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Effectiveness of Ethnoscience-Based Creative Problem Solving Learning Model on Problem-Solving Abilities

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Abstract: Problem-solving ability is a skill that requires thinking by using and connecting with various rules that we already know that are important for students to have. This study aims to determine the effectiveness of the ethnoscience-based creative problem-solving learning model on the problem-solving abilities of sixth-grade students at MIN 2 Ponorogo. This study was designed using a quantitative research method with an experimental research type. While the research design is Quasi Experimental Design. The sample used was 21 students of class VI MIN 2 Ponorogo as the experimental class sample and 23 students as the control class sample. Data collection was carried out by observation and tests. The research data were then analyzed using the T test, N-Gain test, and Cohen's Effect Size test. The problem-solving abilities of students who applied the ethnoscience-based creative problem-solving learning model were different when compared to the problem-solving abilities of students who applied the conventional learning model. Based on the calculation of the two-tailed t test, it was found that the sig. (2 tailed) 0.000 and the value is less than 0.05, and the one tailed t test can be seen that the significance value is 0.00 and the value is less than 0.05, so it can be concluded that H0 is rejected and H1 is accepted. Therefore, it can be said that the problem-solving ability of students in the experimental class with the ethnoscience-based creative problem-solving learning model is better than the problem-solving ability of students in the control class.

Keywords: Creative Problem Solving; Ethnoscience; Problem-Solving Skills

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INTRODUCTION

Schools are educational institutions that organize teaching and learning activities, as well as receive and administer lessons according to level, age, major, and other factors. Life and education go hand in hand and cannot be separated. Their nature is immutable in life, whether in the lives of individuals, families, nations, or countries. The progress of a nation is largely determined by the progress of its education. Given its importance to life, education must be implemented optimally to achieve the desired results (Maulana, 2023). Elementary school is the basic or initial level in the Indonesian education system. Each student requires six years to graduate from this level.

According to Siswandi, the creative problem-solving learning model is a variation of problem-solving using systematic techniques to solve a problem. Puccio also describes a learning model that functions to improve thinking processes, thereby improving the ability to overcome existing difficulties (Kurniawan et al., 2022). Based on the opinions above, it can be concluded that the creative problem-solving learning model is a learning model that focuses on problem-solving using established techniques. This model can also train students to improve their ability to overcome existing difficulties. The creative problem-solving learning model focuses on problem-solving using established techniques. This model can also train students to improve their ability to overcome existing difficulties. Ethnoscience, on the other hand, incorporates local culture into the learning process. Therefore, the ethnoscience-based creative problem-solving learning model focuses on problem-solving using established techniques and utilizing local culture during the learning process.

In the National Curriculum currently implemented in Indonesia, problem-solving skills are one of the skills required to be trained for students. Problem-solving skills are a key quality indicator in modern society, which is highly technical, scientific, and complex. Problem-solving in the context of science learning can be used to construct new scientific knowledge and facilitate science learning (Siswati & Corebima, 2021).

Gagne states that problem-solving ability is a form of skill that requires thinking by using and connecting with various rules that we already know (Nugrahani, 2018). Then Liliasari also states that problem-solving ability uses basic thought processes to solve known or defined difficulties, gather facts about the difficulty and find additional information needed. Then, conclude or propose alternative solutions to the problem. There are four indicators of problem-solving ability according to Polya (Saedi et al., 2011): understanding the problem, planning a strategy, implementing the strategy, and checking back.

