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The Effect of Sicabox Media on Students' Scientific Thinking Ability on the Material of the Properties of Light in Madrasah Ibtidaiyah

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Abstract

This study aims to reveal and analyze the effect of SICABOX learning media on the scientific thinking ability of science students in grade IV SD. This type of research is experimental research with a quantitative approach. This experimental research is classified into pre experimental form of one group pretest posttest design. The data collection techniques used are interviews, observations, documentation and tests (pretest and posttest). The data analysis technique used is descriptive analysis to calculate the mean, median, mode, standard deviation, and variance. Requirements analysis with normality test, homogeneity test, and through independent t-test. The results of the study using the t-test state that the results of the posttest hypothesis test calculation obtained a sig. (tailed) value of 0.001 <0.05, it can be concluded that there is a difference in the average student learning outcomes between the control class and the experimental class. In other words, we can conclude that SICABOX media has an effect on students' scientific thinking. I recommend this paper to develop critical thinking and problemsolving aspects.
Keywords: Learning Media, Scientific Thinking, Science

Introduction

Intellect is the thinking power that exists in humans since they were born and is one of the powers of the human soul (Salminawati, 2021). The main feature that distinguishes humans from other creatures is the mind that is used to carry out the thinking process. Humans have the ability to think, which means they can find new ways to achieve their goals. In this way, humans think to find understanding or understanding, form opinions, and also draw conclusions or decisions from what is desired. To obtain knowledge that is true, a scientific thinking process is needed.

Scientific thinking is the process of thinking by using reason to consider, decide and develop knowledge. The scientific thinking process is a series of thought processes that use reason by considering, deciding and developing knowledge (Wulandari, 2017). Scientific thinking is a study of higher-order thinking that is applied by honing the mind in effective learning with students because scientific thinking is developed so that thinking is broad, systematic, and thorough (Nurya et al., 2021). Meanwhile, according to Fitriyanti, he revealed that scientific thinking means a logical way of thinking that requires expertise using a certain approach which can later be accounted for the truth (Fitriyanti, Farida F, 2020)

Scientific thinking means thinking in an organized and careful manner using a particular method of reasoning. It all depends on each person's thinking experience. Scientific thinking means thinking logically and empirically (Anas, 2016). Logical means making sense, and empirical means talking about things in depth based on facts that can be accounted for.

Scientific thinking is not only a systematic and empirical thinking process but also has the ability to gain knowledge and apply it in real-world situations. The cognitive processes underlying scientific discovery and everyday scientific thinking have been a topic of intense research and speculation for nearly 400 years (e.g., Bacon, 1620; Galilei 1638; Klahr 2000; Tweney, Doherty, & Mynatt, 1981). Understanding the nature of scientific thinking has become a central issue not only for our understanding of science, but also for our understanding of what it means to be human (K. N. Dunbar & Klahr, 2012).

One of the first investigations of scientific thinking i.e., a collection of general-purpose processes operating on complex and abstract components of scientific thinking was conducted by Jerome Bruner and his colleagues at Harvard (Bruner et al., 1956). They argued that scientific thinking is as hypothesis testing and data collection with the ultimate goal of determining whether something is a member of a category. The second early research on scientific thinking was developed by Peter Wason in (K. N. Dunbar & Klahr, 2012). Wason, like Bruner et al, saw the key component of scientific thinking as hypothesis testing. While Bruner et al. focused on the different types of strategies people use to formulate hypotheses, Wason focused on whether people use strategies that try to confirm or disconfirm their hypotheses.

One of the nature of natural science (IPA) is scientific thinking (liza et al, 2022), As said by (Anas, 2018), that the competencies of elementary science subjects are as follows: 1) show a scientific attitude (curiosity, honesty, logical, critical, and discipline through science), 2) ask what, why, and how questions about the surrounding nature, 3) make observations of science objects using the five senses, tell the results of science observations with clear language, record and present data from observations of the surrounding nature in a simple manner; 4) report the results of observations of the surrounding nature orally and in simple writing; 5) describe science concepts based on observations; 6) present data from observations of the surrounding nature in the form of tables or graphs. Scientific thinking is an important component in developing high-level thinking skills, because by having the ability to think scientifically, students can think more thoroughly and broadly (Fitria & Arif, 2023).

