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Learning Science Through Ethnoscience Integrated Problem-Based Learning Model to Improve Critical Thinking Skills

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ABSTRACT

This study examines the effectiveness of problem-based learning in improving critical thinking skills and student learning outcomes. This research method uses an experimental technique that applies control and practical classes to the research process. The results of this study indicate that learning science through an ethnoscience-integrated problem-based learning model is more effective than conventional learning models for critical thinking skills in science content for class IV SD Negeri 102 Makale 5. It is proven that there has been an increase in the average student learning completeness score of 38.67 %. From the results of the t-test, it is known that Ho is rejected because the value is (55.663) > (2.030) and the N-Gain test results for the experimental class are 0.735, which are in the high category. The control class is 0.441 which are included in the medium category. The average value of the final test in the realm of student knowledge in the experimental class was 85.33, an increase compared to the control class, which was 75.05. While the results of learning the content of science class IV SD Negeri 102 Makale 5. From the results of the t-test, it is proven that Ho is rejected because the value is (55.663) > (2.030). While the N-Gain test results for the experimental class were 0.735 in the high category, and for the control class, 0.441 were in the medium category. The average value of the final test in the realm of student knowledge in the experimental class was 85.33, which experienced an increase compared to the control class, which was 75.05.

Keywords: Science, Problem Based Learning, Critical Thinking, Learning Outcomes, Ethno science.

INTRODUCTION

Natural Science is one aspect of education as a tool to achieve educational goals, namely to raise individuals who are literate in science. Events presented in science literacy are events in the real world that relate to nature and are close to students' lives. (Efendi & Wardani, 2021) States that learning science has a unique and complex nature because it requires critical thinking skills in analyzing problems. The provision of quality science education will impact the achievement of a country's development. Through the implementation of science learning, students are expected to be able to solve real-life problems in the current 21st-century era (S. N. Pratiwi et al., 2019).

Tana Toraja is an area that has a variety of traditional music, both vocal and instrumental music. (Field & Lestari, 2021) states that these traditional musical instruments are usually used or displayed at traditional ceremonies or religious rituals. The current shift in cultural values impacts existing local culture and wisdom. The influence of foreign cultures that entered and developed in the community resulted in a decrease in the interest of students and even the community to continue to preserve the culture in their area, which had a broad impact on the balance of people's lives, especially in education. One of them is traditional music, which is created and loved by the community and must be preserved from generation to generation as a means of entertainment and as a regional identity. (Amalia et al., 2020) The current shift in cultural values has resulted in cultural values and local wisdom being neglected, so concrete action is needed to integrate local culture into learning to preserve local cultural values.

Nisa et al. (2015) argue that education in Indonesia should be able to use a scientific approach to ethnoscience, which is original knowledge in the form of language, culture, morals, customs, and technology found in society or certain people in which there is an element of expertise. Scientific. In the 2013 curriculum, it is also explained that learning carried out in elementary schools can be developed thematically and integrate ethnoscience in learning activities which in its implementation include: observing, asking, gathering information, trying, and communicating. Integrating ethnoscience into the learning process can be done through culture around the community (Suryanti et al., 2021). In addition, ethnoscience-based science learning will be beneficial for students to be able to overcome difficulties in understanding abstract lessons by providing learning experiences that involve students in a complex manner according to the real world and as an alternative in realizing the formation of nationalist character through strengthening local wisdom values by implementing ethnoscience (Puspasari et al., 2019).

Ethnoscience-based learning is an effort carried out in a planned manner through observation and wise utilization of the potential in the local area to create conditions and an active learning process for students to develop their potential (Pingge, 2017). The application of ethnoscience learning is not only following the times but also aims to instill an attitude of love for their culture and nation, increasing students' knowledge and understanding of the culture and potential of their region (Puspasari et al., 2019). Agreeing with this (Khoiri & Sunarno, 2018) explain that Ethnoscience-integrated learning is essential to empower students' embedded knowledge to develop indigenous knowledge in society and study it towards formal science learning as a study of learning in schools. In line with this (Hadi et al., 2019) also explain that a learning process occurs not only in the classroom, but students can also learn through their social environment.

Students' low critical thinking skills are caused by the absence of active involvement of students in the learning process, so most students are unable to express their own opinions about the problem-solving process that occurs in science learning which also affects student learning outcomes (Maqbullah et al., 2018). To be able to overcome these problems in science learning and facilitate the development of critical thinking skills and student learning outcomes, a learning approach is needed that involves indigenous knowledge existing in a local community environment as a source of learning and also a learning model that can assist teachers in organizing learning. In order to achieve the learning goals, namely through the Problem-based learning model (Amalia et al., 2020).

