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THE EFFECT OF EARTH ROTATION DIORAMA LEARNING MEDIA ON THE CRITICAL THINKING ABILITY OF SCIENCE SUBJECTS IN STATE ELEMENTARY SCHOOL

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Abstract

This study aims to investigate the influence of Earth Rotation Diorama learning media on the critical thinking ability of grade VI students in elementary school. This study uses a quantitative method with *a quasi-experimental design*. All participants in this study were students in grade VI of SD Negeri No 060909 Medan Denai. The data collection technique was carried out using research instruments in the form of questionnaires on the validity of questions and tests (pretest and posttest). The sampling technique in this study uses simple random sampling, with the sample used being 15 grade VI students who are divided into control groups and experiments groups to be given a pretest and a posttest. The data analysis is quantitative or statistical through validity, realism, difficulty level of questions, differentiation, data normality, homogeneity, and hypothesis test calculated using SPSS version 30. From this study, the results were obtained, from the posttest showed that the experimental class exceeded the control class. Students' critical thinking skills are tested at a real level = 0.05. Tallahassee ($\propto > 0,855 > 0,514$). And the significant rate is 0.001 to 0.05. The data normality test showed that the pretest < posttest in the control class with a sig of 0.067, 0.05, and the experimental class with a sig of 0.144, 0.05, showed that the data followed a normal distribution. Because the results of the hypothesis test are less than 0.05, it can be concluded that the use of Earth Rotation Diorama media has proven to be efficient in improving critical thinking skills.

Keywords

Earth Rotation Dioramic, Critical Thinking Skills, Learning Media, Quasi-experimental Design, Students.

INTRODUCTION

In today's information age, critical thinking is critical. In this context, basic education is a level of formal education that significantly impacts children's futures. Therefore, developing critical thinking skills is one of the main goals because it can help students understand and apply the subject in their daily lives. Critical thinking is an evaluative process that analyses situations, events, problems, or difficulties to reach justifiable conclusions (Hitchcock & Hitchcock, 2017).

Critical thinking is a person's mental attitude when facing a problem. It combines creativity, curiosity, and thinking to solve problems and make decisions in the book. It is stated that critical thinking is an individual's personality trait that influences their behaviour and choice of actions, leading to satisfaction in daily life. Critical thinking encompasses experiential phases that develop a student's conceptual understanding of the environment (Aprina et al., 2024). Critical thinking involves filtering out irrelevant information, identifying important patterns or relationships, and using known logic or rules to reach conclusions. Critical thinking is demonstrated in the ability to analyse, understand relationships, combine information, and draw conclusions. In elementary school, students, especially in higher grades, need to be taught critical thinking because it can affect their ability to understand lessons. This critical thinking can encourage students to come up with new ideas. The importance of applying critical thinking to make the learning process meaningful and to help students gain knowledge. There are five indicators of critical thinking: providing explanations, developing soft skills, concluding, providing further explanations, and setting strategies and tactics (Hendrajanti & Rochmiyati, 2023).

These critical thinking skills are important for students today, in the future, and even in the future. Practicing critical thinking is important to develop a deeper understanding of the observed phenomena. The existence of an observation process allows hypothesis testing to produce valid conclusions about the observed phenomenon. Students should always be encouraged to think critically. Practicing critical thinking impacts students' ability to cope with adult life (Elder & Paul, 2020). However, in reality, many students have difficulty developing these skills. One-way learning methods and a lack of a diverse learning environment can limit students' critical thinking skills. As a result, they are less prepared to face the existing challenges. This decline in talent can be seen from the results of the 2022 PISA (Programme for International Student Assessment) test, which shows that Indonesian students' mathematics and science achievements are below OECD (Organisation for Economic Cooperation and Development) standards (Darmawan, 2020).

UPT SD Negeri No. A VI at 1. Based on an interview with the homeroom teacher of class VI. Homeroom teacher, VI. He said that the critical thinking skills of elementary school students have not been seen. We also understand this because the number of daily tests is still relatively low. He also said that the exam results for grade 6 students had not reached the KKM score; the KKM score was 70, and the students' scores were all below the KKM score, namely 40-50. It was found that students had difficulty applying the information they had to analyse and evaluate. Students' low critical thinking skills stem from the lack of ability to reason in response to information. Students tend to receive information without asking further questions, resulting in a superficial understanding. Another problem that causes low critical thinking skills for students is the limited learning resources (Perdanasari & Sangka, 2021).

