Motivational Beliefs and Learning Effectiveness of Video Instruction in Procedural Tasks

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Abstract. This research aims to determine the advantages of using multimedia presentations in teaching-learning activities, especially the use of video tutorials that affect student work on procedural tasks. This study compares student learning performance using paper-based manuals to students using video tutorials. The effectiveness was measured by using pre-test, post-test and retention as repeated measures before and after training, as well as students' motivational beliefs (relevancy of the task and efficacy by self). Furthermore, we also showed the students' mood in teaching-learning processes. This research involved 62 students of a public junior high school in Bandar Lampung with the average age of 14 years old and they were assigned into experiment and control conditions. The instruments which were used in this study are video instruction, manual paper, questionnaires, and test. The results showed that students with the use of video tutorial media had significantly higher post-test and retention scores. The average score obtained by students who were using video-based tutorial was twice higher than the average score obtained in the paper-based manual condition. During the training, it was found that students who received instruction via video had more positive moods than those who received instruction via paper-based manuals. Students who used video instruction were more motivated and enthusiastic in learning.

Keywords: Learning Effectiveness · Video Tutorials · Paper-based manual · Cognitive Load Theory

1 Introduction

Currently, most people use video media instead of paper-based manuals. As a learning medium, video has proven to be widely adopted in several countries. Many instructional designers argue that these electronic multimedia devices provide more benefits, both for teachers and students. Practical and easy to use is one of the advantages of these electronic media. In addition, why video is more advantageous in learning situation nowadays is due to several reasons. The first is because of the widespread use of computer around the world and the second is the lower cost of the internet bandwidth. Therefore, this advancement enables and facilitates the use of and creation of video with animation in computer based-learning environments [1]. In addition, the public can convey large amounts of information in a very short time by using video [2]. It is common knowledge that if a picture is worth a thousand words [3], and ten thousand words can be delivered

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by illustration [4], then the use of video is unquestionable and capable of conveying millions of words of information.

One type of video, called on-screen video, can be used to demonstrate what is happening on the monitor screen [2]. On screen-video is a full motion recording on a computer screen or as a show-me-how instruction [5]. This tool can also function as a computer screen record and demonstration. According to [2], the using of on-screen videos is to demonstrate procedural tasks. This task is characterized by training and acquiring skills in multimedia learning to get more complex contents. In addition, on-screen video also allows demonstration of applications in learning environment by using media that incorporates contexts authentically. On the other hand, on-screen video increases the practice of manually incorporating screenshots and the multimedia representation of already worked examples. It is trusted that the video on the screen can help carry out procedural learning tasks by realistically depicting what happens at the computer with similar objects.

Several studies have been conducted to determine the effectiveness of video learning media compared to static image media or paper instruction manuals in improving students' learning performances. In this case, [6] assessed students' performances using performance and achievement tests for students who received instructions through printed media or video instructions. The results showed that media video-based teaching materials were excellent in terms of pedagogic to print-based teaching materials regarding instructional effectiveness in teaching practical skills. Similarly, [1] investigated that video learning media is superior to static visualization media for students when understanding procedural tasks. The results show the general advantages of video media over static image media. In addition, an experiment was also conducted by [7] compared the students who received media video-based with students who received paper manual-based instructions. It was proved that the results were comparable to Donkor's study. Students who are given learning with video media achieve a higher level of learning than students who are given paper-based manual media.

If referring to several previous studies, dynamic visualization has no effect on student learning outcomes. Examples of dynamic visualization in this case is video and animation. It was found that static visualization outperformed dynamic visualization for novice students. In addition, according to [8] animation can confuse students who have limited prior knowledge. Thus, [9] suggested that dynamic animation, especially media video-based was not effective compare with the static image media. Although in reality, the complexity and speed of animation in presenting information can sometimes distract students. Although animation was proven to improve student learning outcomes in some cases, the content information presented in animation and static images was unmatched. Referring to the many inconsistencies found, of course the topic to compare the effectiveness of media video-based with the media paper-based tutorials remains an interesting area of investigation.

