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The Role of Canva-Based Learning Media in Improving Mathematical Critical Thinking Skills in Elementary School Students' Data Analysis Material

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A B S T R A C T

The development of digital technology provides opportunities for teachers to create more interactive and engaging learning experiences. This study aims to determine the effectiveness of Canva-based interactive learning media in improving fifth-grade students' Mathematical Critical Thinking skills in data analysis material. This research employed a quantitative approach using a quasi-experimental method with a non-equivalent comparison-group design involving a control class and an experimental class. Data were collected through pretest and posttest instruments. The results showed that the experimental class experienced a significant increase in the average score, from 47.86 in the pretest to 70.00 in the posttest, indicating a substantial improvement compared to the control class. The data were analyzed using normality, homogeneity, and independent samples t-tests. The normality test results indicated that all data were normally distributed (Sig. > 0.05), while the homogeneity test showed equal variances between groups (Sig. = 0.733 > 0.05). Furthermore, the t-test result showed a significance value of 0.000 (< 0.05), indicating a significant difference between the two groups. These findings demonstrate that Canva-based interactive learning media is effective in enhancing students' Mathematical Critical Thinking skills in elementary school data analysis learning.

1. Introduction

Basic education plays a strategic role in shaping students' cognitive development, including through mathematics learning that hones logical and analytical thinking skills (Halimah et al, 2024). In the topic of data analysis, fifth-grade students' are expected to be able to organize, present, and interpret information correctly (Lestari et al., 2024). However, several studies show that students' still experience various obstacles, such as difficulty reading graphs, understanding symbols, calculating

values in diagrams, and drawing appropriate conclusions (Kusumaningpuri et al., , 2022). This was also expressed by several teachers at Nisam Antara during a Focus Group Discussion (FGD) with researchers. In the discussion, they expressed students' learning difficulties, particularly in mathematics. They also revealed that many students' were unable to understand data presentation in the form of pictograms or bar charts. Teachers reported that students' often misplaced graph axes, miscalculated data frequencies, and were confused about interpreting the differences between the largest and smallest values. This situation impacted low mathematics scores, particularly in data analysis.

This problem is closely related to students' low Mathematical Critical Thinking skills. Mathematical Critical Thinking is the ability to analyze, evaluate, and draw conclusions from information logically and systematically (Enis, 2018; Facione, 2020). In the context of data analysis, this ability includes interpreting visual information, comparing data, and drawing conclusions based on evidence. Learning that still focuses on procedures and memorization results in students' being less trained in critical thinking, resulting in suboptimal conceptual understanding (Kusumaningpuri et al., 2022). This is supported by recent findings that show students' critical thinking skills can be improved through the integration of interactive learning media that promote active engagement and problem-solving processes (Yunita et al., 2025).

To address this issue, the use of interactive learning media becomes an important alternative. Learning media serve as tools that help teachers deliver information more clearly and systematically. Through media, abstract concepts can be visualized in the form of images, animations, and other concrete representations, making them easier to understand (Arsyad, 2020). In addition, learning media can increase students' motivation and engagement, as well as accommodate diverse learning styles, leading to more effective and meaningful learning experiences (Sadiman, 2019). Research also shows that interactive multimedia development can significantly improve students' learning outcomes and critical thinking skills in elementary education (Astuti & Kowiyah, 2024).

Interactive learning media allow students' to actively engage with the material rather than passively receive information. students' can interact through quizzes, simulations, and navigation features, which enhance engagement and stimulate curiosity (Munir, 2022). Furthermore, interactive media provide immediate feedback and flexible learning opportunities, enabling students' to identify and correct their mistakes efficiently (Daryanto, 2020). This is reinforced by studies showing that innovative digital learning media based on problem-based learning approaches can effectively enhance students' critical thinking skills (Ainiyyah et al., 2025).

One of the relevant tools that can be utilized is Canva. Canva is a digital design platform that provides various visual features such as templates, icons, animations, and graphic elements that can be used to develop engaging learning materials. With its simple and user-friendly interface, Canva allows teachers to create attractive instructional media without requiring advanced design. The visual elements

produced through Canva help clarify concepts, capture students' attention, and enhance both motivation and understanding of the material (Suryani et al., 2024). Moreover, recent developments in interactive multimedia technology, including augmented reality-based learning media, have also been shown to improve students' engagement and conceptual understanding (Khusnunnisa' & Andriani, 2025). Therefore, Canva is considered a relevant tool to support technology-based learning in elementary schools.