The use of workbooks also makes the learning process monotonous. Students are not actively involved in learning, have low interest, and motivation (Owens et al., 2020). This shows that students still do not understand the lesson. As it is said, science is one of the subjects that students are least interested in. This condition affects the way teachers teach. As a lesson planner, a teacher must prepare many necessary things before starting the teaching process, including educational media. This role is carried out so that the learning process and learning outcomes can be achieved as much as possible. In this regard, it is assumed that science is a science that studies natural events in the form of facts, concepts, principles, and laws that can be proven through scientific activities. Moreover, science is a form of learning that can encourage students to think critically, and in this context, students are educated to be sensitive to the surrounding environment (Widyawati & Setianingsih, 2021).

One of the teaching aids that needs to be created is educational media. Creating new learning tools is an ongoing process, with clear relationships that must be evaluated at every turn. Therefore, students need to develop critical thinking skills and have teaching aids that support the learning process. In this way, the author turns to the use of educational media. Media is a resource that teachers can use to convey information to students. Another definition is that media combines two or more elements to support the learning process. This means the media simplifies the teaching and learning, including the message's sender and receiver. Many tools include books, newspapers, television, radio, internet, tapes, videos, VCRS, movies, slides (photo frames), photos, drawings, graphics, and computers. Teachers use media to convey information related to learning during the learning process (Nicolaou et al., 2019).

Learning requires media to convey educators' messages to students. In addition, the benefits of learning media include clarifying learning materials, making learning more enjoyable, and possibly improving student learning outcomes. Therefore, it can be concluded that learning media helps attract students' attention, clarify important concepts, and achieve learning goals. The presence of teaching aids can motivate students so that high learning outcomes are achieved. There are many types of science teaching aids that teachers can use to convey information to students. For example, the medium for science education is the Earth Rotation Diorama medium. The Earth Rotation Diorama is an informative, realistic, or living environment that can be seen from all directions and reflects the current situation. The Earth Rotation Diorama Media is a vehicle that contains material related to the Earth's rotation (Bloomfield, 2022).

The 3d teaching aids developed by the researchers are props or teaching media in the shape of a circle made of plastic boxes containing many miniature planets, such as the Moon, Sun, and Earth, in space, as well as indicators that can rotate the world automatically with a generator. This 3d assist automatically rotates the trajectory in Earth's orbit by pressing the on/off button. This way, students can actively participate in learning activities and understand lessons more easily. The purpose of using the Earth Rotation Diorama tool is to invite students to think critically about the material on the Earth's rotation and how to use the tool. Students can understand concepts they did not understand before and observe the Earth's rotation more easily thanks to the model IV at SDN Girilintang.

The critical thinking skills of elementary school students, especially grade VI, are still relatively low. This is due to learning methods that tend to be one-way, the use of monotonous teaching media such as workbooks, and the lack of varied learning resources. This condition impacts low student involvement in the learning process, exam scores that have not reached the Minimum Completeness Criteria (KKM), and the lack of students' ability to analyse and evaluate information in depth. Previous research supports these findings, such as that conducted by Aida et al. (2022), Mujaddi et al. (2022), and Winarni et al. (2024), who showed that using Earth Rotation Diorama media can improve students' critical thinking skills by encouraging them to ask questions and discuss actively. Research by Azzahrani & Sukasih (2025), Grey et al. (2019), and Kennedy et al. (2021a) also shows that students are more enthusiastic about learning when using the Earth Rotation Diorama than conventional learning, thus positively impacting their learning outcomes. In addition, research from (Fitriana & Al Masjid, 2025; Rendi et al., 2024; Supriana et al., 2023) emphasises the

importance of critical thinking in primary education, which includes the ability to analyse, filter information, and draw logical conclusions. Therefore, using innovative learning media such as the Earth Rotation Diorama is important in supporting the development of students' critical thinking skills from an early age.

