

Effectiveness of Video-Based Learning on Students' Memory: A Randomized Controlled Trial

Hathush Nehan Robert^{1*}, Yaashiyni a/p Vejanthern¹, Samindi Navanchana Fernando¹, Kishanthini a/p Viswanaathan¹, Erick Tan Yan Jin¹, Soe Moe², Mila Nu Nu Htay^{2*}, Htoo Htoo Kyaw Soe²

Corresponding author email id: hathushrobert458@gmail.com, drmlnnh@gmail.com

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ABSTRACT

Along with the technological development, the use of video-based learning has increased rapidly in the higher education sector. This study aimed to assess the effectiveness of video-based learning on medical students' memory while comparing with the effectiveness of text-based learning. A randomized controlled trial was performed in a private medical university in Malaysia by recruiting 40 medical students. The sample was randomized as block randomization. The intervention group was shown a video on DNA Fingerprinting and were given a questionnaire to assess the memory, concentration, satisfaction, and performance. The control group was given a text on the same topic which was followed by a questionnaire to assess the memory, concentration, satisfaction, and performance. All statistical tests were seen at two-tailed level of level of significance ($p < 0.05$). The mean score percentage of the video-based learning was 74.5 whereas the text-based learning had a mean score percentage of 78.0. The text-based group scored more than the video-based group (mean score difference = 3.5 ± 16.45 , 95% CI = -7.93, 14.93, $p = 0.538$). The concentration was measured using a Likert scale and both the intervention and control group gave a score of 4. The study showed that the participants preferred video-based learning for future use. In conclusion, the video-based intervention learning was more preferred method than text-based learning although the mean score percentage was lower in the intervention group.

¹ Faculty of Medicine, Manipal University College Malaysia, Jalan Batu Hampar, 75150 Bukit Baru, Melaka, Malaysia

² Department of Community Medicine, Faculty of Medicine, Manipal University College Malaysia, Jalan Batu Hampar, 75150 Bukit Baru, Melaka, Malaysia

INTRODUCTION

E-learning and web-based learning is rapidly becoming a vital part of the teaching methods used in medical schools and continuing medical education throughout the world [1,2]. Of the multiple reasons, availability of electronic gadgets including smartphones, tablets, and laptops and online learning favors for e-learning.

Cognitive load theory provided guidance throughout the planning and development of the educational animations utilized in the present study [3,4,5] in step with the Centre for Education Statistics and Evaluation: "Cognitive load theory is predicated on variety of wide accepted theories regarding however human brains method and store data [6]. These assumptions include that human memory are often divided into remembering and Long-Term Memory (LTM); that data is hold on within the long-run memory within the style of schemas; which process new data ends up in "cognitive load" on remembering which may have an effect on learning outcomes [7,8,9].

The use of video-based learning has been proliferating in higher education. Video-based learning is a technique that mimics motion on the screen and is widely used in academics in recent years. The use of animated videos that contains animated graphics set to a narrative script and animated cartoons, which are animated short films used as a form of entertainment as well as learning materials have various advantages such as providing memorable examples, increasing students' interest by telling stories [10], and attaining students' attention [11,12], helping students with difficulty in quickly processing large tracts of written text or dialogues to increase learning efficiency and understanding [13], encouraging students to participate in class discussion [14], and helping remedy misconceptions [15,16,17]. The utility of videos as learning tools has been studied and compared with conventional printed materials [18].

Studies have shown that videos have unique characteristics in using the audio or verbal channel and the visual or pictorial channel to convey educational ideas. A combination of the uses of both channels to convey appropriate and complementary information can improve student retention [19] and engagement with the videos [15,20].

Several studies have been conducted to examine which of the two modalities was best suited for acquiring theoretical knowledge among medical students regarding medical curriculum. A previous study was done to see if video intervention was more effective in reducing the stigma against mental health illness among undergraduate students in private medical colleges in Malaysia [21]. According to the dual-coding theory [22] and supporting original research [23], video material was more likely to enhance retention of information than text material alone [24]. In this study, we aimed to evaluate the effectiveness of video-based learning compared to text-based learning for teaching DNA fingerprinting technique by assessing the students' memory and concentration in both groups.

