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Digital Learning Tools and Critical Thinking: A Study on Nearpod-Integrated Worksheets in Elementary School

Caesarea Zahra Harmoni *, Sri Lestari Handayani

Primary School Teacher Education, Universitas Muhammadiyah Prof. Dr. Hamka, Jakarta, 13830, Indonesia

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* Corresponding author:

E-mail: 2101025022@uhamka.ac.id

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ABSTRACT

Critical thinking skills are essential for students to face 21st-century challenges. This study aims to analyze the impact of implementing Interactive Digital Worksheets (IDWs) through the Nearpod platform on improving critical thinking abilities among fifth-grade students at SD Islam Ruhama. A quantitative approach using a quasi-experimental design—specifically the Nonequivalent Control Group Design—was employed. The sample consisted of 39 students divided into experimental and control groups. Data were collected using essay-type questions based on Ennis' FRISCO framework, which had been validated and tested for reliability. An Independent Sample T-Test revealed a significant difference in post-test scores between the two groups, with a p-value less than 0.05. The effect size was calculated at 0.94572, indicating a high magnitude of influence. These results suggest that IDWs have a substantial positive impact on students' critical thinking development. Therefore, integrating IDWs via Nearpod can serve as an effective instructional strategy aligned with 21st-century learning competencies.

1. Introduction

21st-century skills are a set of competencies designed to align individual capacities with the evolving demands of the modern era, aiming to equip students with essential abilities for success in the 21st century (Fikri et al., 2021). These skills encompass life and career development, creativity and innovation, as well as proficiency in information, media, and technology (Rahma et al., 2023). At the elementary level, integrating these skills into classroom instruction is crucial for fostering higher-order thinking and preparing students for future challenges. Critical thinking, as defined by (Hasanah et al., 2023), represents a deeper form of analytical reasoning that strengthens students' problem-solving abilities. Similarly, (Setyawan & Kristanti, 2021) describe critical thinking as an advanced cognitive

process aimed at making informed decisions through deep analysis. According to Robert H. Ennis (as cited in Fatiah et al., 2022), critical thinking is an active and conscious process that involves achieving deep understanding and rational decision-making. Ennis's framework, outlined by the acronym FRISCO (Focus, Reason, Inference, Situation, Clarity, Overview), highlights the key stages of critical thought (Reeder, 2022). Overall, nurturing critical thinking has become a central focus in contemporary education, as it empowers students to address present and future challenges effectively (Rahmani & Hikmawan, 2025)

Observations conducted in Class V at SDI Ruhama revealed signs of student boredom and lack of focus during evaluation tasks. This issue was further explored through an interview with one of the teachers, who attributed the problem to limitations in the implementation of digital-based learning. The current teaching methods rely heavily on conventional tools such as paper worksheets and lecture-based approaches. Data from Muatan Pelajaran IPAS (Natural Sciences and Social Sciences) evaluations supports this observation, as more than 50% of the students have not achieved the Minimum Mastery Criteria (KKM) of 75. This unsatisfactory performance indicates a misalignment between the teaching strategies employed and the need to develop students' critical and creative thinking skills.

Given these findings, there is a clear indication that the development and strengthening of students' critical thinking skills require urgent attention. One promising strategy to address this challenge is the integration of technology-based learning media (Cicik & Nuraini, 2024). Digital tools can enhance student engagement, particularly in remote or underserved areas (Nanang & Jatun, 2024). Interactive Digital Worksheets (IDWs) offer a solution by enriching teaching methods through project-based learning, online learning, and game-based learning, which improve understanding and retention of material (Teguh et al., 2025).

The Nearpod platform is one example of a digital tool that can be used to enhance critical thinking skills. By capturing students' interest and facilitating a deeper understanding of learning concepts, Nearpod aligns with the view that digital-based learning can significantly improve critical and analytical skills (Ifan, 2024). However, the use of Nearpod has limitations, such as high data consumption and the need for stable internet connectivity, which may hinder its effectiveness in areas with poor infrastructure (Ami, 2021).