Using the model, students learn passively and actively participate in the learning process. This is expected to arouse students' curiosity, encourage them to ask questions, and allow them to analyse the information they receive. Although these media have great potential to improve student understanding, few studies address the impact of these media on students' critical thinking skills, especially at the elementary level. This study aimed to test the impact of the Earth Rotation Diorama teaching environment on the critical thinking skills of sixth-grade students. Classes in elementary schools. We hope this research will contribute to developing more active teaching materials in schools.

METHOD

This research is a quantitative research with a quasi-experimental design approach carried out directly in the field, precisely in 2025 in class VI UPT SD Negeri No.060909, which is located on Jl. Tangguk Bongkar X No. 39, Tegal Sari Mandala II, Medan Denai District. This study examines the influence of using Earth Rotation Diorama media on students' critical thinking ability in understanding Earth rotation materials. Data was collected through instruments such as validity questionnaires and critical thinking tests, which were carried out in two stages: pretest and posttest. The data analysis techniques used were quantitative, using the help of SPSS version 30, including validity, reliability, difficulty level of questions, differentiation, normality, homogeneity, and hypothesis tests. Following the opinion of Sugiyono (2018), quantitative research aims to test the hypotheses formulated beforehand. This approach is based on a scientific paradigm, as Ardial (2022) explained.

The sample in this study was determined by a simple random sampling technique, which is a random sampling technique without paying attention to certain strata in the population. Based on this approach, class VI, consisting of 15 students, was used as a sample. The students were divided into two groups, namely the control group and the experimental group. The control group will be given a pretest and a posttest without special treatment. In contrast, the experimental group will be

given treatment using Earth Rotation Diorama media. A pretest and posttest will be carried out to measure the influence of media on students' critical thinking skills.

Hipotesis H_0: There is no significant effect of using Earth Rotation Diorama media on the critical thinking ability of students in grade VI of UPT State Elementary School No.060909. H_1: There is a significant influence of the use of Earth Rotation Diorama media on the critical thinking ability of students in grade VI of UPT State Elementary School No.060909.

FINDINGS AND DISCUSSION

Findings

Based on the results of the initial trial of the use of Earth Rotation Diorama learning media in this study, several problems arise, such as a lack of abstract understanding and critical thinking skills. The researchers used product-moment correlation to ascertain the validity of each question by comparing each question's score to the total score. This test was performed at a significance level of 5%. A high correlation coefficient indicates good validity, while a low correlation coefficient indicates that the item may be invalid and needs to be revised. The lowest correlation value is determined at a significance level of 5% to demonstrate the question's validity. This process is necessary to ensure the accuracy and reliability of research results and that testing can be used for broader evaluation purposes. The following table shows the results of the validity analysis.

Table 1. Validity Test Results

		Question 1	S2	S3	Size S4	S5	SK
Question 1	Korelasi Pearson	1	,722**	,723**	,381	,547*	,844**
	Signature. (2 tails)		,002	,002	, 161	.035	<.001
	N	15	15	15	15	15	15
S2	Korelasi Pearson	,722**	1	,458	,381	0.614*	0,808**
	Signature. (2 tails)	,002		,086	, 161	,015	<.001
	N	15	15	15	15	15	15
S3	Korelasi Pearson	,723**	,458	1	,366	, 644**	,782**
	Signature. (2 tails)	,002	,086		, 180	,010	<.001
	N	15	15	15	15	15	15
Size S4	Korelasi Pearson	,381	,381	,366	1	0,605*	,689**
	Signature. (2 tails)	, 161	, 161	, 180		.017	.005
	N	15	15	15	15	15	15
S5	Korelasi Pearson	,547*	0.614*	, 644**	0,605*	1	,860**
	Signature. (2 tails)	.035	,015	,010	.017		<.001
	N	15	15	15	15	15	15
CS	Korelasi Pearson	,844**	0,808**	,782**	,689**	,860**	1
	Signature. (2 tails)	<.001	<.001	<.001	.005	<.001	
	N	15	15	15	15	15	15

Table 1 shows five valid essay questions given to students after submitting their application for eligibility verification. Based on the product-moment table, the table R value was 0.514 for 15 participants with a significance level of 5%. This means the validity test shows that the item used to measure the dimensions you want to measure is valid.

