From passive to critical consumption: The role of educational content in short videos to improve students' critical thinking skills

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Abstract: The engaging and personalized nature from short video makes it quickly popular, yet concerns persist about their potential to diminish critical thinking skills. This study investigates whether short videos with educational content can improve students' critical thinking skills. Using a quasi-experiment method, Thirty-three participants were divided into control and experimental groups, with critical thinking measured using the Holistic Critical Thinking Scoring Rubric (HCTSR) based on essay analysis in pretest and posttest. After administering educational short videos to the experimental group, the results showed that there was an increase in students' critical thinking skills, shown by the result of controlling the pretest variable through the ANCOVA test with a p-value of <0.001. The result highlights the potential of educational short videos as tools for fostering critical thinking by providing interventions which prioritize treatment fidelity through standardized protocols (SOPs) for content delivery, validating assessment tools, and structuring content design. Recommendations for future research include larger sample sizes, repeated data collection at strategic intervals, and rigorous validation of question complexity.

Keywords: Vocational education; Quality education; Critical thinking; Short videos; Educational intervention

1. Introduction

The popularity of short videos is increasing among social media users (Zhang, 2020). Short video refers to video content that has a short duration, ranging from a few seconds to a few minutes that is published online on various social media platforms (Liao, 2024). One of the reasons why short videos have become so popular is because of their characteristics of better affinity and personalization than longer videos (Elgaaied-Gambier & Mandler, 2021). Short videos can be easily digested due to the shorter duration of the content. The short duration allows for a more focused delivery of material without overloading students' cognition. This is in accordance with the principle of microlearning (Aldosemani, 2019; Leong et al., 2021). Furthermore, short videos are also in accordance with the characteristics of the human brain, which more easily remembers content that is presented visually and concisely than long material (Guo et al., 2014; Sweller, 1988). Additionaly the combination of graphics, music, and narration makes learning more interesting, especially for the generation that is accustomed to visual content on platforms such as TikTok, YouTube Shorts, or Instagram Reels.

However, short videos allow users to acquire core information in a very short time, but they will miss out on deep reflection on the events around them. When in-depth reading is replaced by shallow video content, one's intention to think will further disappear, which will eventually lower

one's critical thinking ability (Gao & Xiao, 2023). In contrast, short videos with educational content will be different. The difference can be in terms of active involvement of short video users such as asking questions, interactivity or with reflection so that short videos can be an entry point in the habit of critical thinking.

With its advantages, there is an idea to make short videos as learning media (Zhu et al., 2022). The idea is to include educational content in the short video format, such as research conducted by Zheng & Yan (2023) which showed that the level of knowledge in the group that was intervened with short videos was significantly higher (95.1%) than the group that did not get the intervention (82%). The positive trend in the use of short videos does not only apply to theoretical learning, even in learning that emphasizes practices, short videos can have a good influence on students' skills (Bulca et al., 2022). Therefore, This study aims to see whether short videos with educational content can improve students' critical thinking skills.

2. Methods

Quantitative research design was chosen through Quasi Experiment to fulfill the purpose of this study. Quasi Experiments can manipulate conditions in the learning process (Maciejewski, 2018).

2.1 The study design and participants

Convenience sampling was used to select 33 Mechanical Engineering students in two different classes. The classes used were classes that have been determined by the Department of Mechanical Engineering. The classes raise administrative and ethical barriers, so it was not possible to do random assignment (Cohen et al., 2017). This makes the research findings only applicable to students in the Mechanical Engineering department. The control group (CG) consisted of 17 students while there were 16 students in the experimental group (EG). The inclusion criteria covered: (1) aged 17-20 years, (2) are first-year students in the Mechanical Engineering department, (3) have never done learning using short videos, and (4) take technical drawing courses. The exclusion criteria was students who have taken technical drawing courses in the previous year.