Ethnoscience can be defined as knowledge possessed by a nation or ethnic group or social group (Anwar & Sumarna, 2022). Sudarmin argues that ethnoscience is knowledge possessed by a nation or ethnic groups or certain social groups as a form of local wisdom. Fasasi also argues that ethnoscience is knowledge derived from the norms and beliefs of certain local communities that influence the interpretation and understanding of nature (Saija & Tahya, 2023). Linguistically, Pranata Mangsa comes from two words, namely pranata which means rules and mangsa which means season, or the periodization of climate on earth caused by changes and shifts in the sun's orbit. Pranata Mangsa is cultural science knowledge and its knowledge is full of wisdom that connects people with their environment to understand each other and increase a sense of respect and ownership of the earth. According to Fidiyani and Kamal, Pranata Mangsa is the local wisdom of the Javanese people in reading natural signs to determine the seasons that are used as a benchmark in the fields of agriculture and fisheries. Based on the opinions above, it can be concluded that Pranata Mangsa is cultural scientific knowledge and guidelines for the Javanese people regarding the periodization of time during one year which is divided into 12 mangsa based on the rotation of the sun. Currently, Pranata Mangsa is used as a guide to prepare for natural disasters and related to weather forecasts. Pranata Mangsa in Javanese society functions as a guide in daily activities and a benchmark to avoid unwanted things. Pranata Mangsa also provides information about the changes and division of seasons each year which is full of local cultural wisdom in Javanese society (Handayani et al., 2018).

In today's era, many schools still use learning models or methods that lack variety or are not tailored to students' learning needs. Teachers still use outdated models and methods in delivering material. Yet each student has different needs and characteristics. The impact on students is that many learning outcomes still do not meet the Minimum Competency. Therefore, teachers need to adjust their teaching methods and styles so that students can understand the lessons correctly and well (Situmorang, 2024). Furthermore, observations made by researchers at MIN 2 Ponorogo, particularly among sixth-grade students in science, showed that many students still experience difficulty in solving problems due to the lack of variety and non-contextual learning models or methods. Learning that only focuses on memorization is often ineffective in developing critical and creative thinking skills.

The creative problem-solving learning model is a learning model that focuses on problem-solving using established techniques. This model can also train students to improve their ability to overcome existing difficulties. This model encourages students to think outside the box and find innovative solutions to problems they face. This model can be used by teachers in the

learning process to improve students' problem-solving skills. In addition, teachers can integrate local and cultural knowledge into the learning process, one of which is through pranata mangsa. By linking the subject matter to the cultural context of students, learning becomes more relevant and interesting. Based on the explanation above, the researcher is interested in conducting a study entitled "The Effectiveness of the Ethnoscience-Based Creative Problem-Solving Learning Model on Problem-Solving Skills in Science Learning for Grade VI of MIN 2 Ponorogo."

METHOD

This study used an experimental research type with a quasi-experimental research design. That is, research that aims to find the effect of certain treatments on other things under controlled conditions (Tumurang, 2024). The study was conducted in the odd semester of the 2024/2025 academic year at MIN 2 Ponorogo. The population of this study was 66 sixth grade students. While the research sample was 21 students for the experimental class and 23 students for the control class. Data collection techniques used observation and tests, while the data collection instruments were in the form of observation sheets for the implementation of learning and student activities as well as problem-solving ability test questions. Validity and Reliability tests were carried out on the problem-solving ability test instrument, the Cronbach's reliability test showed a figure of 0.851 where the instrument was reliable for use. Data analysis techniques used the T-Test, N-Gain, and Cohen's Effect Size Test. **Table 1** shows the Problem-Solving Ability Indicators and **Table 2** shows the Quasi-Experimental Research Design.

Table 1. Problem Solving Ability Indicators (Murtiyasa & Wulandari, 2022)

Indicator	Descriptor
Understanding Problems	Students are asked to identify the problems presented.
Formulating a Plan	Students are asked to plan strategies to overcome problems.
Executing The Plan	Students are asked to carry out strategies that have been planned previously.
Looking Back	Students are asked to re-examine the solutions they have chosen to solve existing problems.

Table 2. Quasi-Experimental Research Design

Group	Pretest	Treatment	Posttest
Experimental Group	Problem Solving Ability Pretest	Treatment using the Creative Problem Solving Model based on ethnoscience	Problem Solving Ability Posttest

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Control Group	Problem Solving Ability Pretest	Treatment using the Conventional Model	Problem Solving Ability Posttest

FINDING AND DISCUSSION

Based on the normality test calculation using SPSS version 23, the significance value of problem-solving ability in the control class was 0.260 > 0.05, while in the experimental class the value was 0.327 > 0.05. This means that the problem-solving ability data in both classes are normally distributed. The homogeneity test results in the control and experimental classes showed that the mean was 0.893 > 0.05, so both data can be said to be homogeneous.