Table 2. Reliability Test

Reliability statistics	
Alfa Cronbach	N posting
855	5

Table 2 shows the reliability of r15 of 0.855, much higher than the r of the table of 0.514. This shows that the items used in this study are reliable. Due to this high reliability, the data collected is considered accurate and supports the internal validity of the research, so this research is also beneficial in the context of education.

Table 3. Test Difficulty Test Results

No Questions Asked	**TK %**	**Jenis**
1	71	Simple
2	57	Soon
3	71	Simple
4	71	Simple
5	71	Simple

Table 3 shows 1 question at the medium level and four at the easy level. This shows the difference in the difficulty level of the tested questions and helps assess the extent to which students' abilities are differentiated between questions. A straightforward question may not be challenging enough to assess a student's ability. Intermediate-level questions can lead to problems that require in-depth understanding.

Table 4. Other Strengths

No Questions Asked	**DP**	**Kind**
1	0.736	Very good
2	0.680	of course
3	0.679 years	of course
4	0.519	of course
5	0.755 years	Very good

Table 4 shows that media questions have varying levels of discrimination. Know that two questions are outstanding in a category, and three are good. This shows that the problem is distinguishable. This analysis provides insight into the effectiveness of each question in measuring students' understanding and skills in the context of the teaching environment in which the questions are used.

Data Analysis Techniques

Before conducting a hypothesis test using a t-test on students' critical thinking test scores, the first step is to test assumptions; This includes statistical assumptions that must be met before performing t-tests, such as testing the normality and homogeneity of the data. Testing these assumptions is important to ensure uniform validity.

1. Normality Test

To check the normality of the data, the Lilliefors test is performed, which can assess whether the data is distributed normally or not. The general criterion used is that the Lcal value is smaller than the Ltable value with a significance level of 0.05.∝

Table 5. Data Normality Test Results

		Kolmogorov-Smirnov			Shapiro-Wilk		
	Class	Statistics	df	Signatur e.	Statistics	df	Signatur e.
Student learning outcomes	Pre-Test Control	, 228	8	,200*	year 835	8	,067
	Post-test control	, 228	8	,200*	year 835	8	,067
	Pre-test experiments	, 214	7	,200*	858	7	.144
	Trial by trial	, 214	7	,200*	858	7	.144

Lilliefors Means Repair
Source: SPSS version 30

This table shows the normality test results of pre-test and post-test data for both groups. Table 5 above shows that the Sig value of the pre-test and post-test controls is 0.067, meaning the data is usually distributed according to Lilliefors. In addition, the average pre- and post-trial trial was 0.144.$A\ value > 0.05$ indicates that the data is usually distributed. Therefore, the pretest and posttest data show a normal distribution.

2. Homogeneity Test

Table 6. Homogeneity Test Results

Variance Homogeneity Test					
		Live Statistics	**df1**	**df2**	**Signature.**
Student learning outcomes	Average	1,387 years	1	13	, 260
	By median	1,491 years	1	13	, 244
	Based on adjusted median and df	1,491 years	1	9, 144	, 253
	Based on interruptions	1,373 people	1	13	, 262

Source: SPSS version 30

Table 6 shows a significance value of 0.260 from 0.05. This shows that the data of the two tests, namely the post-test control class and the experimental class, are identical. This decision is based on a statistical test used to test the homogeneity of variance, which is an important requirement before hypothesis testing.

Hypothesis Test

Once it is confirmed that the sample is normally distributed and homogeneous, the next step is to apply a t-test to test the hypothesis in this study and determine whether the hypothesis in this study will be accepted or rejected based on the significant difference between the post-test averages of the control class and the experimental class.

Table 7. Hypothesis Test Student Critical Thinking Test

Independent Sample Testing											
		Levene's Test for Variance Equations		**T-Test for The Average Equation**							
										95% confidence interval of the difference	
		F	**Signature.**	**T**	**df**	**Important One Side P**	**Double Page**	**Average Difference**	**Standard Errors**	**Lower**	**Head**
Student learning outcomes	Assume the variance is the same	,000	1.000	-4.583	12	<.001	<.001	-20.000	4,364 people	-29.509	-10.491
	Do not expect similar deviations			-4.583	12.000	<.001	<.001	-20.000	4,364 people	-29.509	-10.491

Table 7 shows the level of significance determined by looking at the Independent Sample T-Test Results table in the Same Variance section. This is believed to be seen in the table above. The independent sample t-test gives a bilateral significance level between 0.001 and 0.05. Since the hypothesis test result was less than 0.05, it can be concluded that using Earth Rotation Diorama media in the classroom environment significantly influences students' critical thinking skills compared to more common teaching methods.