Research by (I. Muhammad et al., 2025) demonstrates that digital worksheets effectively improve students' critical thinking skills. (Tri et al., 2024) also found a positive and significant impact of Digital Worksheets on elementary school students' critical thinking abilities. Furthermore, (Rofiyadi & Handayani, 2021) successfully developed an interactive learning medium for IPAS material in Class V, highlighting the importance of digital learning in supporting effective interactions. (Susanto, 2021) confirmed that the Nearpod platform significantly enhances critical thinking skills. Therefore, the application of technology-based learning media like IDWs through platforms such as Nearpod emerges as a strategic solution to address the issues of low critical thinking skills and academic achievement among students.

The primary objective of this study is to investigate the effectiveness of integrating technology-based learning media, specifically Interactive Digital Worksheets (IDWs) via the Nearpod platform, in improving critical thinking skills and academic performance among students in Class V at SDI Ruhama. Additionally, the study aims to explore how the implementation of digital tools can overcome existing limitations in conventional teaching methods and enhance student engagement and motivation.

2. Methodology

The research method used is quantitative with a quasi-experimental approach, in which one group was given treatment in the form of a product relevant to the research, while the other group did not receive the treatment (M. Muhammad, 2021). The research design employed is based on the Nonequivalent Control Group Design. This study was conducted at SD Islam Ruhama, involving a population of 59 students, consisting of all fifth-grade students in the 2024/2025 academic year. The sampling technique used was Non-Probability Sampling with the Purposive Sampling method. Based on the homogeneity test, class V A (20 students) was selected as the control group, and class V C (19 students) was selected as the experimental group, resulting in a total sample size of 39 students.

The data collection technique in this study was a test in the form of essay questions, consisting of 10 items. The test instruments focused on critical thinking skills, developed based on Ennis' theory, which includes the FRISCO indicators (Focus, Reason, Inference, Situation, Clarity, Overview), with the instrument blueprint presented in Table 1 below.

Table 1. Instrument Grid

Indicator	Aspect	Question Indicator	Question Form	Question Number
Focus	Understand the problem	Given questions, students are able to identify elements related to the circulatory system in the context of physical activity and the main issues discussed in the statement.	Esai	1,2
	Setting a goal or problem	Given a statement, students are able to check the speed of blood flow in the body.	Esai	3,4
Reason	Giving reasons	Given a question, students are able to provide reasons for the increased heart rate and the importance of the heart working harder during physical activity.	Esai	5,6
	Justification	Given a question, students are able to construct an explanation or defense of an opinion based on scientific evidence.	Esai	7,8
Inference	Skills of drawing conclusions	Given a question, students are able to draw conclusions between eating patterns and the risk of	Esai	9,10

		diseases in the human circulatory system.		
	Logical	Given a question, students are able to provide arguments about the importance of regular health check-ups in preventing diseases in the human circulatory system.	Esai	11,12
Situation	Contextual considerations	Given a statement, students are able to analyze the lifestyles of traditional and modern societies that may influence the risk of circulatory system diseases.	Esai	13,14
	Communication	Given a question, students are able to explain diseases in the human circulatory system to elderly patients using language that is easy to understand.	Esai	15,16
Clarity	Contextual fit	Given a question, students are able to explain the causes of a disease in the human circulatory system.	Esai	17,18
Overview	Understanding between elements in a problem	Given a question, students are able to analyze the relationship between eating patterns and lack of physical activity toward diseases in the human circulatory system.	Esai	19,20

The test instrument will be evaluated for its reliability using a validity test calculated through the Pearson Product Moment correlation coefficient. In addition to the validity test, this study also employs the Cronbach's Alpha reliability test. Data analysis in this study includes a normality test using the Lilliefors test and a homogeneity test using the Fisher test. Subsequently, the data will be analyzed using an Independent Sample T-test and an effect size test.

This study is conducted through several stages. The first stage is the preparation stage, which includes the development of the research proposal, instrument validation, and submission of research permits. The second stage is the implementation of the study, in which the experimental and control classes are given different treatments, accompanied by the administration of pre-tests and post-tests to the students. The third stage is data analysis, which includes the normality test, homogeneity test, Independent Sample T-test, and effect size test to determine the magnitude of the treatment effect.

3. Results and Discussion

The research conducted aimed to examine the effect of Interactive Digital Worksheets (IDWs) on the critical thinking skills of fifth-grade students at SD Islam Ruhama. Data collection techniques were carried out using test instruments that had been validated, aiming to demonstrate their reliability (Akbar & Barni, 2022). Reliability testing was also performed using Cronbach's Alpha to assess the

level of trustworthiness of the test instruments (Brayen et al., 2024). The results obtained are presented in Tables 2 and 3 below.