According to previous study, for example [6], he did not assess motivation as an important factor on the learning process effectively. In fact, basically motivation requires special attention so that instructional multimedia users feel confident in their abilities when experiencing obstacles or failures that are difficult to avoid, related to training and operating software. The assumption is that a multimedia learning environment can

increase student engagement and motivation. According to [10], the process of individual motivation: personal goals and interests, incentives, individual personality differences, and meta-cognitive knowledge is very influential on effort in learning activities. This argument is confirmed by [11] who argued that the pattern of cognitive load is mediated not only by instructional design, but also by student learning activities that influenced by students' interests and learning goals. In addition, [2] adds that motivation and acceptance have a significant impact on students' sustained level of interest and concentration. In addition, participants' mood, which reflects their feelings of happiness, sadness, or neutrality during learning plays a vital role when students concentrate during teaching and learning process. All of these processes will certainly produce results, namely the achievement of educational goals. Therefore, this research was conducted to fill in the gaps in previous study by involving students' motivational beliefs and moods. This is a novel aspect or a breakthrough of this study.

The purpose of this study was to determine and validate the effectiveness of using video to aid students' comprehension of procedural tasks in text formatting. The study compared students who used a paper-based manual to those who used a video-based manual. The minimalist principle and Cognitive Theory in Multimedia Learning (CTML) serve as theoretical frameworks for creating video and paper-based instructions. The CTML is a theoretical framework that enables the development of design principles for multimedia learning. It is applicable in a variety of situations where multimedia is used to instructional design. It refers to the process in perception (information intake via the eyes and ears), the storehouse of perception (i.e., acoustic and visual-sensory memory), and the various working memory subsystems [12]. CLT for multimedia learning makes three assumptions [13]: double assumptions [14], working memory capacity constraint [15, 16] and assumption of active processing.

In terms of motivation, this study utilized Keller's ARCS model. According to [17] ARCS model, motivational constructs such as task values and the expectations [18] in completing tasks, to be capable and successful can result in more challenging experiences. If it is related to design instructions, we need to catch the student's attention from the start. Next, we can build relevance by associating it with something useful, significant, and meaningful. By completing this step successfully, of course, we could gain the value, which as an excellent start in increasing the student's motivation and role. Following that, students are expected to be confidence in their ability to complete the task at hand. Finally, if learners successfully complete the tasks, they will feel satisfied with the learning process, which will likely result in the improved learning outcomes.

2 Method

2.1 Participants

This research involved 62 students of eighth-grade (age average 14.9 years old) from one of Bandar Lampung's Junior High School. They voluntarily participated. Students were assigned to conditions at random. The experiment (video) group consisted of 14 males and 17 females, while the control group consisted of 12 males and 19 females. Gender distributions did not differ significantly between two conditions. The participants gained adequate skills and mastery on Microsoft Word during the lesson of information

Table 1. Research design

	Pretest	Intervention		Posttest	Retention Test
		Paper	Video		
Control	O	X		O	O
Experiment	X		X	O	O

and communication technology lessons (TIK). Additionally, when asked to create report study, they usually used Microsoft Word. There were two participants failed on the retention test: one in the experimental class and another in the control class.

2.2 Study Design

This research employed a quasi-experimental pre-post-test intervention design. The participants were assigned to one of two conditions: control and experiment. The research design is summarized in Table 1.

2.3 Instruments

A paper-based manual, a video, practice materials, questionnaires, and a test were used as the instruments in this research.

2.3.1 Paper Manual

Because paper tutorials are extremely beneficial and appropriate for novice learners, their use should be enticing. Additionally, tutorials are self-explanatory materials that do not require teachers. This necessitates that the tutorial was made clearly through the users' direct action. The fundamental aspect of the design constructions for this tutorial is using minimalism principles [19] and the four components model [20].

2.3.2 Video

The video website's interface is divided into two sections. On the left side, a navigation list that functions similarly to the table of contents while on the right side, it demonstrates the windows viewing. When students click on a title on the left, the video associated with that title appeared on the right side. In a paper-based tutorial, the purpose of homepage served the same as the table of contents. The homepage was created using text formatting to correspond to each chapter of the tasks. Each chapter started with a page of introduction. At the introduction, participants will be briefed on their problems and solutions. Then, after the introductory chapter, the content chapter where students will be asked to complete tasks related to video presentations. It was referred to as the Task Page.