Developing scientific thinking skills is one of the goals of science learning for children. Scientific thinking gives children the opportunity to ask questions, conduct experiments and develop their own knowledge, investigate independently, gather information and find answers to questions themselves (K. Dunbar & Reasoning, 2004)(K. Dunbar & Reasoning, 2004). Teachers should put their children as active learners and give them the opportunity to experiment and explore their abilities, because one of the efforts to develop students' scientific thinking is by directly involving children in the learning process. Children are invited to seek their own learning experiences. So that children become active both physically and mentally when following their learning. And students will get their own impressions from their learning experience (Widya, 2016).

Learning approaches that emphasize mastery of material are considered unsuccessful in creating active, creative and innovative students. Although they can "remember" information in the short term, they fail to provide skills to overcome problems in long-term life. Every educator is expected to have the ability to explain lesson content, deal with students, help solve problems, manage classes, organize teaching materials, determine class activities, arrange learning evaluations, determine methods, media, or even answer questions properly and wisely (Nasution, 2017). The quality of education is highly dependent on the teacher's ability to make the learning process interesting so that students easily understand the material being taught. Therefore, in carrying out the learning process, teachers must be able to apply the right strategies and create a conducive, active, and fun learning atmosphere (Jayanti et al., 2020). The success or success of education can be seen from the existing quality, which means that

it can be seen from the process or the quality of its graduates. Therefore, education is said to be successful or successful, if the teaching and learning process runs properly and produces a quality generation (Daulay et al., 2020)(Daulay et al., 2022)..

Based on the results of tests conducted in class 5 of MIS Madinatussalam in science subjects on the properties of light, it can be seen that students who can think scientifically are only 30%, this is a very small number. This can occur due to the lack of teachers in learning methods and planning. As well as lacking in the use of innovative and creative teaching materials. Teachers still focus on using conventional teaching methods, with the lecture method, using only packages and worksheets that make students less enthusiastic in learning and less understanding of what they are learning. Especially in the material of the properties of light in science learning, teachers only use media in the form of textbooks without any tools such as learning media, which results in children's minds stopping around the textbook. This can cause students to be lazy to think further and the ability to think scientifically in students will not be formed.

Based on these problems, researchers feel the need for suitable learning media to support student learning and improve students' scientific thinking related to the properties of light. According to (Rambe et al., 2021)(Rambe et al., 2021), learning media includes all forms of efforts used to convey messages from senders to recipients, with the hope of stimulating students' thoughts, feelings, attention, and interests so that teaching and learning activities can take place. According to Nurdiana, learning media is a tool used by teachers to communicate with students, learning media is also a tool that can make it easier for teachers to deliver material and make it easier for students to understand (Risqi & Siregar, 2023). Sokon defines media as all forms and channels for the process of transmitting material information conveyed (Saragih, 2018). The functions of learning media are: 1). Changing the focus of formal education, meaning that the learning media changes learning from theoretical to functional and practical. 2). Generate learning motivation. 3). Provide learning stimulation, especially to foster students' curiosity.

The right learning media that will be applied by researchers is SICABOX media (media properties of light). SICABOX media is a visual media that can be used for the science learning process, especially in the material of the properties of light. This learning media is made by adjusting the five properties of light, namely light propagates straight, light can be reflected, light can penetrate clear objects, light can be refracted, and light can be decomposed (Sholiha et al., 2017).. This light properties box media is used to overcome students' difficulties in understanding the material of the properties of light. This media is in the form of a box in which there are several objects that support the explanation of the five properties of light. The existence of this learning media can increase teacher creativity, especially in science lessons on the properties of light, which should be practiced directly by students (Fadhilah et al., 2020).