Table 1. Instrument Validity Statement

Description	Number of Questions	Question Number
Valid	13 items	1,3,4,5,8,9,11,13,15,16,17,19,20
Not Valid	7 items	2,6,7,10,12,14,18

Table 2. Instrument Reliability Description

Cronbach's Alpha	N of Items
.923	13

The instrument validation was conducted at SDN Pondok Betung 1 involving 32 students. Using the Pearson Product Moment test with a 5% significance level, the results showed that 13 items were valid and 7 items were invalid. Based on the calculation using Cronbach's Alpha with a 5% significance level, the items were found to be reliable with a very high classification (Ratna, 2023).

Based on the results of the previous item trials, the next stage was data collection, which was carried out at SD Islam Ruhama. Data collection involved administering Pre-Test and Post-Test questions to both the control class and the experimental class. The results of this implementation are shown in Figure 1 below.

ITEM SCORE DIAGRAM

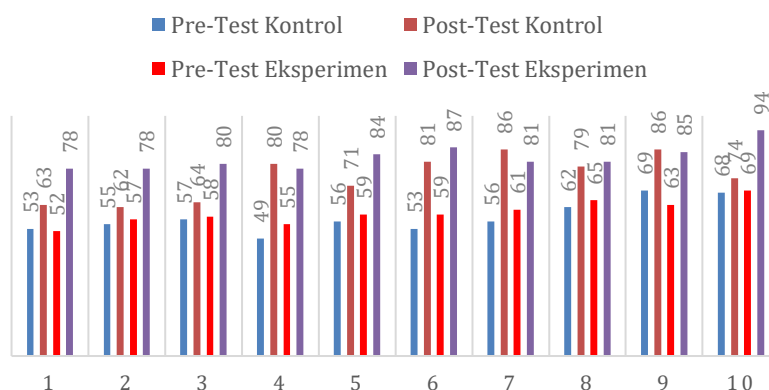


Figure 1. Item Score Diagram

Based on the diagram, an increase in scores can be observed for each test item. In the control class Pre-Test, the lowest score was found on item number 4, which measured the Reason indicator, while the highest score was on item number 9 with the Clarity indicator. Meanwhile, in the control class Post-Test results, the lowest score was found on item number 2 with the Focus indicator, and the highest scores were on item number 7 with the Situation indicator and item number 9 with the Clarity indicator.

Furthermore, the experimental class Pre-Test results showed that the lowest score was on item number 1, which measured the Focus indicator, while the highest score was on item number 10 with the Overview indicator. As for the Post-Test results in the experimental class, the lowest scores were recorded on items number 1 and 2, both measuring the Focus indicator, and the highest score remained on item number 10 with the Overview indicator, as shown in Table 4 below.

Table 4. Item Scores

Description	Lowest		Highest	
	Item Number	Indikator	Item Number	Indikator
Pre-Test Kontrol	4	Reason	9	Clarity
Post-Test Kontrol	2	Focus	7	Situation
			9	Clarity
Pre-Test Eksperimen	1	Focus	10	Overview
Post-Test Eksperimen	1	Focus		
	2	Focus	10	Overview

Based on the table above, there are several reasons for the differences in achievement for each indicator (Lukman & Setiani, 2025). The variation between the highest and lowest scores for each test item can be attributed to several factors. The Focus and Reason indicators tend to receive lower scores, indicating that the learning process has not explicitly trained students' reflective and argumentative thinking skills needed to set goals and construct logical reasoning (Noor Haykal & Ismail, 2023). Conversely, by connecting the material to real-life contexts, students are more naturally trained in the Situation, Clarity, and Overview indicators. This is because students are able to construct comprehensive meaning and develop ideas more clearly and relevantly (Fakhri et al., 2024).

Based on these findings, it can be concluded that both classes still need to further develop skills in constructing logical arguments or strong justifications. The control class demonstrated strong abilities in writing down information and identifying contextual main goals. Meanwhile, the experimental class showed that students were able to understand the problem situation, discourse structure, and interrelation among elements key aspects in forming a coherent understanding.