2.3.3 Questionnaires

Before, during, and after training sessions, questionnaires were created to assess motivation. The questionnaires were constructed using a seven-point Likert scale, with one point indicating "complete disagreement" and seven indicating "complete agreement." On this scale, students were asked to place a cross. A cross in the middle (4 point) can be regarded as the statement's neutral position. In both conditions, all questionnaires were administered on paper.

In the pre-test session, participants were asked personal characteristics questions to ascertain their name, gender, and date of birth. Three questions per training task were included in the motivation questionnaires, for six tasks totally. Firstly, an experience question ("Have you ever encountered this difficulty?"). Secondly, to inquire about the task's relevance ("How frequently do you wish to solve this problem?"). Cronbach's alpha was determined to be satisfactory for these questions (0.88). Thirdly, self-efficacy is requested ("How confident are you that you can solve this problem?"). Cronbach's alpha was also satisfactory for self-efficacy questions (0.86).

The participants were asked three types of questions during the training sessions: moods, motivational beliefs (task relevance and self-efficacy), and their time. After completing a training task, students in each condition were asked to complete the question measures. The mood was elicited by the following question: "How do you feel after completing this task?" To address the question, a model pictogram from [21] was modified slightly. There were five different smiles available: happy, certain, neutral, uncertain, and sad. Those who select "happy" and "certain" will receive a positive mood. Those who selected "uncertain" and "sad" will be assigned a negative mood. These questions were asked ten times in total during training. Students are asked to complete motivation questionnaires immediately following training. There are a total of 16 questions, eight of which assess task relevance and eight of which assess self-efficacy belief. Cronbach's alpha reliability for these questions was also satisfactory (0.89) for task relevance and 0.76 for self-efficacy.

2.3.4 Test

Students' skill performance was evaluated using hands-on tests. The test was given prior to training, immediately following training, and as a delayed post-test. Each test included six questions that detailed tasks in the text format. The post-test and retention test were designed identically to the previous knowledge examination (pre-test). All questions of the tests, such as pre-test, post-test, and retention test were included in a screenshot depicting the final correct response or actions that participants should be taken. Students were required to complete the task on their own. All of the examinations were graded according to the criteria as follows. 1 point was awarded to those who completed the task correctly. 0 point were given for all other options (i.e. incorrect method or without any problem solving). The maximum possible score on the test is six.

2.3.5 Analysis of Data

ANOVA was used to analyse the data from this experiment study. All analyses were conducted with a significance level (alpha) of 0.05. (two-sided). Scores on pre-, post-,

Table 2. Lavene Statistic for Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
pretest	1.341	1	60	.251
posttest	.038	1	60	.846
retention	.573	1	58	.452

Table 3. Descriptive statistics in the learning outcomes in pre-test, post-test, and retention test

Condition	Pre-test			Post-Test			Retention Test		
	N	M	s.d.	N	M	s.d.	N	M	s.d.
Manual	31	1.35	1.01	31	2.19	0.83	30	2.37	0.85
Video	31	1.81	1.30	31	5.00	0.85	30	5.03	0.80
Average		**1.58**	**1.18**		**3.60**	**1.64**		**3.70**	**1.57**

N = Number of students; M = Means; s.d. = Standard deviation
Maximum score is 6

and retention tests were considered repeated measures. To determine gender differences between two conditions, a t-test statistical analysis was used. Cohen's d statistic was used to determine the strength of the relationship between two measures. Cohen's d = 0.2 refers to a small effect size, d = 0.5 refers to a medium effect size, and d = 0.8 refers to a size of large or high effect.

3 Results

Does the video scores better on post-test and retention test?
As shown in Table 2, the pretest, posttest, and retention test all met the requirement for variance homogeneity. The Lavene statistic with alpha set to 0.05 indicated that the assumptions of homogeneous variances were met in the pretest with p = 0.25, posttest with p = 0.84, and retention test with p = 0.45. As a result, the following calculation was performed using ANOVA, as shown in Table 3.