Previous research conducted by (Faradhita, 2022) stated that the use of this light properties box media can significantly improve student learning outcomes. Other research conducted by (Prasetya, 2022)(Prasetya, 2022), found that with the media box of the nature of light, students become more understanding of the learning and students become enthusiastic about learning. Likewise with the opinion (Sholiha et al., 2017)(Sholiha et al., 2017), stated that there was also a gap in students' understanding of the properties of light through the media box of the properties of light.

The difference between this research and previous research is that this research focuses more on children's scientific thinking. As written above, previous research focused on student learning outcomes only, what was measured was only the level of memory and understanding that could not make students think more broadly, namely by thinking scientifically. Based on the

description above, it can be concluded that the ability in science lessons assessed by most teachers is only the ability in the cognitive aspect that has not reached the aspect of scientific thinking ability of science. This attracts the attention of researchers to conduct research on abilities that are not only related to student learning outcomes, but further on the ability to think scientifically because this ability is one of the factors expected to develop after children learn science. The selection of the right model in learning affects student success. To support the success of science learning that is oriented towards students' ability to think scientifically about science in their lives in the future.

Method

This research will use a quantitative approach using experimental methods. This experimental research is classified into pre-experimental form of *one group pretest posttest design*, which consists of a control group and an experimental group that will be given treatment to compare them. After being taught conventionally, the control group students will be used as a comparison class to determine the effect of SICABOX media on their scientific thinking skills. The quantitative approach is a type of research that aims to reveal symptoms thoroughly and complexly through data collection from natural settings, using the researcher himself as an important instruction (Syahrum & Salim, 2012). The object of this quantitative research is to measure students' scientific thinking skills. The sample used was all students of class IV-A which amounted to 30 students and class IV-B 30 students. The instrument used in this study was a written test in the form of multiple choice of 10 questions. The data collection techniques used were interviews, observation, documentation and tests (pretest and posttest). The data analysis technique used is descriptive analysis to calculate the mean, median, mode, standard deviation, and variance. Requirements analysis with normality test, homogeneity test, and through independent t-test. The research was conducted at MIS Madinatussalam, Jl. Sidomulyo Pasar IX Dusun IX, Sei Rotan, Kec. Percut Sei Tuan, Kab. Deli Serdang.

Results

After data collection, descriptive statistics were used to generate the character value scale and test for normality. Paired sample t-test to assess the hypothesis with SPSS. This study had two classes: control and experimental. In the experimental class, SICABOX media was given to each group. While the control class was not given media.

Normality Test

To detect whether the data in this study is normally distributed, a normality test is carried out with the Kolmoggrof ample test. A data can be said to be normal if it meets the criteria for a sig value> 0.05.

Table 1. Normality Test Results.

	Class	Kolmogorov-Smirnova			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Student	Experiment Pre Test	.118	30	.200*	.973	30	.636
Scientific	Experiment Post Test	.146	30	.101	.938	30	.079
Thinking	Control Pre Test	.133	30	.183	.959	30	.288
Results	Control Post Test	.146	30	.101	.946	30	.135

Based on table 1 above, it can be seen that all data values of the experimental and control groups as well as the pre-test and post-test show that the sig. > 0.05. So this data is normally distributed.

Descriptive Statistical Analysis of Research Data

In this section, the results of the respondents will be presented which serves to clarify the results of the researcher's discussion. With a description of the respondent's data, it will make it easier for researchers to interpret the research data. The results of the descriptive statistical tabulation data are as follows:

Table 2. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Experiment PreTest	30	10	90	47.67	17.943
Experiment PostTest	30	50	100	78.00	14.239
Control PreTest	30	10	70	40.00	15.757
Control PostTest	30	20	70	45.00	13.326
Valid N (listwise)	30				

Based on the descriptive statistical table data above, it can be seen that the average pre-test value of 30 respondents in the control class is 40.00, for a post-test value of 45.00. While the average pre-test value in the experimental class is 47.67, for a post-test value of 78.00. The respondents' answers in the control class had the lowest score in the pre test of 10, post test of 30 and the highest score was 70 in the pre test and 70 also for the post test. Meanwhile, the experimental class has the lowest value in the pre test of 10, post test and the highest value of 90 for the pre test and 100 for the post test. And each has a standard deviation on the control class pre test of 15.757, 13.326 for the post test. Meanwhile, the experimental pre-test class amounted to 17,943, and 14,239 for the post test.