Based on the explanation above, ethnoscience-integrated science learning is beneficial because it can train students to find out, practice critical and analytical thinking, and work together to solve a problem. Therefore, researchers are interested in studying "Science Learning through the Ethnoscience Integrated Problem-Based Learning Model to Improve Critical Thinking Skills and Learning Outcomes of Elementary School Students in Sound Material."

MATERIALS & METHODS

This research is included in the type of quantitative research. This type of research is quasi-experimental. This research was conducted to test the effectiveness of a treatment on the sample. This study uses a Quasi-Experimental Research Method Design type Non-equivalent Control Group Design. The non-equivalent group design in this study used an experimental class and a control class that was selected randomly or randomly.

The research began by giving pretests to both classes. Then the experimental class was given treatment through the Problem-Based Learning model, while the control class did not use only the Conventional model. At the end of the research activity, the experimental and control classes were given a final test.

This design follows the objectives to be achieved, namely to test the effect of the Problem-Based Learning model in Ethnoscience integrated natural science learning on critical thinking skills and learning outcomes of elementary school students on sound source material before and after it is given. Treatment. The two groups were then given a pretest to determine the initial conditions and the differences between the experimental and control groups. In the pretest results of the two groups should not have much difference.

RESULT AND DISCUSSION

Study Result

The research results from the implementation of research that has been carried out related to science learning through an ethnoscience integrated problem-based learning model to improve critical thinking skills and elementary school student learning outcomes in sound material, namely: (1) results of observations from student activities in the control class and experimental class ; (2) the results of students' critical thinking skills; (3) student learning outcomes; (4) pretest and posttest data normality test in the control class; (5) pretest and posttest data homogeneity test in the control class; (6) test the control class hypothesis; (7) control class n-gain test; (8) pretest and posttest data normality test in the experimental class; (9) pretest and posttest data homogeneity test in the experimental class; (10) test the experimental class hypothesis; (11) experimental class n-gain test.

Observations were made at the time before and after giving a treatment by the teacher in research in control and experimental classes using student activity observation sheets. The results of the analysis before and after the application of science learning through the ethnoscience-integrated problem-based learning model is shown in the realm of skills seen in Table 1.

Table 1 Observation Results Before and After the Application of Science Learning through an Ethnoscience Integrated Problem-Based Learning Model

Class	percentage			Average
	1	2	3	
Control	63,75%	87,5%	96,25%	82,5%
Experiment	91,25%	95%	98,75%	95%

The results of the calculations presented in the table can be seen through student activity through the observation process carried out by researchers in the control class. The average percentage of student scores is 82.5%, with excellent criteria. In contrast, in the experimental class, the average percentage of student scores is 95% during three times of learning activities with excellent criteria. The control and experimental classes have an average difference of 12.5%. With this, it can be seen that there is a difference in the average activity of students in the control class who are given conventional learning treatment and the experimental class who are given treatment in the form of science learning through an ethnoscience integrated problem-based learning model at the first meeting with a percentage of 91.25%. And the second meeting with a percentage of 95%, and the third meeting with a percentage of 98.75%.

The results of students' critical thinking skills carried out during the learning process are in the form of pretest scores and posttest scores to determine the effectiveness of learning science through an ethnoscience-integrated problem-based learning model.

Critical thinking skills

The pretest results measured the initial IS for students in the experimental and control classes, which were carried out before being given the treatment. In comparison, the final critical thinking skills of students in the experimental class and control class were measured by the results of the posttest after being given treatment which is used to calculate the increase in students' critical thinking skills and also to conclude from the hypotheses that have been written. The experimental class was given treatment using science learning through an ethnoscience-integrated problem-based learning model. In contrast, the control class used conventional learning models with media provided by the class teacher. The acquisition of pretest and posttest grade IV students can be seen in Table 2.