Table 3 demonstrates that the students possessed nearly identical prior knowledge regarding the execution of procedural tasks in text formatting. As shown in Table 2, the difference between pretest and posttest was marginal and not statistically significant, F (1, 60) = 2.31, p = .13. The post-test revealed significant differences between the means of the two conditions, F (1, 60) = 170.98, p = .000. The difference in means between conditions was significant in the retention test, F (1, 58) = 154.92, p.000. The results of these repeated measurements indicated a statistically significant difference in both the post-test and retention test. In other words, the video condition significantly outperformed the paper-based manual.

Table 4. Motivational beliefs of students (mean) during training

		Task relevance				Self-Efficacy Belief			
		Before		After		Before		After	
	N	M	s.d.	M	s.d.	M	s.d.	M	s.d.
Manual	31	3.56	1.29	5.48	1.1.08	3.70	1.24	5.19	0.77
Video	31	4.63	1.55	6.15	0.38	4.51	1.56	6.02	0.46
Average		4.10	1.52	5.82	0.87	4.10	1.46	5.61	0.76

N = number of students; M = mean; s.d. = standard deviation
Maximum score is 7; a higher score means a more positive appraisal

Table 5. The reports of moods (mean/frequencies) before and after training

Condition		Positive		Neutral		Negative	
	N	M	s.d.	M	s.d.	M	s.d.
Manual	31	6.48	3.01	2.68	2.36	0.94	1.15
Video	31	7.78	3.05	1.83	2.42	0.32	0.83
	Average	**7.13**	**3.07**	**2.26**	**2.41**	**0.63**	**1.04**

N = number of students; M = mean; s.d. = standard deviation

Does condition affect motivation gains?
According to Table 4, the comparison of conditions on Task Relevance and Self-Efficacy prior to training revealed significant differences for these two measures: F (1,60) = 8.79, p = .004 for Task Relevance and F (1,60) = 5.14, p = .027 for Self-Efficacy. As a result, these variables were included in the ANOVA as covariates. After training, task relevance was greater for them that used video than for those that used manual tutorials, F (1, 59) = 6.58, p = .013. After training, students who used video had significantly higher self-efficacy beliefs, F (1, 59) = 21.26, p.001.

Does this condition effects to the mood?
According to Table 5, in both conditions, students exhibited a generally positive mood during training session. About two thirds of ten samples measured were considered neutrally. A negative mood was reported in only one of the ten measurement instances. Even though more students in the video condition had positive moods compared to the manual condition, the discrepancy between the conditions was not significant statistically, F (1, 60) = 2.81, p = .09. In the neutral mood condition, more students were neutral in the manual state than in the video state, but the difference is not statistically significant, F (1, 60) = 1.90, p = .17. It was, however, a significant difference among the negative mood conditions statistically, F (1, 60) = 5.76, p = .02. Few students with a negative

mood in the video condition than in the manual condition. This indicates that instructing via video can help reduce negative moods during training.

4 Discussions

It was discovered in this experiment that students in the video condition improved their skills more than those in the tutorial condition in the post-test and retention test. Table 3 showed that the average of post-test score obtained by participants on the paper-based manual condition was 2.19, while it was 5.00 in the video condition. Additionally, the video demonstrated a higher level of rigor and superiority to the paper-based manual during the retention test. The score average by using the media video-based was twice that of the mean average in the tutorial condition (5.03 compared to 2.37). The difference in these ways shows that the video is more effective at text formatting than the paper-based manual on both of these two measures. As predicted, both the post-test and retention tests revealed a statistically significant difference in means for the video condition (see Table 3). It can be assumed that with the table of contents on the video website helps the user in navigating and exploring the content of the video material more easily. When we connect it to [22] navigation principle, this is actually used. Learners will benefit from navigation features if they are based on navigational principles. This table of contents probably provided the participant with additional options for selecting learning materials. Additionally, using a goal or sub-goal as the chapter title in the table of contents may help participants become more engaged in their learning. This is referred to give labels. By labelling, the students became to be aware to what they were learning, especially on declarative knowledge. In these circumstances, students were directly prompted to identify sub-goals that were pertinent to their own interests. Additionally, labelling can serve as a cue to create sub-goals [2]. So, it is assumed that when the table of contents is presented without the goals' names, learners will experience increased cognitive load (for example, just indicate chapter 1, chapter 2, chapter 3, etc.). Some empirical research substantiated this prediction [2].