Table 3. Results of the Two-Tailed Posttest for the Control and Experimental Classes

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Nilai	Equal variances assumed	.018	.893	-10.073	42	.000	-26.156	2.597	-31.396	-20.916
	Equal variances not assumed			-10.147	41.817	.000	-26.156	2.578	-31.359	-20.953

After that, a two-tailed t-test (Table 3) and a one-tailed t-test (Table 4) were conducted. Both tests aimed to determine the similarities in the characteristics of the control class and the experimental class. Based on Table 3, it can be seen that the sig value (2 tailed) in the posttest was 0.000, which means that the value is smaller than the alpha value ($\alpha = 0.05$). Therefore, H1 is accepted and H0 is rejected, meaning there is a difference between the control class using the lecture learning model and the experimental class using the ethnoscience-based creative problem-solving learning model. So it can be concluded that the average problem-solving ability of students in the experimental class using the ethnoscience-based creative problem-solving learning model is higher than the control class using the lecture learning model.

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Table 4. One-Tailed Test Results for Posttest Scores of Control and Experimental Classes

One-Sample Test

	Test Value = 0					
					95% Confidence Interval of the Difference	
	T	Df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Nilai	29.740	43	.000	70.455	65.68	75.23
Kelas	19.394	43	.000	1.477	1.32	1.63

Based on **Table 4**, the significance value is 0.00 and is less than 0.05, so it can be concluded that H0 is rejected and H1 is accepted. Therefore, it can be said that the problem-solving ability of students in the experimental class with the ethnoscience-based creative problem-solving learning model is better than the problem-solving ability of students in the control class.

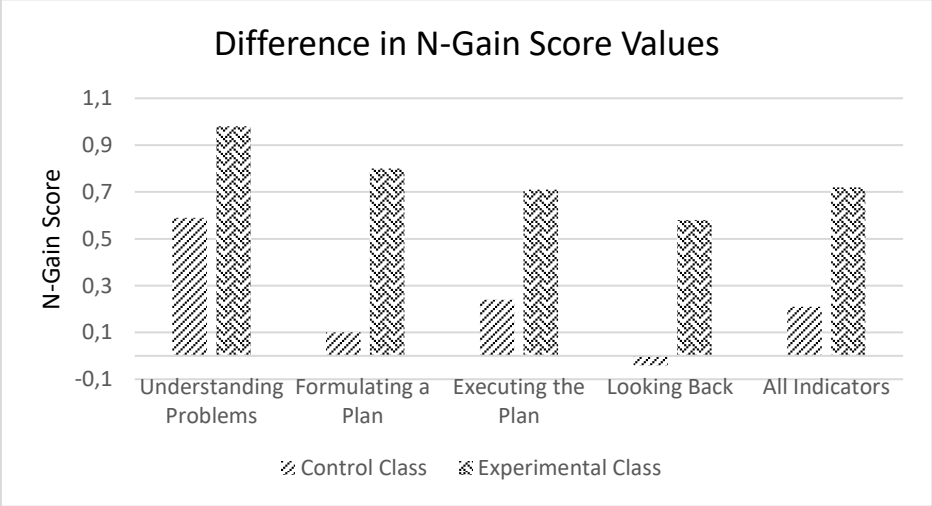

Figure 1. Difference in N-Gain Scores of Control and Experimental Classes on Problem Solving Ability

Next, using the n-gain test (**Figure 1**) to determine the improvement in each indicator. In the control class, the average value of the n-gain test was obtained, namely, the indicator of understanding the problem got a result of 0.59, the indicator of planning a strategy got a result of 0.10, the indicator of implementing the strategy got a result of 0.24, and the indicator of checking back got a result of -0.04. For the calculation result of the n-gain test of problem-solving ability in the control class was 0.21. It can be concluded that the use of conventional learning models is not effective for use in science learning activities on the Earth's revolutionary motion material. While in the experimental class, the average value of the n-gain calculation was obtained, the indicator of understanding the problem got a result of 0.71, the indicator of

planning a strategy got a result of 0.80, the indicator of implementing the strategy got a result of 0.71 and the indicator of checking back got a result of 0.58. For the calculation result of the n-gain test of problem-solving ability in the control class was 0.72. It can be concluded that the use of ethnoscience-based creative problem-solving learning models is quite effective for use in science learning activities on the Earth's revolutionary motion material.