Table 2 Results of Pretest and Posttest Critical Thinking Skills

No	Information	Pretest		Posttest	
		Control	Experiment	Control	Experiment
1	The number of students	36	36	36	36
2	Average	51,24	48,25	79,05	80,39
3	The highest score	60	69	89	94
4	Lowest score	40	40	74	74
5	Number of students completed	0	0	36	36
6	Mastery learning (%)	0%	0%	100%	100%

It can be explained that from the results of table 2, it shows that the initial critical thinking skills of the control class and the experimental class have an average that is not too far away, namely the average pretest score in the control class is 51.24, and the experimental class is 48.25. After being given treatment using the model in each class, there was a difference in the experimental class obtaining a posttest average of 80.39 and the control class obtaining a posttest average of 79.05. Thus, the average increase in critical thinking in the experimental class is higher by 32.14 compared to the control class, which is equal to 27.81. Furthermore, the pretest value in the control and experimental classes is 0% for learning completeness. In the posttest scores, students who experienced learning mastery in the control class were 100%, and in the experimental class were 100%. Based on the results of students' pretest and posttest learning, it can be concluded that the experimental class, which was given treatment in the form of science learning through the ethnoscience-integrated problem-based learning model, obtained higher scores compared to the control class, which applied conventional learning models.

Learning outcomes in the realm of student knowledge that have been carried out during the learning process are in the form of pretest scores and posttest scores to determine the effectiveness of science learning through an ethnoscience-integrated problem-based learning model. Initial ability in the realm of knowledge of students in the experimental class and control class was measured by the results of the pretest, which was carried out before being given treatment. In comparison, the final ability of students in the experimental and control classes was measured by the results of the posttest after being given treatment, which was used to calculate the increase in students' abilities and conclude from the hypotheses that had been written. The experimental class was given treatment using science learning through an ethnoscience-integrated problem-based learning model. In contrast, the control class used conventional learning models with media provided by the class teacher. The acquisition of pretest and posttest grade IV students can be seen in Table 3.

Table 3 Pretest and Posttest Learning Outcomes

No	Information	Pretest		Posttest	
		Control	Experiment	Control	Experiment
1	The number of students	36	36	36	36
2	Average	56,19	46,66	75,05	85,33
3	The highest score	72	70	82	100
4	Lowest score	46	36	70	74
5	Number of students completed	2	1	36	36
6	Mastery learning (%)	5,5%	2,7%	100%	100%

It can be explained that the results of table 3 show that the initial abilities of the control class and the experimental class have an average that is not too far away; that is, the average pretest value in the control class is 56.19, and the experimental class is 46.66. After being given treatment using the model in each class, there is a considerable difference; the experimental class obtained a posttest average of 85.33, and the control class obtained a posttest average of 75.05. Thus it is known that the average increase in the experimental class was 38.67 higher than that of the control class, which was 18.86. Furthermore, for mastery learning, the pretest value in the control class was 5.5%, and the experimental class was 2.7%. In the posttest scores, students who experienced learning mastery in the control class were 100%, and in the experimental class were 100%. Based on the results of students' pretest and posttest learning, it can be concluded that the experimental class, which was given treatment in the form of science learning through the ethnoscience-integrated problem-based learning model, obtained higher scores compared to the control class, which applied conventional learning models.

DISCUSSION

The discussion of research results examines the meaning of research findings which consist of observations of students' activities in the experimental class, differences in learning outcomes in the form of pretest scores and posttest scores between the experimental class and the control class, as well as the effectiveness of science learning through an ethnoscience integrated problem-based learning model on critical thinking skills and learning outcomes. This study aimed to determine the effectiveness of science learning through an ethnoscience-integrated problem-based learning model.

Student activity during the learning process using science learning through an ethnoscience-integrated problem-based learning model looks very active and enthusiastic. Students also play an active role in discussion activities with their study groups. When the teacher allowed asking questions, some students raised their hands to ask the teacher about material that students did not understand. In this study, observations of students' activities using science learning through an ethnoscience-integrated problem-based learning model were carried out at every meeting on science content. The results of the analysis are seen in Figure 1.

Diagram 1 Percentage of implementation of science learning through an ethnoscience-integrated problem-based learning model