Another factor that may have contributed to the video's superiority over the tutorial was the number of practices performed by the video participants. Practice was designed to ensure that the learning tasks completed during training were successful. As an independent part of procedural skills or knowledge can be more effective if taught or practiced separately, and this needs to practice repeatedly [2]. Participants in the video condition practiced the tasks after watching the video. The students also practice during the tutorial, but they do it while reading the instructions. In tutorials, it is assumed that students were not actively involved in learning because they only follow tutorial instructions briefly. As a result, students in the video condition were more aware of the need to solve problems through increased practice on their own than in the tutorial conditions.

As previously discussed, video-based media resulted in greater motivational gains in task relevance and self-efficacy beliefs after training. At the outset, an unexpected result was getting from motivation questionnaires treated before training. The results show that there was a significant difference between the conditions before and after training (see Table 3). However, ANCOVA analysis revealed that there were still significant differences in the condition that tutorial training has lower results than video training. It

means that self-efficacy and task relevance increase significantly as a result, especially video-based training.

Of course, this was a participant's first experience in using on-screen video and as of a tutorial guide for learning about text formatting. Several students expressed to the experiment and comment on how much they enjoyed studying through self-instructed multimedia demonstrations in training. They were ready to have a challenge in solving any problems on their own. They believe in their post-training motivation. Most of students in the media video-based demonstrated a range of agreement between "agree" and "completely agree" following training (mean average 6. 15 for Task relevance and 6.02 for self-efficacy with maximum point a 7 for completely agree). Prior to training, students in the media video-based displayed a moderate level of motivation (not far from the midpoint of 4 as neutral).

Motivational positive impacts were connected to involve in learning and cognitive point of view. Referring to the cognitive-motivational process model [23], the first mediators of motivation's effect on learning are the duration and frequency of exposure. It was argued that the amount of time spent on a task has an effect on learning outcomes. According to their findings, high initial motivation caused students spending more time on learning task. People called this as persistence. Following that, students with knowledge in lower base but have a high motivation level were steadier and thus accumulating more knowledge over time than comparing low-motivated students. On the other way, students who are highly motivated to learn typically devote more time to the learning process, which helps them stay persistent and successful in learning tasks. [24] confirmed this finding and corroborated this research.

According to the treatment, students who used video media were more motivated to complete learning tasks during training, and were even able to gain more knowledge than students who used manual media. This result confirmed how motivation is important [25, 26]. As expected, the research's findings revealed significantly more positive moods among the participants during training (see Table 5). On the other hand, the video condition had a statistically significant effect on negative moods. This means that training could increase the students' positive perceptions and feelings while also decreasing their negative moods. In this case, mood was appropriate to represent and track students' motivational states of enjoyment, fear, frustration, anxiety, and other similar emotions throughout training. Mood was thought to have an effect on students' motivation and concentration levels during educational activities.

Due to the lack of systematic observation of what students were doing by using their computers during text formatting training, additional research must be conducted using systematic measures to validate the findings.

5 Conclusions

From the findings, this research concludes that there is a successful comparison of experiment between the use of video-based instructions and paper-based manuals. It is believed that videos are superior to tutorials in the following ways: (1) students who use video-based media show greater learning better as measured by post-test and retention tests; (2) learners with the using video-based media demonstrated greater motivational

beliefs following training, as measured by self-efficacy and task relevance measures; and (3) students also have higher positive mood during training. A suggestion for further research needs to be done because this research lacked of systematic strategy for recording students' activities during training in order to monitor what was happening and determine whether students in both conditions completed tasks correctly. Additionally, a qualitative method for additional analysis is required to round out these quantitative measures.

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