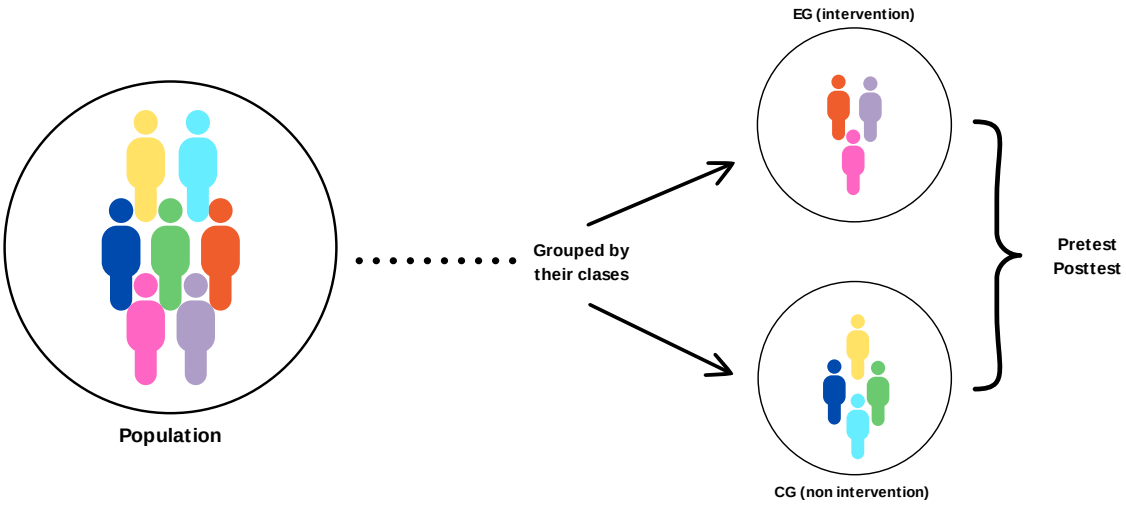


Figure 1. Research design

2.2 Group assigment

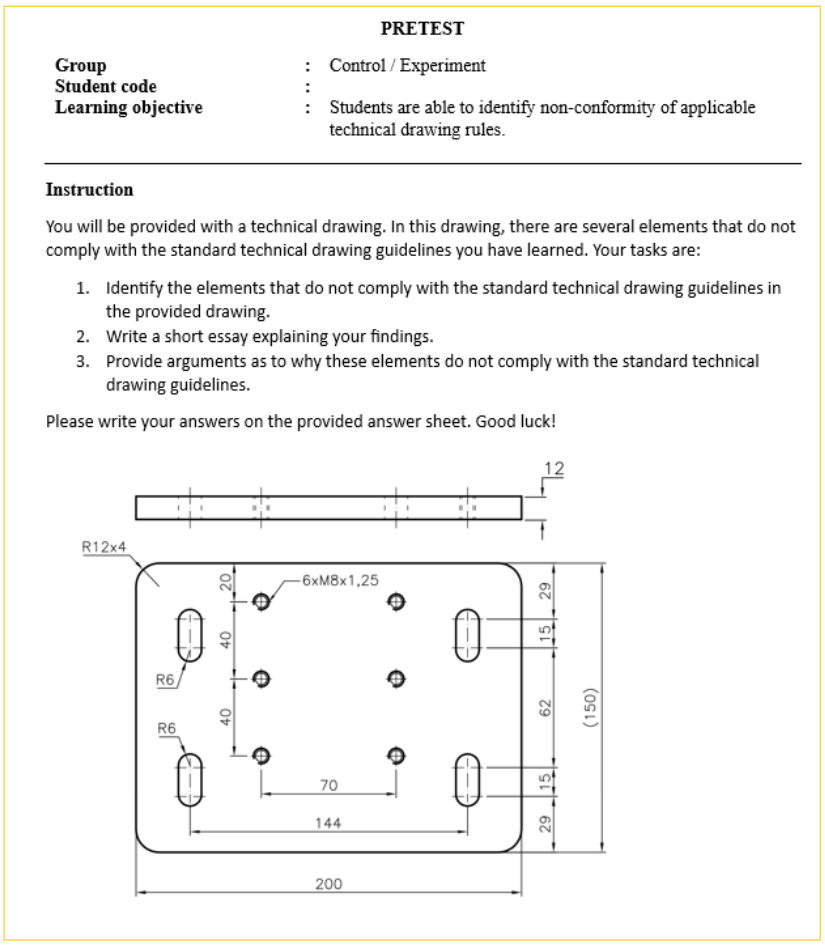
The control group whose 17 students will receive conventional learning, while the experimental group whose 16 students will receive the same learning method, enriched by the intervention of short videos with educational content. Table 1 below shows comparison of demographic characteristics of students.