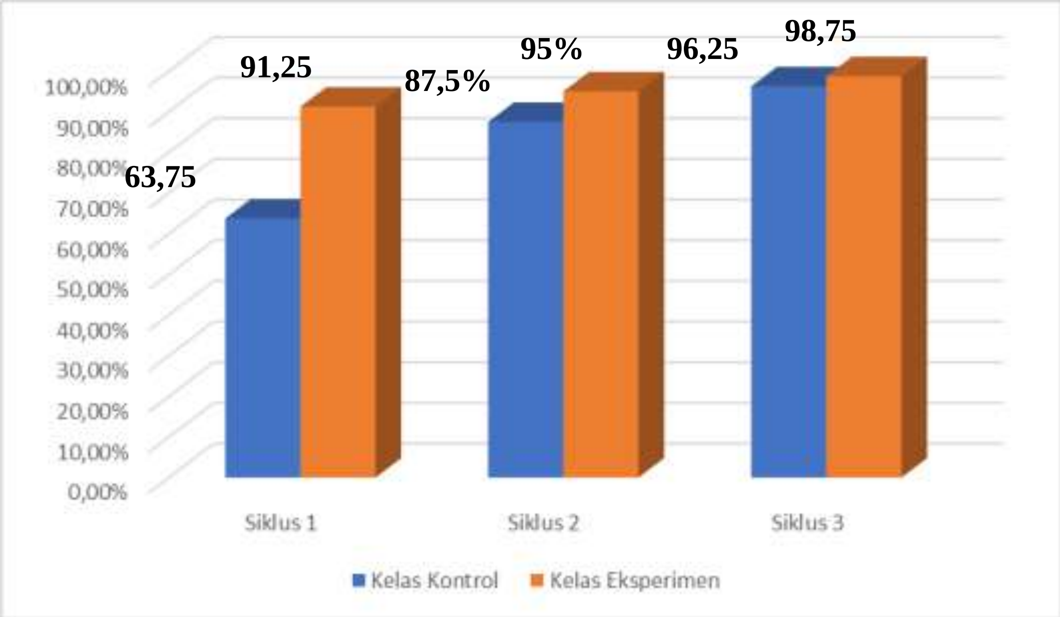

Diagram 1 shows that the application of science learning through the ethnoscience-integrated problem-based learning model in control and experimental classes increases at each meeting. It is known that student activity through the observation process carried out by researchers in the control class average percentage of student scores is 82.5%. The average percentage of student scores in the experimental class is 95% during three learning processes with excellent criteria. So that the control and experimental classes have an average difference of 12.5%. With this, there is a difference in the average activity of students in the control class by being given conventional learning treatment and the experimental class by being given treatment in the form of science learning through an ethnoscience-integrated problem-based learning model.

Before being given treatment to the control class, the research process was first given pretest questions in 15 multiple choice questions and seven essay questions. Students are given a pretest before being given treatment. The pretest questions used to test students' initial abilities are related to the material that will be given during the learning process about sound. Based on the level of classical completeness, in the control class, two students (5.5%) out of 36 got pretest scores above the specified KKM.

The average value of the pretest in the control class was 56.19, and the posttest was 75.05. The results of calculating the average similarity show that the sig. (2-tailed) value in the control class shows the sig. (2-tailed) value. (2-tailed) of 0.200, which of the data is sig. > 0.05, the data in the control class is usually distributed

Pretest and posttest values are used to determine the effectiveness of science learning through an ethnoscience-integrated problem-based learning model in the form of student learning outcomes. The final ability of the experimental class can be seen from the posttest results obtained after being given treatment to calculate the similarity of initial abilities, which can then be concluded based on the research hypothesis using the pretest and posttest values obtained before and after students are given treatment for three meetings with the experimental class given science learning treatment through an ethnoscience-integrated problem-based learning model.

Testing the normality of the pretest and posttest from calculating the average similarity results shows that the sig. (2-tailed) value in the experimental class is 0.200, which of the data is the sig. > 0.05, the data in the experimental class are normally distributed

Based on the control class data results, the experimental class obtained the results of the pretest score with an average of 48.25, while the control class had an average of 51.24%. Meanwhile, the posttest results for the experimental class averaged 80.39, and the control class averaged 79.05% with all students completing. The increase in the average mastery of students' critical thinking skills in the experimental class was 32.14%, and that in the control class was 27.81. So that students' critical thinking skills in sound material experience change before and after using science learning through an ethnoscience-integrated problem-based learning model.

From these data, the N-Gain in the experimental class shows the number 0.735, so it is included in the high category. So there is an increase in critical thinking skills in the experimental class. This shows that the experimental class that was given treatment using science learning through an ethnoscience integrated problem-based learning model was more effective towards critical thinking skills in science subject matter, which increased significantly compared to the control class using conventional learning models.

Based on the experimental class data results, the experimental class obtained the results of the pretest score with an average of 46.66, while the control class had an average of 56.19%. Meanwhile, the posttest results for the experimental class averaged 85.33, and the control class averaged 75.05% with all students completing. The increase in the average mastery of student experimental class learning outcomes was 38.67%, and that of the control class was 18.86. So the student's learning outcomes in sound subjects experienced a change before and after using science learning through an ethnoscience-integrated problem-based learning model.

