the experiment.

Variables and Hypotheses

Dependent Variable 1: The mean score of the assessment (overall). The assessment consists of four hands-on tasks, one task for each criteria – safety, equipment, procedure and housekeeping. The maximum score for each task is 3 marks. Thus, the total mark for the assessment test is 12 marks.

Hypothesis 1: The Active group will score more on the assessment test rather than the Passive group. This is because the instruction of the tutorial that contain lots of operation and procedure will be better with the active voice as the active voice highlight on the action (British

Council Malaysia, n.d.). In addition, active voice provide a straightforward instruction of the idea or procedure compared to passive voice, which can make the sentences harder to follow (Your Dictionary, n.d.).

Dependent Variable 2: The mean score of the assessment (by criteria). Scoring method for the assessment is same as in Dependent Variable 1.

Hypothesis 2: The Active group will score more on the procedure and housekeeping assessment. The reason for the hypothesis is same as in Hypothesis 1.

RESULTS & DISCUSSION

The raw data of the experiment was recorded in Microsoft Excel 2013. Then it was transferred into SPSS software version 21 to be analyzed. By using SPSS, the average scores for the overall performance of the participants as well as average scores based on criteria - safety, equipment, procedure and housekeeping - was analyzed. In addition, independent t-test was utilized in order to analyze the significant value in comparing the means between the two groups in the study – Active group and Passive group.

The effect of machines' command of instruction (active and passive voice) on hands-on learning performance (in overall)
The graph in Figure 3 below illustrates the total average scores of both Active and Passive groups in overall.

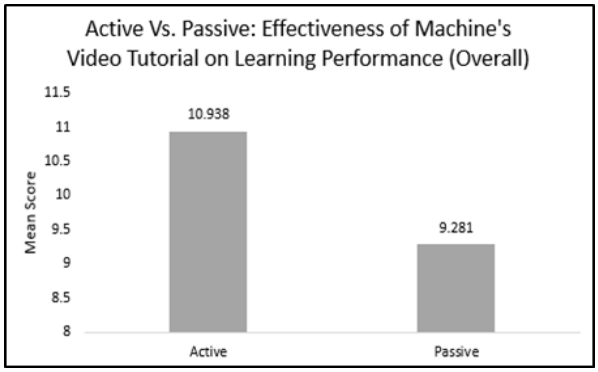

Figure 3 Overall score of different types of voice tutorials on learning performance

In overall, by comparing the total scores of the hands-on assessment, performance of the Active group is better than the Passive group. On average, the Active group score 10.938 while the Passive group score 9.281 of full marks of 12. Next, the data was further analyzed by using SPSS to compute the mean of the hands-on learning performance of the two group and Independent sample t-test was performed. The output of the model given that there was a significant different in the scores for Active group (M = 10.938, SD = 0.704) and Passive group (M = 9.281, SD = 1.110) conditions; t (16) = 5.040, p < 0.0001. These results suggest that different type of voice in the video tutoring does have an effect on hands-on learning performance of the machine's video tutoring. Specifically, the result suggests that when an active voice was used as the command for instruction, the hands-on learning performance of the machine's video tutoring increases.

Based on Figure 3, Active group has higher score than Passive group because participant was able to understand the information better when the action word is used as the focus (British Council Malaysia, n.d.; Your Dictionary, n.d.). This is parallel with the previous study on active voice and passive voice, in which the subject that have active voice performed better recalled than passives when syntactic criteria were considered (Slobin, 1966).

The effect of machine's command of instruction (active and passive voice) on hands-on learning performance (by criteria – safety, equipment, experiment procedure, and housekeeping)
The graph in Figure 4 below depicts the average mean of score between Active and Passive groups in terms of safety, procedure, equipment and housekeeping.