Discussion

This research was conducted at UPT SD Negeri No 060909 Medan Denai in grade VI. In this study, the untreated group was designated as the control group, and the treated group as the experimental group. The Diorob educational environment was designated as the experimental group. This study aims to determine the impact of using the Earth Rotation Diorama environment on the critical thinking skills of grade 6 students. To find out these developments, in the first stage of the experimental course, a preliminary trial was carried out; in the next stage, the Earth Rotation Diorama learning environment was used, and a post-trial was carried out (Ardial, 2022; Indriani & Rofiah, n.d.; Yulianti et al., 2025; Yusuf et al., 2020).

The results of the critical thinking test of a similar sample of students in the experimental class before and after the test of the two-sided significance level were 0.01 and 0.05. Considering that the hypothesis test results are less than 0.05, it can be concluded that using the Earth Rotation Model affects the critical thinking ability of grade VI students. This research is supported by previous research, especially from. This research is entitled "The Effectiveness of Earth Rotation Diorama Media in Improving Critical Thinking Skills, Collaboration, and Learning Outcomes of Elementary School Students in 2019-2024". This study has differences and similarities with previous and current researchers (Franke & Sarstedt, 2019; Roth et al., 2023; Schäfer & Schwarz, 2019; Vaismoradi & Snelgrove, 2019). The similarity lies in the medium used, while the difference lies in the purpose of the research.

During the learning process, students can learn many important skills such as simple explanations, analysis, drawing conclusions, further explanations, strategising, or planning actions. All of this is the first stage in developing critical thinking skills. This study found that critical thinking indicators, especially those that provide simple explanations and planning strategies, increased significantly in the outstanding category. In contrast, the other three indicators all increased in the good category. The application of the Diorama of Earth Rotation educational media

into the context of education has received a very positive response. This proves that the Earth Rotation Diorama media can effectively develop students' critical thinking skills (Kartini & Syafiq, 2024; Kennedy et al., 2021b; Mangal & Mangal, 2019; Sanjaya et al., 2024).

The experimental group outperformed the control group on simple explanations, analysis, results, supplemental explanations, and planning strategies. The most significant increase was recorded in the ability to answer essay questions sub-index. The Earth Rotation Diorama media contains many practice questions, encouraging students to answer research questions. The study suggests that students' ability to answer questions can be improved by presenting questions in the form of questions. This follows research conducted by (Kennedy et al., 2021c; Lestari & Afriansyah, 2022; Putri & Pujiastuti, 2021a; Setiana & Purwoko, 2020). He notes that when students are given practice questions that they are expected to do well, their skills in answering questions will improve drastically. Further research is still ongoing. A study shows that students need to practice to develop critical thinking.

The Rotation Diorama of the Earth Media provides many opportunities to develop students' critical thinking skills. These benefits include motivating learning, engaging students, interacting with classmates, problem-solving, learning about mini-planets, and learning various skills, such as thinking (Chiu et al., 2021; Howell, 2021; Putri & Pujiastuti, 2021b; Salmons & Wilson, 2023). The teaching method of the Earth Rotation Diorama, which presents material using teaching aids, received a good response from students because it required them to focus on using their hearing and sight simultaneously. Therefore, the hypothesis test shows that if the value is less than 0.05, there is a significant difference between the learning outcomes before and after the impact on the experimental group. It proved that the Earth Rotation Diorama improves students' critical thinking skills.

CONCLUSION

The results of this study show that the use of Earth Rotation Diorama media significantly improves the critical thinking skills of science students in grade VI of SD Negeri 060909 Medan Denai. The results of statistical tests support the hypothesis that this medium is effective, with the T-cal value greater than the T-table value and a significance value of < 0.05. Earth Rotation Diorama media makes learning more interesting and can help students understand the concept of Earth rotation in depth. The increase in *posttest* scores compared to *pretests* shows a good response to the

use of this media. The Earth Rotation Diorama learning media has proven to be efficient in improving critical thinking skills.

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