The average increase through N-gain reinforces this. The N-Gain in the experimental class shows the number 0.735, so it is included in the high category. So there is an increase in learning outcomes in the experimental class. This shows that the experimental class that was given treatment using science learning through an ethnoscience-integrated problem-based learning model was more effective in learning outcomes in science subject matter which increased significantly compared to the control class using conventional learning models.

The effectiveness of science learning through an ethnoscience-integrated problem-based learning model is very suitable to be applied to elementary schools because students are in the concrete operational stage in the age range of 7-11 years. At this stage, students are inquisitive about concrete objects; this follows Piaget's theory (Rifa'i, 2016). This theory is used in elementary science learning because, in the lessons, it emphasizes direct learning experiences in the development of process and scientific skills. Implementing science learning through an ethnoscience-integrated problem-based learning model in the experimental class can help students think critically about students; using science learning through an ethnoscience-integrated problem-based learning model can create students' writing abilities creatively and effectively by making mind maps. This is undoubtedly very helpful for students in understanding and remembering the material. As intended, of course, the teacher in the class has a role as a facilitator and motivator for students in finding desired alternative answers. So applying science learning through an ethnoscience-integrated problem-based learning model can improve students' ability to think creatively and understand science learning material by finding main ideas independently.

The effectiveness of science learning through an ethnoscience-integrated problem-based learning model shows increased learning outcomes. This learning model is applied in the experimental class, with an average learning result higher than the control class. It is evident from the test results obtained by the experimental class that the n-gain index in the experimental class shows the number 0.735, so it is included in the high category. In contrast, the gain index in the control class shows 0.441, which is included in the medium category. The improvement in the experimental class was better than in the control class.

Research that supports this research has been conducted by (Syafriana, 2017), explaining that problem-based learning is a problem-based learning model where this learning model presents a problem that is contextual so that it can stimulate students to learn. This learning model provides opportunities and fun learning experiences for students through problem-solving through experiences directly faced by students and can train students independently to be skilled in critical thinking.

Prasetyo & Kristin (2020) states that implementing the Problem-based learning model begins with identifying problems and seeking relevant information to understand the problems faced so that through this activity, students can train students critical thinking skills and make students active in learning because the material discussed is related to problems that are often faced by students in everyday life. In addition, the Problem-Based Learning learning model is also considered to affect critical thinking skills significantly and can improve student learning outcomes. This is supported by relevant previous research by (Nopia et al., 2016), stating that the problem-based learning model significantly affects the critical thinking skills of elementary school students. Another study conducted by (Ejin, 2016) also stated that with the problem-based learning model, student activity in learning increased, and all students achieved mastery of concepts and critical thinking skills. Another study by (Ulandari et al., 2020) states that learning science using the problem-based learning method improves students' critical thinking skills. Furthermore, research conducted by (Maulida et al., 2020) the results of his research show that through the application of the problem-based learning model, it improves students' critical thinking skills and cooperative attitudes.

CONCLUSION

Science learning through an ethnoscience-integrated problem-based learning model is practical compared to conventional learning models for critical thinking skills in science content for class IV SD Negeri 102 Makale 5. There is evidence of an increase in the average completeness of student learning outcomes by 38.67%. From the results of the t-test, it was found that Ho was rejected because the value (55.663) > (2.030) and the N-Gain test results for the experimental class were 0.735, which was in the high category, and the control class was 0.441 which was in the medium category. The average score of the final test in the realm of student knowledge in the experimental class was 85.33, an increase compared to the control class, which was 75.05. So that students' critical thinking skills in sound material experience change before and after using science learning through an ethnoscience-integrated problem-based learning model.

Science learning through an ethnoscience integrated problem-based learning model is practical compared to conventional learning models for learning outcomes of science content in class IV SD Negeri 102 Makale 5. It is evident from the results of the t-test that Ho is rejected because the value is (55.663) > (2.030). While the results of the N-Gain test for the experimental class were 0.735, which was in the high category, and for the control class, it was 0.441, which was in the medium category. The average score of the final test in the realm of student knowledge in the experimental class was 85.33, an increase compared to the control class, which was 75.05 so the students' learning outcomes in sound subject experienced a change between before and after using science learning through an ethnoscience-integrated problem-based learning model.

Declaration by Authors

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