Table 1. Comparison of demographic characteristics of students

Group	Short Video	Male	Female	N total	Average
Control	No	17	0	17	18
Experiment	Yes	16	0	16	18

2.3 Experiment plan

In the control group, learning began with a presentation of the learning objectives by the instructor. The instructor then conducted a pretest to ensure there was no difference in the level of critical thinking of students in the two classes. A pretest was given by distributing questions to students. The question contained an engineering drawing that has several discrepancies with the rules in engineering drawing according to ISO standards. The task for students was to find and make an essay on why the things they found were a discrepancy in drawing standards. The pretest was done in 20 minutes. The pretest sheet is presented in Figure 2.



PRETEST

Group : Control / Experiment
Student code :
Learning objective : Students are able to identify non-conformity of applicable technical drawing rules.

Instruction

You will be provided with a technical drawing. In this drawing, there are several elements that do not comply with the standard technical drawing guidelines you have learned. Your tasks are:

1. Identify the elements that do not comply with the standard technical drawing guidelines in the provided drawing.
2. Write a short essay explaining your findings.
3. Provide arguments as to why these elements do not comply with the standard technical drawing guidelines.

Please write your answers on the provided answer sheet. Good luck!

Figure 2. Pretest

An oral presentation with PowerPoint was presented after pretest. This included answering student questions and providing demonstrations. Finally, a posttest to see the final ability of the group was conducted. In closing, the scores obtained by the students were announced. In the experimental group, the initial stages had no difference with the control class. After the pretest, the experimental class was given an intervention in the form of a short video designed by the researcher in addition to their regular learning. A Google Drive link containing the short video was given to them, to be watched independently. The short videos with a duration of 45-60 seconds were made, providing material exposure to ISO standards accompanied by visualizations that made it easier for users to understand the explanation given. During 60 minutes of learning activities, students were provided with material, and they were required to watch short videos in 15 minutes.

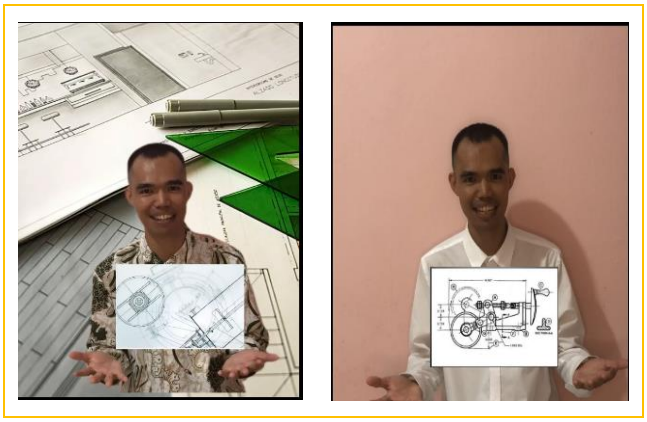


Figure 3. Screenshot of the short video used

During conducting the treatment, students were supervised and assisted if they found difficulties to access short videos. Here, the questions were answered and independent learning was encouraged to students. After the intervention was completed, the students were assigned to do the posttest. It ended with the announcement of student scores. The essays were scored in the range of 1-12. A score of 7-9 received an Acceptable predicate, and a score of 10-12 received a strong predicate. Similarly, scores of 4-6 received an unacceptable predicate, and scores of 1-3 received a weak predicate in terms of critical thinking. Figure 4 explains the experimental plan in detail.