Mathematical Critical Thinking refers to students' ability to analyze, evaluate, and draw conclusions logically and systematically, enabling them to understand the reasoning behind each step in problem-solving (Enis, 208; Facione, 2020). This ability is reflected through several indicators, including identifying problems, analyzing data, interpreting mathematical representations such as tables and graphs, evaluating problem-solving strategies, and drawing conclusions based on logical reasoning (Kilpatrick, 2001). students' with strong critical thinking skills tend to demonstrate more flexible thinking, avoid conceptual errors, and build deeper mathematical understanding, especially in solving data-related problems (Herman et al., 2024).

Several previous studies also support the effectiveness of Canva-based learning media. Asriyani et al. (2025) found that the use of Canva as an interactive learning medium significantly improved elementary students' Mathematical Critical Thinking skills, particularly in aspects of analysis, synthesis, and evaluation. Suryani et al. (2024) reported that Canva-assisted interactive multimedia was proven to be valid, practical, and effective in improving students' critical thinking skills in social studies learning. In addition, Hafidh & Lena (2023) revealed that Canva-based learning media achieved high validity scores across media, language, and material aspects, with very positive responses from teachers and students, indicating that the media is effective, easy to use, and suitable for supporting integrated thematic learning in elementary schools. Other studies also emphasize that digital interactive tools, including quiz-based and multimedia learning platforms, contribute significantly to improving students' engagement and higher-order thinking skills (Insani, 2026). Based on the problems and previous research findings, this study aims to examine the effect of Canva-based interactive learning media on improving fifth-grade students' Mathematical Critical Thinking skills, particularly in data analysis material.

2. Methodology

Research Design

This study employed a quantitative approach using a quasi-experimental method with a non-equivalent comparison-group design. This design was selected because the researcher did not randomly assign participants to groups, but instead utilized existing classes. The study involved two groups, namely an experimental class that received treatment using Canva-based interactive learning media and a control class that received conventional instruction. Both groups were given a pretest before the

treatment and a posttest after the treatment to measure changes in students' Mathematical Critical Thinking skills. This design allows for a comparison of learning outcomes between the two groups to determine the effectiveness of the applied learning media.

Participants

The participants in this study were all fifth-grade students' at SD Negeri 3 Nisam Antara, totaling 58 students. The sampling technique used was saturated sampling, in which all members of the population were included as the research sample due to the limited number of classes available in the school. The sample was divided into two groups based on the teacher's consideration, taking into account the similarity of students' academic characteristics. The experimental class consisted of 29 students' from class V-A, while the control class consisted of 29 students' from class V-B.

Instrument

The instrument used in this study was a Mathematical Critical Thinking test in the form of essay questions. The test was designed to measure students' abilities based on several indicators of critical thinking, including identifying and understanding problems, analyzing data or information, interpreting mathematical representations such as tables and graphs, evaluating problem-solving strategies, and drawing logical conclusions. The instrument was administered twice, namely as a pretest to measure students' initial abilities and as a posttest to measure the improvement after the treatment. Before being used in the study, the instrument was validated to ensure its validity and reliability so that it could accurately measure students' Mathematical Critical Thinking skills.

Data Collection

Data collection in this study was carried out using a testing technique. The process began with administering a pretest to both the experimental and control classes to determine students' initial levels of Mathematical Critical Thinking skills. After that, the treatment was implemented, where the experimental class was taught using Canva-based interactive learning media that incorporated visual presentations, interactive features, and problem-based activities. Meanwhile, the control class was taught using conventional teaching methods, such as lectures and textbook-based learning. After the treatment period was completed, a posttest was administered to both classes using the same instrument to measure the improvement in students' Mathematical Critical Thinking skills.

Data Analysis

The data analysis technique used in this study was quantitative analysis, consisting of descriptive and inferential statistics. Descriptive analysis was conducted to determine the mean scores of the pretest and posttest in both groups and to examine the extent of improvement in students' Mathematical Critical Thinking skills.

Before conducting hypothesis testing, prerequisite tests were carried out, including a normality test using the Kolmogorov-Smirnov and Shapiro-Wilk methods to determine whether the data were normally distributed, and a homogeneity test using Levene's test to determine whether the variances between the groups were equal. After the assumptions were met, hypothesis testing was conducted using an independent samples t-test to determine whether there was a significant difference between the experimental and control groups. The decision criteria were based on the significance value, where a significance level of less than 0.05 indicates a statistically significant difference. All statistical analyses in this study were performed using SPSS.

3. Result and Discussion

The results of students' Mathematical Critical Thinking tests in the control and experimental classes are presented in Table 1.