METHODS

Study setting

An experimental study was conducted in November 2021 through an online meeting (Microsoft Teams) by recruiting medical students in a private medical university in Malaysia.

Sample size and sampling

A sample size of 40 participants was estimated and participants were recruited by convenience sampling method. The inclusion criteria were the medical students who volunteered to participate in the study and whose informed and written consent was obtained via Google forms. The exclusion criteria were any students who did not fill up the questionnaire completely and those were not available when consent and questionnaire forms were distributed.

After recruiting 40 participants, they were randomly assigned into two groups of 20 participants in each intervention (video-based learning) and control groups (text-based learning). The randomization was performed online employing a block randomization method.

Study intervention and control

The video about DNA fingerprinting was distributed, which was obtained from YouTube. The text material was made by transcribing the contents of the video into text. The trial was conducted online via Microsoft Teams application. First, the intervention group (video-based) intervention was conducted. Informed consent was obtained from all the participants. Then, the video was shown via screen share. The video was approximately 4 minutes in duration, after which the participants were asked to answer a questionnaire.

The control group (text-based) trial was conducted similar to the intervention group where instead of video, the participants were sent the text material that was designed for the study and were given 7 minutes to read it, following which a link to the questionnaire was sent to them and the responses were collected.

Data collection

An online consent form given to the participants via google form and collected before the commencement of the experiment. The questionnaire consisted of two parts. The first part consisted of ten multiple choice questions and answers. The questions and answers for the multiple-choice question was based on information given by the Youtube video. For each correct answer, one mark was awarded. No negative markings were given if incorrect.

The second part contains feedback and satisfaction of the student's performance towards the experiment. The students were asked to respond to the questionnaire by using a five-point Likert scale from strongly disagree to strongly agree. The online questionnaire was distributed via google forms for the students to answer immediately after the experiment had concluded.

Data analysis

Data was saved in Microsoft Excel and compiled, while Epi info V7.0 was used for the statistical analysis of the data. For quantitative data, the range, mean along with standard deviation, and median along with interquartile range were calculated. For the qualitative data, the frequency and percentage were calculated. Level of significance was set at 5% which was 0.05. Statistical test that was used for hypothesis testing was determined based on the independent and dependent variables. Unpaired t-test and Mann Whitney U test were used for the data analysis.

Ethical consideration

Ethical approval was granted by the Research Ethics Committee, Faculty of Medicine, Manipal University College Malaysia. The participants were well informed that participation was voluntary, and informed consent was acquired. The participants were informed that the study was strictly confidential. They were also encouraged to answer the entire questionnaire during the data collection period.

RESULTS

A total of 40 participants were divided into two groups and only 35 participants' data were completed. The text-based group had a response rate of 75% whereas the video-based group had a response rate of 100%.

Of those who responded, 11 of the participants were in the age group of 22 - 23 years in the text-based group with mean age of 22.8 years and 11 of the participants were in the same age group in the video-based group with mean age of 21.9 years. Most of the participants were noted to be females (62.9%), leaving a total of 13 responses to be that of males (37.1%). In the text-based group 60% were females while 40% were males and in the video-based group 65% were females while 35% were males (Table 1).

Table 1: Socio-demographics of the participants (n=35)

Variable	Frequency (%)		
	Text-based (n=15)	Video-based (n=20)	
Age (years)	< 22	1 (6.67)	6 (30.0)
	22 - 23	11 (73.3)	11 (55.0)
	>23	3 (20.0)	3 (15.0)
	Mean (SD)	22.8 (1.01)	21.9(1.21)
	Min - Max	21 - 25	20 - 24
Gender	Female	9 (60.0)	13 (65.0)
	Male	6 (40.0)	7 (35.0)
Ethnicity	Chinese	2 (13.3)	3 (15.0)
	Indian	7 (46.7)	8 (40.0)
	Malay	0 (0)	2 (10.0)
	Others	6 (40.0)	7 (35.0)

Table 2 shows the results of the analysis of the two mean scores obtained from the text and video groups. The unpaired t-test was conducted to test the difference between the two means and to assess its significance. The text-based group scored an average of 78% with a standard deviation of 13.73, whereas the video-based group had an average score of 74.5% and a standard deviation of 18.20. The difference in means was found to be 3.5, suggesting that the text-based group may have performed better than the video-based group. However, the finding was not statistically significant (Table 2).