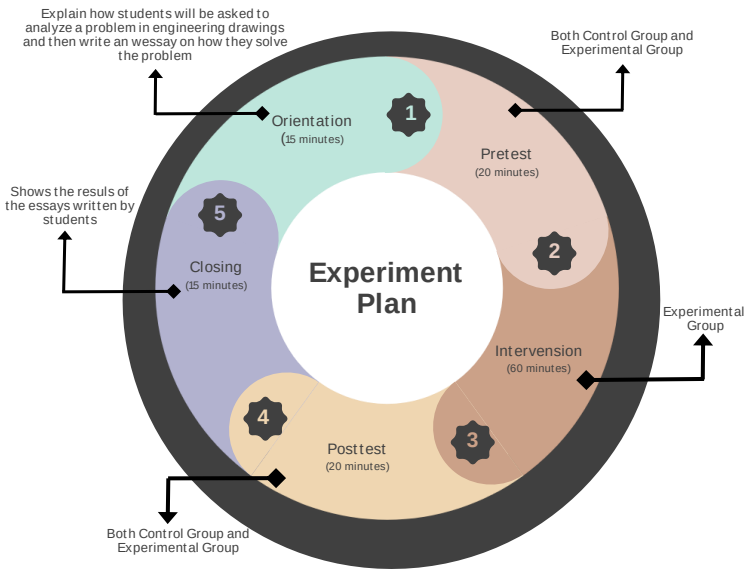


Figure 4. Experiment plan

2.4 Data collection and tools

The Holistic Critical Thinking Scoring Rubric (HCSR) by Facione & Facione (1994) was used to measure students' critical thinking skills by evaluating writing activities. This rubric has four levels, starting with weak, unacceptable, acceptable, and strong levels. The components for each level are presented in Table 2.

Table 2. The holistic critical thinking scoring rubric level and its components

Levels of critical thinking	Components
Weak	Biased, think superficially, defends false claims, incapable of establishing a cause-effect relationship, incapable of using evidence, closed to different ideas.
Unacceptable	Misinterprets the problems, is inadequate to put forward strong reasons, ignores alternative ideas, is incapable of making objective evaluations, evaluates without any evidence, and retains prejudice.
Acceptable	Defines the problem correctly, explains the claims and justifications related to the subject, accepts different ideas, and tries to reach correct results.
Strong	Defines the problem correctly, explains the claims and justifications related to the subject, evaluates different ideas as a whole, reaches definite and logical results, and makes accurate and unbiased evaluations.

The essays written by students in answering a case based on these components were assessed. HCSR has been widely used to determine the level of critical thinking of students, for example in a study conducted by (Singh & Butola, 2024) who used HCTSR as a tool to evaluate the level of critical thinking of nursing students in critical situations (e.g., stroke cases, head injuries). Data were collected through case-based scenarios.

2.5 Quality control

A quality control was implemented to maintain the accuracy, objectivity, and authenticity of the data. The classes were taught by the same teacher. This would help ensure that differences in results between the control and experimental classes were not due to differences in teaching style, experience, or approach of the teacher. The division of classes into control and experimental groups was completely randomized. The control group was ensured to receive the same treatment and attention as the experimental group, except for the intervention with educational short videos. After all, a pretest was also conducted in both groups before the intervention to ensure that there was no difference in the level of critical thinking in both groups. Data were evaluated, and descriptive statistics were used to analyze the demographic characteristics of the research object. Normality and homogeneity tests of the data were conducted, prior to t-tests and ANCOVA. Data normality and homogeneity tests were conducted, as well as t-test and ANCOVA.

2.6 Short video

The short videos used in this study were short videos made for research purposes and short videos circulating on social media that are related to learning. Figure 5 below shows the syntax of the short video used to intervene the experimental group. The making of this short video was based on several sections that can be seen in Table 3.