Table 1. Results of the Mathematical Critical Thinking Test

Control Class			Experimental Class		
Name	**Pretest**	**Posttest**	**Name**	**Pretest**	**Posttest**
AM	40	40	MH	20	90
AZ	60	60	H	20	80
A	70	70	KF	50	90
BR	50	50	MF	30	70
DP	60	60	R	40	90
DR	50	50	W	30	70
FN	70	70	MAG	40	70
GS	60	80	MAS	40	40
IS	70	70	MAZ	60	60
MD	50	50	MA	70	80
MA	40	40	MF	50	60
MZ	40	40	MF	60	70
MRK	60	60	MH	50	60
MF	50	50	MH	70	80
MAA	50	50	MK	80	80
MHM	60	60	MK	70	70
MZM	50	50	MMRP	50	70
NA	40	40	MAS	40	50
NR	60	60	MS	40	60
NU	70	70	M	60	70
NH	50	50	MS	50	70
PA	40	40	NUH	50	80
RJ	20	20	NS	60	70
SAZ	20	60	RM	50	60
WF	50	40	JR	40	50
Z	30	30	RM	60	90
ZF	40	40	SN	40	90
AF	30	30	UR	20	60
WA	40	40	UN	30	80
1410	1460		1340	1960	
50,36	52,14		47,86	70,00	

Based on Table 1, the control class demonstrated only a marginal improvement in Mathematical Critical Thinking skills. The mean pretest score increased from 50.36 to 52.14 in the posttest, resulting in a gain score of 1.78 points, equivalent to an improvement of approximately 3.53%. This limited increase indicates that conventional instruction produced only a slight enhancement in students' Mathematical Critical Thinking skills. Most students in the control class obtained similar scores in both tests, suggesting that the learning activities provided insufficient stimulation to promote substantial cognitive development.

In contrast, the experimental class showed a markedly greater improvement after receiving instruction through Canva-based interactive learning media. The mean pretest score increased from 47.86 to 70.00 in the posttest, yielding a gain score of 22.14 points, or approximately 46.26% improvement. Compared with the control class, the experimental class achieved an additional gain of 20.36 points. These findings clearly indicate that students who learned using Canva-based interactive media experienced substantially higher improvement in Mathematical Critical Thinking skills than those who received conventional instruction.

The difference in gain scores between the two groups is particularly important because it directly reflects the effect of the experimental treatment applied in this study. Although both groups were assessed using the same pretest–posttest procedure, the experimental group received Canva-based interactive learning media, whereas the control group received conventional learning. The considerably larger gain observed in the experimental class suggests that the treatment contributed meaningfully to the development of students' Mathematical Critical Thinking skills, thereby supporting the effectiveness of the instructional intervention implemented in the experimental design. The comparison of the average pretest and posttest scores in both classes is also illustrated in Figure 1 below.

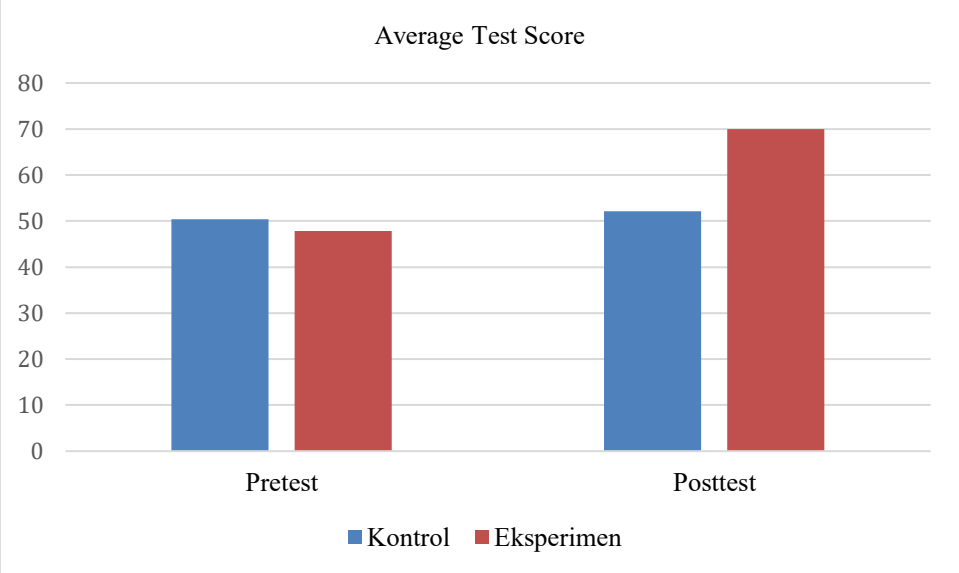

Figure 1. Average Test Score Graphics

As shown in Figure 1, both classes experienced improvement after the learning process, but the magnitude of the increase differed considerably. The control class showed only a slight rise, whereas the experimental class demonstrated a sharp increase in the posttest mean score. This visual comparison supports the data in Table 1 and confirms that the learning treatment using Canva-based interactive media was more effective than conventional instruction. The figure makes the difference between the two classes easier to interpret, especially in showing that the experimental class achieved a much stronger improvement after treatment. To strengthen the descriptive findings, the data were analyzed statistically through normality and homogeneity tests. The results of the normality test are shown in Table 2.