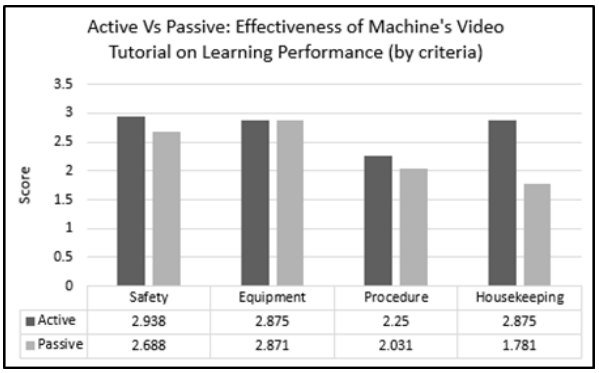

Figure 4 Mean score of different types of voice tutorials on learning performance based on criteria

Comparing mean scores of the assessment by criteria – safety, equipment, procedure, and housekeeping – hands-on performances of the Active group are slightly better than the performances of the Passive group. In safety criteria, the score for Active group is 2.938 while the score for Passive group is 2.688. In procedure criteria, the score for Active group is 2.25 while the score for Passive group is 2.031. Next, for housekeeping criteria, the Active group score is 2.875, while for Passive group only score 1.781. Lastly for equipment criteria, the score for groups are almost similar with Active group score 2.875 while Passive group score 2.871.

In general, based on all the criteria compared, the output of independent sample t-test shows that there is only one significant different in the scores. In housekeeping criteria, there is a significant different between Active group (M =

2.875, SD = 0.289) and Passive group (M = 1.781, SD = 0.856) conditions; t (16) = 4.844, p < 0.0001. In safety criteria, there is marginally significant different between Active group (M = 2.938, SD = 0.250) and Passive group (M = 2.688, SD = 0.479) conditions; t (16) = 1.852, p = 0.077. In equipment criteria, there is no significant different between Active group (M = 2.875, SD = 0.342) and Passive group (M = 2.781, SD = 0.407) conditions; t (16) = 0.706, p = 0.486. In procedure criteria, there is no significant different between Active group (M= 2.250, SD = 0.577) and Passive group (M = 2.031, SD = 0.427) conditions; t (16) = 1.219. p = 0.233. These results suggest that, the used of active voice or passive voice for machine's video tutoring does not have a significant effect on the hands-on learning performance except in housekeeping aspect. The hypothesis made stated that the Active group will perform significantly better in two of the criteria – procedure and housekeeping. The results only agree with the hypothesis for housekeeping but not the procedure. In housekeeping section, the use of active voice helps to focus on the action that need to be taken by the participants during the hands-on assessment as the used of active verbs express meaning more emphatically and vigorously compared to passive voice in which it lack strength on the action (Hacker, 2003). From the raw data compiled, the scores for Active group and Passive group in procedure part are 36 and 32.5 out of 48, which both are quite low. This is because it is hard for the participants to remember the exact things to be done especially if the video is too long so they might have left out some little details during the hands-on assessment. Another hypothesis stated that the Active and Passive groups will have a similar score on the safety and equipment assessment tests because in these sections of the video tutorial, only short sentences or the name of the PPEs and equipment was presented. Thus, there is no difference in sentences (no differences in hands-on performance). The results found from the experiment agreed with the hypothesis as both safety and equipment part has no significant difference between the Active group and Passive group.

CONCLUSION

To conclude, the experiment shows that using an active voice as the command for instruction in the machine's video tutorial would result in a better user learning performance on understanding the machine's video tutorial rather than using passive voice. In overall, there was a significant different in the scores for Active group (M = 10.938, SD = 0.704) and Passive group (M = 9.281, SD = 1.110) conditions; t (16) = 5.040, p < 0.0001. Based on all the criteria compared, there is only one significant different in the scores. In housekeeping criteria, there is a significant different between Active group (M = 2.875, SD = 0.289) and Passive group (M = 1.781, SD = 0.856) conditions; t (16) = 4.844, p < 0.0001. In safety criteria, there is marginally significant different between Active group (M = 2.938, SD = 0.250) and Passive group (M = 2.688, SD = 0.479) conditions; t (16) = 1.852, p = 0.077. In equipment criteria, there is no significant different between Active group (M = 2.875, SD = 0.342) and Passive group (M = 2.781, SD = 0.407) conditions; t (16) = 0.706, p = 0.486. In procedure criteria, there is no significant different between Active group (M= 2.250, SD = 0.577) and Passive group (M = 2.031, SD = 0.427) conditions; t (16) = 1.219. p = 0.233. The results from this study will provide additional information about the machine's video tutorial in general and, more particularly, will recommend a suitable type of voice for the command of instruction of machine's video tutorial. In addition, the finding from this study also could lead the other similar research studies in deeper approaches.

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