Table 3. Short video sections

Section	Rationale
Question	Using an open-ended question engages viewers' curiosity and primes them to analyze or evaluate
Depth of analysis	Explaining how to reach the answer
Explanation Compare 2-3 arguments	Presenting 2-3 arguments on a topic will stimulate users to always consider alternative answers
Use of visuals to map logic, biases, or evidence gaps	Clarifying complex ideas, aiding synthesis
Advice	Providing actionable strategies
Interactive Engagement	Triggering critical thinking

Based on these criteria, figure 5 depicts the syntax of the short video used in this study.

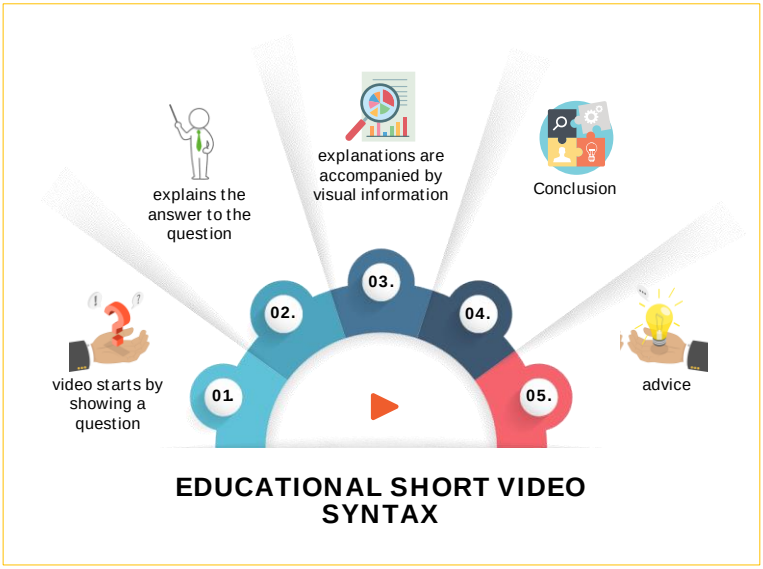


Figure 5. Short video syntax

3. Funding and discussion

First, descriptive data were presented, followed by inferential statistics of the results obtained in the control and experimental groups in both the pretest and post-test. In order to determine the appropriate statistical test to use, normality was tested using the Shapiro-Wilk test and homogeneity of variance using the Levene's test. Once normality and homogeneity of variance were verified, the parametric Student's t-test was applied. Table 4 shows the descriptive data of the pretest and posttest of both groups.

Table 4. Descriptive Statistics

Group	Short Video	N	Pretest					Posttest				
			Min	Max	Max Possible	M	Std. Dev	Min	Max	Max Possible	M	Std. Dev
CG	No	17	4	12	12	8.1	2.59	3	11	12	6.82	2.24
EG	Yes	16	5	11	12	8.0	1.86	5	12	12	8.25	1.91