Table 2. Normality test

Data	Kolmogorov-Smirnov Statistic	df	Sig.	Shapiro-Wilk Statistic	df	Sig.
Pretest (Control)	0.150	29	0.093	0.934	29	0.061
Posttest (Control)	0.155	29	0.074	0.954	29	0.074
Pretest (Experimental)	0.125	29	0.200	0.956	29	0.200
Posttest (Experimental)	0.158	29	0.061	0.931	29	0.061

Based on Table 2, all significance values are greater than 0.05. This indicates that the data in both groups were normally distributed, so the assumption of normality was fulfilled and the data were appropriate for parametric statistical analysis. The homogeneity test results are presented in Table 3.

Table 3. Homogeneity Test

Test	Levene Statistic	df1	df2	Sig.
Based on Mean	0.429	3	112	0.733
Based on Median	0.372	3	112	0.773
Based on Median (adjusted df)	0.372	3	110.195	0.773
Based on Trimmed Mean	0.415	3	112	0.743

As shown in Table 3, the significance value based on the mean is 0.733, which is greater than 0.05. This means that the variances of the control and experimental classes were homogeneous. Therefore, both classes had comparable variance characteristics, and further comparison between the two groups could be conducted appropriately. The significance of the difference between the two groups was then tested using the t-test, as shown in Table 4.

Table 4. Paired T-Test

Variable	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error	Lower	Upper
Equal variances assumed	0.195	0.661	5.670	56	0.000	-20.345	3.588	-27.533	-13.157
Equal variances not assumed	-	-	5.670	55.738	0.000	-20.345	3.588	-27.534	-13.156

Based on Table 4, the Sig. (2-tailed) value is 0.000, which is lower than 0.05. This indicates that there was a statistically significant difference between the Mathematical Critical Thinking skills of students' in the control and experimental classes after treatment. The mean difference of -20.345 indicates that the average score of the control class was 20.345 points lower than that of the experimental class. Thus, the statistical analysis confirms that Canva-based learning media was significantly more effective than conventional learning.

From a discussion perspective, the substantial improvement observed in the experimental class can be explained by the specific characteristics of Canva-based learning media that support the development of Mathematical Critical Thinking skills. In data analysis learning, students are required not only to read numerical information but also to analyze patterns, interpret visual representations, and make evidence-based decisions. Canva provides visual and interactive features that present data in the form of attractive tables, diagrams, charts, and infographics, enabling students to focus on relevant information more effectively. As a result, students were better able to identify relationships among data points, compare values, recognize trends, and organize information systematically. These activities directly support the critical thinking indicator of data analysis, which is essential in solving statistical problems at the elementary school level.

Furthermore, the use of Canva contributed to students' ability to evaluate information and draw logical conclusions from graphical representations. Through visually organized learning materials, students were encouraged to examine the accuracy of information presented in charts and diagrams, distinguish important data from less relevant information, and justify their answers using available evidence. The interactive presentation also helped students interpret mathematical representations more accurately, reducing common errors in reading graph axes, identifying frequencies, and comparing quantities. Consequently, students became more capable of drawing conclusions based on data rather than relying on assumptions. This finding suggests that the effectiveness of Canva-based learning media was not limited to improving overall test scores; it also enhanced specific dimensions of Mathematical Critical Thinking, particularly data analysis, information evaluation, interpretation of visual representations, and evidence-based conclusion drawing. These results are consistent with the view of Facione (2020) and Ennis (2018), who emphasize that critical thinking develops when learners actively engage in analyzing information, evaluating evidence, and making reasoned judgments.

4. Conclusion

This study shows a significant difference between the experimental and control classes, confirming that the use of Canva-based interactive learning media can improve students' understanding of data analysis material more effectively than conventional learning. Data visualization through animations, icons, and interactive graphics helps students' read, interpret, and present data more accurately. This finding also strengthens the theory that visual-digital media can facilitate

knowledge construction and support mathematical thinking processes, especially in materials that require data interpretation and representation skills. Practically, the results of this study provide implications for teachers to integrate interactive digital media as part of the Independent Curriculum learning strategy, especially because the character of data analysis material is very suitable for a technology-based visual approach. From a policy perspective, this study indicates the need for school support in providing technological facilities and teacher training to maximize the use of interactive learning media for a more effective and student-centered learning process. Further research is recommended to develop more complex interactive features in Canva, testing the media's effectiveness at different grade levels.

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