Table 6. Results of Cohen's Effect Size Test for Experimental Class and Control Class

Independent Samples Effect Sizes					
		Standardizer[a]	Point Estimate	95% Confidece Interval	
				Lower	Upper
Nilai	Cohen's d	8.603	3.040	2.154	3.909
	Hedges' correction	8.761	2.986	2.115	3.839
	Glass's delta	9.224	2.836	1.803	3.845

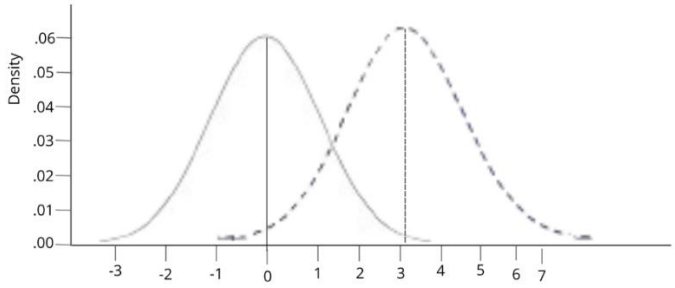

Figure 2. Graph of Cohen's Effect Size Test Results

Based on **Table 6**, it can be seen that the Cohen effect size obtained was 3,040 > 1.00, meaning there was a strong effect, so it can be concluded that the use of the ethnoscience-based creative problem-solving learning model had a strong influence on students' problem-solving abilities. From Figure 2, it can be seen in the graph that there is a distance between the control class and the experimental class, which means there is a large influence on the experimental class that was given the Creative Problem Solving model assisted by Ethnoscience. So, it can be seen from the results of this study that the effect size is 3.040 which is included in the "large" category. Therefore, it can be concluded that the Creative Problem Solving model based on ethnoscience has a large influence on improving students' reasoning abilities.

From the results of the analysis of the implementation of the ethnoscience-based creative problem-solving learning model, it is said to have been implemented well. This means that learning was carried out according to the plan and standards set. This is because, based on the results of the learning implementation percentage obtained, it was 88%. From the results of the

observation analysis regarding student activities when the ethnoscience-based creative problem-solving learning model was implemented, the percentage was 82%. Therefore, it can be concluded that student activity when the ethnoscience-based creative problem-solving learning model was implemented was active.

In the ethnoscience-based creative problem-solving learning model, there are four syntax steps that must be followed: problem clarification, opinion expression, evaluation and selection, and finally, implementation (Kurniawan et al., 2022). The learning process is divided into three activities: introduction, main topic, and conclusion. Before beginning the lesson, the teacher provides an apperception or asks students questions, such as "How many seasons do we experience today?" Apperception activities can develop thinking skills, including memory, and foster students' courage in answering questions and expressing opinions. These questions can develop thinking skills, including memory skills, and develop students' courage in answering and expressing opinions (Pandu et al., 2023). The final preliminary activity is for the teacher to convey the learning objectives. Learning objectives serve as a guide for teachers in planning and implementing teaching and learning activities and serve as indicators of the success of the process (Amanda et al., 2024). The final preliminary activity involves students listening to the learning objectives presented by the teacher. Learning objectives provide students with guidance on what is expected of them in the learning process. When students know the objectives they want to achieve, they will be more focused and motivated. (Albina & Pratama, 2025).

In the first syntax, namely problem clarification, the teacher gives a problem to students through a short story on the student worksheet. The problem given is related to ethnoscience, namely pranata mangsa which is related to the Earth's revolution. The teacher explains about pranata mangsa which is related to the Earth's revolution. Pranata mangsa is used in this learning because the place where the researcher used the majority of parents are farmers and they also live on the island of Java which uses pranata mangsa in determining the planting season. The benefit of problem clarification is that students can understand what kind of problem solving is expected (Sari et al., 2020). Previously, the teacher divided students into five small groups. The purpose of this group division was to increase student participation as group members, so that no student was passive or neglected during the learning process (Rokayah, 2014).