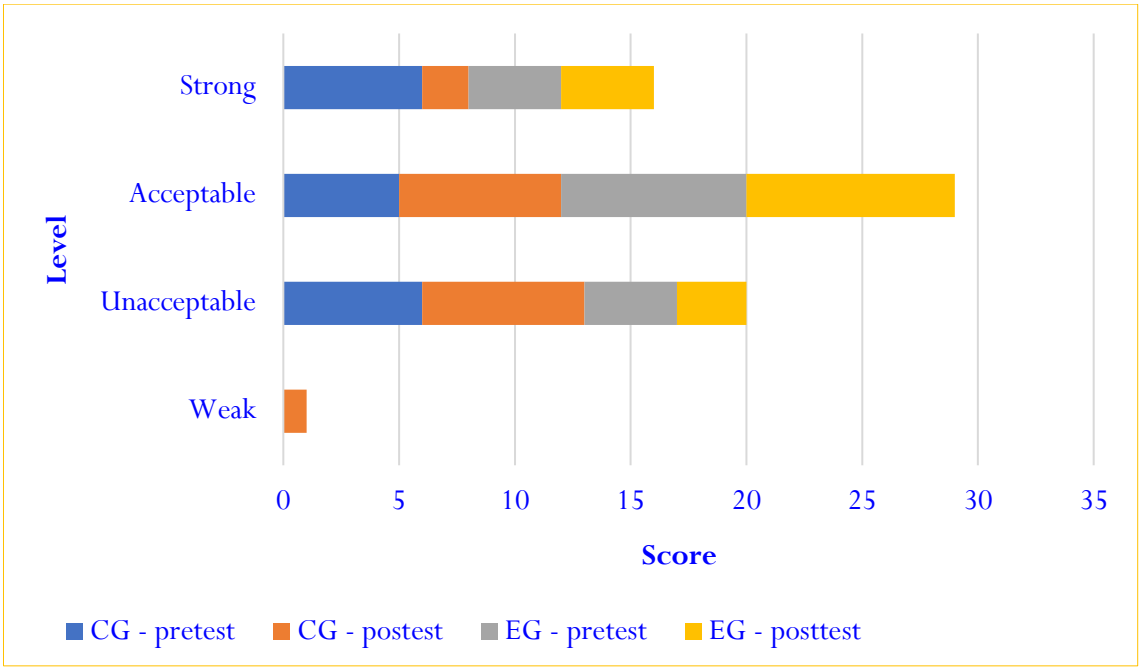


Figure 6. Diagram of the distribution of critical thinking ability levels

The data showed that in the pretest, the two classes did not show a big difference. However, the difference was seen after the intervention in EG. Table 5 shows the results of the Shapiro-Wilk test with a p-value> 0.05, which means that the distribution of research data is normal.

Table 5. Shapiro-Wilk test

Group	Statistic	df	p
CG-pretest	0.938	17	0.293
CG- posttest	0.976	17	0.293
EG- pretest	0.946	16	0.424
EG-posttest	0.975	16	0.916

The results of the Homogeneity of variance test with Levene's test on the pretest obtained the results of F = (1,31)= 3.675 with p = 0.64, and for the posttest was F = (1,31) = 0.573 with p = 0.454, confirming that the parametric statistical tests could be used, particularly t-test.

3.1 Students critical thinking skills on pretest

Table 6 shows the results of the t-test for independent samples for the pretest in both classes to see if there is a significant difference in critical thinking skills between the two classes before the intervention.

Table 6. T-test for independent sample for pretest

Group	N	Average	Std. Dev	T	P
CG	17	8.1	2.59	-0.149	0.883
EG	16	8.0	1.86		

The pretest results showed no significant difference in the level of critical thinking between EG and CG, as the p-value (0.883) was greater than 0.05. This means that before the intervention of the short educational videos, both groups had similar critical thinking skills. The similarity of critical thinking ability between the two classes prior to the intervention makes any potential differences, seen in the posttest likely to be due to the intervention itself, rather than pre-existing differences. The next step was to conduct a t-test for independent samples for the post-test to see if there is a significant change after the implementation of educational short videos in the experimental class.

3.2 Students critical thinking skills on posttest

The posttest results showed that there was an increase in EG's average critical thinking ability after the intervention. However, the p value (0.059) was slightly above the general significance threshold (0.05). This means that the increase in critical thinking ability in EG was not statistically significant. However, this result cannot be completely discounted. These results indicate that short videos with educational content may have a potential effect on improving students' critical thinking skills, but this effect is not strong enough to be considered statistically significant.

Table 7. T-test for independent sample for post-test

Group	N	Average	Std. Dev	t	p	Cohen's d
CG	17	6.82	2.24	1.959	0.059	0,682
EG	16	8.25	1.91			

This could be due to several external variables, the first of which is treatment fidelity. It is possible that students in the experimental class did not implement the same intervention, particularly in terms of the duration of watching the short videos. This non-uniformity will affect the stimulation of critical thinking from the short videos. For example, if the question section that stimulate curiosity or explanation section that compare 2-3 arguments are skipped, students will miss the opportunity to engage in evaluative reasoning. Hence, there is a need to standardize the intervention protocol for the facilitator and students tested with an independent observer to record whether the intervention was implemented according to the protocol as done by Krass (2016). The facilitator will be in charge of ensuring all participants get the same duration that directly activates the critical thinking process.