Independent sample t test

Conducted to determine whether there is a difference in the average of two unpaired samples. The results of the hypothesis test calculation can be seen in the following table:

Table 3. Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
						One-Sided p	Two-Sided p			Lower Upper
Student Scientific Thinking Results	Equal variances assumed	.093	.761	9.268	58	<,001	<,001	33.000	3.561	25.873 40.127
	Equal variances not assumed			9.268	57.747	<,001	<,001	33.000	3.561	25.872 40.128

Based on the table above, the sig value is obtained. (tailed) of 0.001 <0.05, it can be concluded that there is a difference in the average student learning outcomes between the control class and the experimental class. In other words, we can conclude that SICABOX media has an effect on students' scientific thinking.

Discussion

Science learning is theoretical knowledge that is obtained or compiled in a typical or special way, namely by making observations, experiments, conclusions, compiling theories, experiments, observations and so on linking one way with another. SICABOX media is one of the media in which students can experiment. SICABOX media can be utilized to improve the scientific thinking skills of elementary school students. Scientific thinking is the process of thinking by using reason to consider, decide and develop knowledge. The scientific thinking process is a series of thought processes that use reason by considering, deciding and developing knowledge (Wulandari, 2017). Scientific thinking is a study of higher order thinking that is applied by honing the mind in effective learning with students because scientific thinking is developed so that thinking is broad, systematic, and thorough (Nurya et al., 2021). Meanwhile, according to Fitriyanti, he revealed that scientific thinking means a logical way of thinking that requires expertise using a certain approach which can later be accounted for the truth (Fitriyanti, Farida F, 2020).. One of the nature of natural science (IPA) is scientific thinking. Developing scientific thinking skills is one of the goals of science learning for children. Scientific thinking gives children the opportunity to ask questions, conduct experiments, and develop their own knowledge, investigate independently, gather information, and find answers to questions themselves (K. Dunbar & Penalang, 2020)(K. Dunbar & Reasoning, 2004). SICABOX media is a visual media that can be used for the science learning process, especially on the properties of light. This learning media is made by adjusting the five properties of light, namely light propagates straight, light can be reflected, light can penetrate clear objects, light can be refracted, and light can be decomposed (Sholiha et al., 2017).

SICABOX media is a medium that teachers can use as a tool that can improve students' abilities (Faradhita, 2022). This SICABOX media can create active and creative learning and create fun learning. SICABOX media also helps teachers to save time and energy in making students understand the learning of the properties of light (Fadhilah et al., 2020). Learning that uses teaching aids can develop the use of all five senses of students to foster the effectiveness of student learning by hearing, seeing, feeling, and using their minds in a real way, when learning using media students will have a desire to learn and be able to master the concept of the material being taught (Surya et al., 2022).

The SICABOX media made by this researcher is very practical with an attractive design that makes students interested, and in it students can find material on the properties of light in science learning. The material is obtained after students conduct experiments on SICABOX media. Later the results of their experiments can improve students' scientific thinking skills. Students' scientific thinking skills can grow due to experimental activities that can hone students' ways of thinking. The important role of SICABOX Media is that this media makes students interested in learning and makes students focus on learning. During the research, students followed the learning well and focused. So that the achievement of the objectives in using the media is achieved. According to the findings of the research conducted before and after, it was found that the use of SICABOX media had an effect on increasing students' scientific thinking. It can be seen from the increase in student scores, with the average scores before and after being 45.00 and 78.00. The occurrence of a very significant increase that makes this SICABOX media influential for students.

Conclusion

Based on data analysis and discussion in this study, it is concluded that the use of SICABOX media has an effect on increasing students' scientific thinking as evidenced by the

results of the analysis obtained seen from the increase in students' score scores, with an average score before and after that is 45.00 and 78.00. The occurrence of a very significant increase that makes this SICABOX media influential for students on the ability to think scientifically for students.

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