Assumption testing was also conducted through normality and homogeneity tests using SPSS 25.0 for Windows. The normality test was used to determine whether the data were normally distributed or not (Nasar et al., 2024). The normality test employed the Lilliefors test using the Shapiro-Wilk method, with the results shown in Table 5 below.

Table 5. Instrument Reliability Description

Results		Shapiro-Wilk		
		Statistic	df	Sig.
Class	Pre-Test A (Control)	.912	20	.068
	Post-Test A (Control)	.909	20	.061
	Pre-Test C (Experiment)	.975	19	.862
	Post-Test C (Experiment)	.914	19	.088

According to the analysis conducted, and based on the assumption that a significance value above 0.05 indicates data are normally distributed (Febrina et al., 2024), Table 4 displays the normality test results: the Control Class Pre-Test produced 0.068, the Post-Test 0.061, the Experimental Class Pre-Test 0.862, and the Post-Test 0.088. As all values exceed 0.05, it can be concluded that the data follow a normal distribution.

Following this, a homogeneity test was carried out to verify whether the data variance between the groups showed no significant difference (Sianturi, 2022). The homogeneity assessment applied Levene's test, and the outcomes are presented in Table 6.

Table 6. Homogeneity Test Results

		Levene Statistic	df1	df2	Sig.
Mark	Based on Mean	2.330	1	37	.135
	Based on Median	1.130	1	37	.295
	Based on Median and with adjusted df	1.130	1	30.610	.296
	Based on trimmed mean	2.121	1	37	.154

The homogeneity test, conducted using Levene's method, produced a significance value of 0.135. Since this value exceeds the threshold of 0.05, it indicates that the data are homogeneous.

Following the completion of assumption testing, the next procedure involved performing a hypothesis test through the Independent Sample T-Test, often referred to as the T-test. This test is used to determine whether the applied treatment has a statistically significant effect (Ariasanti et al., 2021). According to the decision rule: if the significance value is above 0.05, then the null hypothesis (H_0) is accepted; if it is below 0.05, the alternative hypothesis (H_1) is accepted. The outcomes of the T-test are presented in Table 7.

Table 7. Results of the Independent Sample T-Test

		Sig. tailed)	(2-Mean Difference	Std. Difference	Error
Learning outcomes	Equal variances assumed	.006	6.558	2.232	
	Equal variances not assumed	.005	6.558	2.213	
	assumed				

Based on the calculations performed, significance values of 0.006 and 0.005 were obtained. Since these values are less than 0.05, it can be interpreted that there is a significant effect of using Interactive Digital Worksheets (IDWs) on students' critical thinking skills in the IPAS learning process for Grade V at SD Islam Ruhama.

Having established the existence of an effect from using Interactive Digital Worksheets (IDWs), the next step is to determine the magnitude of this effect through an Effect Size test using Cohen's formula (Khairunnisa et al., 2022; Cohen

1988). The calculation was performed using the Effect Size Calculator, and the results are presented in Table 8 and Figure 2 below.

Table 8. Mean Scores

	Clas	N	Mean	Std. Deviation	Std. Error Mean
Learning outcomes	Post Experiment	19	81.16	5.747	1.318
	Post Control	20	74.60	7.950	1.778



Figure 2. Effect Size Test Results

Based on the results of the effect size calculation using Cohen's d formula, a value of 0.94572 was obtained. According to Cohen's classification (Yestina et al., 2024), this value falls into the large category, indicating a strong effect between the two groups being compared.

4. Conclusion

The findings of this research show that incorporating technology-based instructional tools, specifically Interactive Digital Worksheets (IDWs) via the Nearpod platform, has a significant impact on improving fifth-grade students' critical thinking skills in the IPAS subject at SD Islam Ruhama. This enhancement is reflected in the higher post-test performance of the experimental group compared to the control group, with a large effect size indicating substantial influence.

These results suggest that digital learning methods particularly IDWs offer a more engaging and effective learning environment that promotes concept mastery, sharpens analytical thinking, and strengthens students' critical thinking skills. While challenges such as internet connectivity remain, the use of educational technology has proven to be a relevant and impactful strategy for meeting the demands of 21st-century learning. This study reinforces the need to integrate technology into teaching practices to improve student learning outcomes.

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