During the student opinion-expression stage, each group member can express any possible solutions to address the existing problems without limitation. Students are also asked to fill in the worksheet for students about activities carried out by farmers based on the pranata mangsa (prey system). This stage can develop students' ability to express their opinions

(Yuliastuti et al., 2019). The next activity involves the teacher guiding students in a group discussion to determine possible solutions to the given problem. This group discussion aims to enliven the classroom atmosphere and increase student engagement in the learning process (SIMEON et al., 2024).

The third syntax is evaluation and selection. The teacher asks students to discuss again to determine the appropriate solution to the problem at hand based on the opinions expressed by each group member. The teacher then asks students to consider the solutions they have chosen. Through evaluation and selection, it is hoped that students can choose the most appropriate strategy to solve the given problem (Yuliastuti et al., 2019). After each group has determined a solution to overcome the given problem, the teacher asks each group to write it on the worksheet.

The final stage, or syntax, is implementation. In this stage, students are guided by the teacher in determining solutions to existing problems. The teacher will then review the chosen solution to determine whether it is appropriate or not in addressing the existing problem. If the solution is appropriate, it can be used to address the existing problem. Students are then asked to reevaluate the impact of the Earth's revolution on everyday life, especially in Javanese society. Through implementation, it is hoped that students will be able to determine appropriate strategies to solve the given problems (Sari et al., 2020). In this syntax, students discuss with their groupmates to determine the appropriate solution to a given problem from among several existing solutions. Deliberation in selecting a solution with group members can train students to think creatively and critically (Azmi & Khaira, 2024).

Researchers used four indicators to assess students' problem-solving abilities: understanding the problem, planning a strategy, implementing the strategy, and reviewing it. These indicators were applied to the pretest and posttest questions completed by the students. The N-Gain score for the understanding the problem indicator was 0.98, the N-Gain score for the planning the strategy indicator was 0.80, the N-Gain score for the implementing the strategy indicator was 0.71, and the N-Gain score for the reviewing the indicator was 0.58. The conclusion was that the highest N-Gain score was achieved for the understanding the problem indicator, which was 0.98. This indicates that students were able to understand the given problem. Furthermore, the understanding the problem indicator ranked highest compared to other indicators because the given problem occurred in real life, so students had no difficulty understanding the given problem. For the planning the strategy and implementing the strategy indicators, the N-Gain score was in the sufficient category, indicating that students were quite capable of planning and implementing strategies to solve a given problem. The rechecking

indicator shows that the N-Gain score is in the poor category. This is because students are reluctant to recheck their chosen solutions. They believe their chosen solution is correct without checking or rethinking it. Rechecking is a crucial part of the problem-solving process because it ensures the solution we choose can address the problem at hand (Purnomo, 2021).

Learning that connects traditional community knowledge (ethnoscience) with scientific concepts is considered successful in enhancing students' understanding of the material. This understanding leads to improved problem-solving, creative, and critical thinking skills. This is because the material taught is easier to understand and has deeper meaning for students. Collaboration, which contributes to combining student character education with local cultural values, is considered an integral element of the scientific learning concept (Novanda et al., 2024). Ethnoscience-based learning falls under contextual learning, as teachers connect the content of the learning material to its application in everyday life. By emphasizing cultural context or local wisdom, students not only gain theoretical knowledge but also understand how that knowledge directly relates to their lives (Arbangatul & Faizah, 2025; Rayis et al., 2025). One ethnoscience found on the island of Java that can be used in learning is pranata mangsa. This is because pranata mangsa serves as a time guide for farmers in determining farming activities. Furthermore, pranata mangsa is also used as a time guide for fishing and trading activities (Suardana et al., 2019). The determination of the prey is based on the apparent orbit of the sun, which occurs due to the Earth's revolution. The science of the apparent orbit of the sun and revolution is typically discussed in science lessons. Therefore, the prey system can be used in contextual learning because it is closely related to the material being taught.