Table 2: Comparison of memory mean scores of video-based and text-based learning

Outcome	Text-based	Video-based	Mean difference	95% CI	P*
Mean Score Percentage	78.0±13.73	74.5±18.20	3.5±16.45	-7.93, 14.93	0.538

*Unpaired t-test

Table 3 presents the feedback from the participants towards their experience of the interventions. Satisfaction of text readers had a median score of 4 and video watchers gave a median score of 4. For the performance of the participants on the questions, text-based have a median score 4 and video-based have a median score of 4. The result of concentration of the participants during the experiment, text-based participants had a median score of 4 and video-based group had a median score of 4. When participants were asked whether the given material was sufficient for their understanding, video-based intervention group participants showed a median score of 5 while in text-based group showed a median score of 4. Regarding participants' preference of method for future use, text-based participants gave a median score of 4 and video-based participants gave a similar median score of 4 (Table 3).

Table 3: Feedback of participants comparing between text-based and video-based intervention groups

Variable	Median (Q1, Q3)		
	Text-based group	Video-based group	P*
Satisfaction	4 (4,5)	4 (4,5)	0.352
Performance	4 (3,4)	4 (3,4)	0.913
Concentration	4 (3,5)	4 (3,4)	0.832
Was the given material sufficient	5 (4,5)	4 (4,5)	0.398
Preference for future use	4 (3,5)	4 (4,5)	0.352

*Mann-Whitney U test

DISCUSSION

This randomized controlled trial aimed to compare students' memory and concentration between video-based learning and text-based learning. In order to assess memory, ten multiple choice questions based on the topic of the video and text were applied. There was no significant difference in memory between video-based and text-based learning. Interestingly, a similar study was conducted among the medical students at University of Copenhagen [25]. A randomized control trial was performed with two groups: video and text groups. The outcome was to assess procedural skills and theoretical knowledge, by conducting a primary exam soon after the intervention as well as a follow up exam one month after the intervention. That study reported that there was no difference in theoretical knowledge between the two groups in the primary exam, which is a similar result to our study. However, there was a significant difference in theoretical knowledge in the follow up exam, where the video group performed better than text group. Another study conducted at the Gottingen Medical School among the fourth-year medical students revealed that there was a difference in scores of the retention test between the video and text groups, although the difference was not significant [24].

In this study, the participants' satisfaction between text-based learning and video-based learning was not statistically significant. However, in a similar study conducted by Steen and his colleagues among 60 medical students in University of Copenhagen found out that the students would prefer video learning as compared to text learning [25]. In the context of student's self-evaluated performance, the performance was found to be not significant which coincides with a similar study among medical students further emphasizing that both text learning and video learning did not affect the student's overall confidence [25]. Student's concentrations were not significant among two groups in our study. Previous study conducted in Taiwan at Chung Yuan Christian University found out that video learning was positively influenced by their willingness to use the technology when compared to groups which used less technology such as text learning [26].

Regarding the study materials, text-based learning group gave a higher score about providing sufficient material compared to video-based learning group, however, it was not significant difference. A study conducted by Bhatti and colleagues, shows that there was a significant gain in retention of knowledge with the use of video which contradicts with our finding [27]. In another study, rather than having only video learning as the source of information, students much preferred having a summarized video with written notes or other forms of note taking methods [28]. Preference for future use was not significant, however the quartile range were more centered around a higher score in video learning than in text learning. A separate study done by Pojchong at Siriraj Hospital suggested that implementation of video-based learning bring multifactorial benefit to its user [29]. In another study, an interesting observation found that video was a less preferred learning tool than using text. However, the final results shows that video performed significantly better than text learning [30].

The strengths of this study were comparable groups, simple structures, and applicable breakpoints. There were some limitations in this study. Since the participants were recruited with non-probability sampling method, the generalizability might be limited. The study was conducted online and some students were not able to participate in the experiment due to the internet connection and technical issues.

CONCLUSION

In conclusion, the video-based learning was preferable than text-based learning although the mean score percentage was lower in the video-based group. Future studies should be conducted with the larger sample size with a wider range of sample population to assess the effects of video-based and text-based learnings in comprehension, memory retention, and satisfaction.

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