Second, there is a sense of boredom due to the pretest and posttest which were conducted in too close time interval or in a tired participant's condition. This can affect the participant's ability to provide optimal results. For this reason, it is recommended to provide a sufficient time interval between the pretest and posttest as done by Faria & Lobato Miranda (2024). In the study, it was stated that a time interval would give participants a mental break. This is needed, especially when performing critical thinking skills. It is also a reflection of educational strategies that emphasize cognitive readiness for difficult tasks. The content of the short videos used may not be designed to stimulate students' critical thinking skills. Thus, we need a short video syntax that can stimulate critical thinking skills. Systematically organized video syntax as done by Prasetyo (2024) showed the effectiveness of short videos in improving students' cognitive.

In addition, there are differences in the speed of adjustment to new ways of learning. Some students can adapt at the first time, but some students may need repetition of this way of learning to internalize and critique the content. Repeated interventions as implemented by Kayaalp (2020) can accommodate these differences, so that all students can develop critical thinking skills before the posttest. In addition, this result can also be caused by possible differences in the difficulty level of

questions on the pretest and posttest as found by Skvarc & Fuller-Tyszkiewicz (2024). Dimitrov & Rumrill (2003) revealed that more difficult posttest questions can obscure the improvement of students' critical thinking skills. Moreover, the questions were created spontaneously by the researcher during the study so there was no opportunity for students to prepare answers in advance. Overall, the questions should balance between novelty and consistency. However, statistically, this result was obtained due to the relatively small sample size of the study.

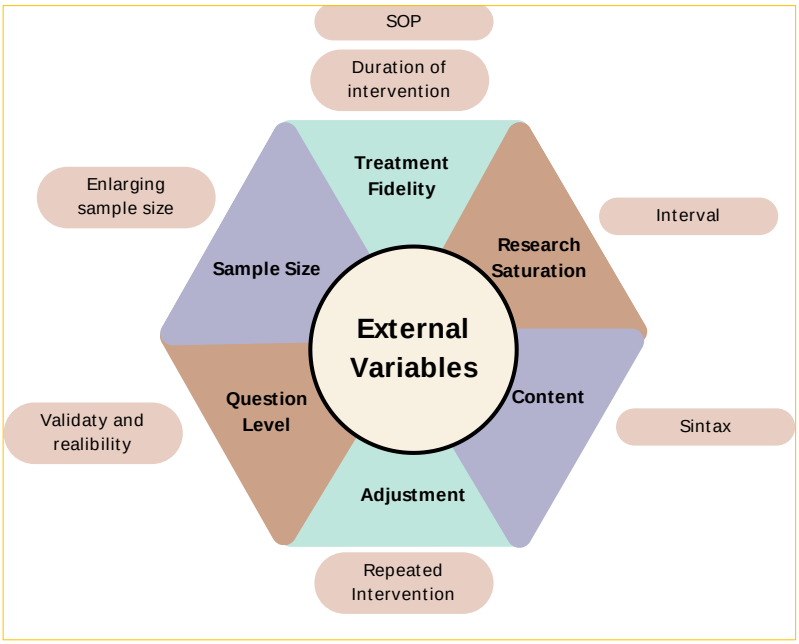


Figure 7. External variables

Small sample sizes can only detect large effect sizes. Meanwhile, in this study, the effect size was moderate with a Cohen's d of 0.6. Cohen's d refers to the effect size used to compare two group means. The larger the cohen's d value, the better the detection. Therefore, a larger sample size is required to achieve good statistical power (Andrade, 2020; Royall, 1986). This allows detection of effects that may not be detected in small samples as suggested by Bonovas & Piovani (2023). Outliers will greatly affect the average when the study uses a small sample. This is in accordance with the findings of Mishra (2019) who suggested maintaining a sufficient sample size. For this reason, further research is needed using a much larger sample size. Future research is also needed with repeated intervention and test methods by including validation of the questions used in the test. These variables are depicted in Figure 7.