The ethnoscience-based creative problem-solving learning model is quite helpful in improving students' problem-solving abilities. According to Darwati, problem-solving skills are a crucial part of the learning process because, in problem-solving activities, students discover concepts for themselves, making learning more meaningful (R & Atmojo, 2024). With the ability to solve problems, students can also think logically to make decisions and can improve their thinking skills in dealing with problems they have never encountered before (Rahma & Sutarni, 2023). The use of ethnoscience in learning also serves as a link between local knowledge from local communities as a learning resource and formal knowledge in schools. Ethnoscience-based learning also encourages students to construct indigenous knowledge from their communities into scientific knowledge. Furthermore, ethnoscience teaches students to stay close to the concrete situations they encounter in everyday life (Hidayati & Dewi, 2023).

The syntax of creative problem-solving learning relates to students' problem-solving indicators. Each learning stage systematically develops key aspects of problem-solving:

understanding the problem, planning a strategy, implementing the strategy, and reviewing it. In the problem classification stage, students are guided to understand and classify the given problem. This aligns with the problem understanding indicator in problem-solving skills (Octadianti et al., 2023). The opinion-expression stage then encourages students to creatively and relevantly propose various strategies for solving existing problems. This stage relates to the strategy planning indicator in problem-solving skills. Furthermore, in the evaluation and selection stage, students are guided to choose the right strategy to solve the problem. This aligns with the problem-solving skill indicator, namely implementing the strategy (Yudhawardana, 2022). The implementation stage is the application of the chosen strategy to solve the problem. This aligns with the indicator for reviewing problem-solving skills, as during the implementation stage, students must truly re-check whether the chosen strategy or solution is appropriate for addressing the given problem (Fauziyah et al., 2024).

It is recommended to apply a fun, creative and interesting learning model to the learning process because it can foster students' interest, talent and ability in understanding the subject matter being taught (Mardlatillah & Sa'adah, 2022). Furthermore, students will be more enthusiastic about participating in the learning process when using a variety of learning models. The teacher's role is crucial in determining the learning model used in the learning process. The learning model is chosen based on the material to be presented and the students' learning styles. Implementing an ethnoscience-based creative problem-solving learning model can improve students' problem-solving skills. This learning model has advantages, including fostering curiosity, fostering student cooperation and interaction, and making education more relevant to life. Students' curiosity will emerge when presented with a problem. Students will think and explore possible solutions. The second advantage is fostering student cooperation and interaction. Collaboration is crucial so students can respect the opinions of others. Furthermore, interaction is also crucial in future social activities. The final advantage is making education more relevant to life. Problems occurring in the surrounding environment are included in this learning process, so students will better understand the connection between what they learn and what happens in their surroundings (Rahmaniati, 2024).

The implications of the research findings are that science learning, particularly at the elementary school level, specifically the choice of learning model, significantly impacts students' problem-solving abilities. This study demonstrated differences in problem-solving abilities between classes using an ethnoscience-based creative problem-solving learning model and those using a conventional learning model. Furthermore, this research provides a reference

and input for educators and prospective educators to improve their learning and consider the learning model used in accordance with the objectives to be achieved.

CONCLUSION

Based on the calculation of the two-tailed t test, it is known that the sig. (2-tailed) value in the posttest is 0.000, which means that the value is smaller than the alpha value (α = 0.05). Then H1 is accepted and H0 is rejected, meaning there is a difference between the control class that uses the lecture learning model and the experimental class that uses the ethnoscience-based creative problem solving learning model. Based on the one-tailed t test, the significance value is 0.00 and the value is smaller than 0.05, so it can be concluded that H0 is rejected and H1 is accepted. Therefore, it can be said that the problem-solving ability of students in the experimental class with the ethnoscience-based creative problem solving learning model is better than the problem-solving ability of students in the control class. The results of the Cohen effect size obtained were 3,040> 1.00, which means there is a strong effect, so it can be concluded that the use of the ethnoscience-based creative problem solving learning model has a strong effect on students' problem-solving abilities. This ethnoscience-based creative problem solving learning model has been proven to provide significant differences between the control class and the experimental class that received learning treatment.

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