3.3 Critical thinking skills of students in the experimental group

A p-value which is significantly greater than 0.05 indicates that there was no significant difference between the pretest and posttest in EG. The difference in results obtained between the pretest and posttest in EG cannot be said to be the result of the intervention. Thus, the use of short videos with educational content did not show any significant effect on students' critical thinking skills.

Table 8. T-test for paired samples EG

EG	N	Average	Std. Dev	t	p
Pretest	16	8.00	1.86	-1.00	0.333
Posttest	16	8.25	1.91		

This result is very contradictory because the t-test for independent samples for the post-test shows a p-value that is not too far different from the normal threshold. Thus, there is still a possibility that short videos with educational content have the effect of increasing critical thinking skills in students. For this reason, the pretest variables were controlled by using the ANCOVA test to gain a deeper understanding (Stanley, 2022).

Table 9. ANCOVA test

Group	N	Mean Square	P
CG	17	19.036	<0,001
EG	16		

The ANCOVA test results showed a p-value of <0.001. This result shows that there is a significant difference between the control and experimental groups after controlling for the pretest variable. The short video intervention with educational content has a significant effect on the critical thinking ability of students in the experimental group compared to the control group.

The lack of significant difference between pretest and posttest on EG through paired t-test is most likely a reflection of the variability in students' critical thinking skills at the beginning. Participants with low pretest scores showed great improvement, while those with already high pretest scores did not show any improvement as Figure 6 shows. This could not be detected by a t-test, instead an ANCOVA that statistically adjusted for pretest differences was able to detect this, revealing a significant intervention effect. A similar pattern was noted in the study by Wright (2006). The inability of the t-test to detect this pattern is due to the characteristics of the test itself which compares group means without adjusting for pretest differences. In contrast, ANCOVA controls for covariates which in this case is the pretest variable thus being able to isolate the intervention effect better.

4. Conclusion

This quasi-experimental study investigated the improvement of critical thinking skills among 33 medical engineering students using short videos with educational content. Although the independent t-test showed that there was no significant difference between the groups, the ANCOVA gave another result, that there was a significant increase in critical thinking skills in the experimental group after controlling the pretest variable. This ability to control the pretest variable is not possessed by the t-test, resulting in different results. In particular, the results of the paired t-test conducted on the experimental group that showed insignificant results reflect the complexity of detecting changes in small samples, where statistical power is limited and external factors (e.g., treatment fidelity, research saturation, content, adjustment, question level, and sample size) can obscure effects. Thus, despite the moderate effect size and low p-value, short educational videos still have practical possibilities.

This finding indicates that short videos with educational content can be used as a supporting tool in education. These short videos can be integrated into the curriculum to train students' critical thinking skills by adjusting the learning objectives. To address the inconsistent results, future research needs to increase the sample size, standardize the duration of watching short videos, and extend the intervention period to reveal long-term effects. Despite methodological limitations, this study confirms that there is potential for short videos with educational content to improve students' critical thinking skills. Further research with a more rigorous methodology is needed to validate these findings and refine their application in diverse educational contexts to promote the development of critical thinking skills.

Author's declaration

Author contribution

Fathir Aspar: Conceptualization, Methodology, Writing -Original Draft. **Refdinal:** Data Curation, Visualization, Validation. **Nelvi Erizon**: Writing -Original Draft. **Jasman:** Software, Validation. **Irzal:** Writing -Original Draft. **Yufrizal A**: Writing -Review & Editing.

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Conflict of interest

The authors declare that there are no competing interests related to the research or publication of this article.

Ethical clearance

The involvement of lecturers and students who are the subjects of this research is in accordance with the Helsinki Declaration.

AI statement

This article is the original work of the author without using AI tools for writing sentences and/or creating/editing tables and figures in this manuscript.

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