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Differences in Students' Conceptual Understanding with the Problem-based Learning Model Through a Scientific Approach at Grade V Elementary School Students

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ABSTRACT

This study presents the impact of the Problem-based Learning model on the conceptual understanding of V-grade students at SD Negeri Karangjati 04 through a scientific approach. The research adopts a quantitative method with a Quasi-Experimental Design (Non-Equivalent Control Group Design). The population comprises all students of SD Negeri Karangjati 04. The sample consists of class VA as the Experimental group and class VB as the Control group. Data collection techniques included tests using pre-tests and post-tests, as well as non-test methods such as observation, questionnaires, documentation, and unstructured interviews. Data analysis involved normality, homogeneity, and independent sample t-tests. The findings indicate that implementing problem-based learning models with a scientific approach can enhance students' conceptual understanding, as demonstrated by the independent sample t-test, which shows a significant value of 0.000 < 0.05 and the simple linear regression test, indicating a significant value of 0.009 < 0.05. Based on these results, it can be concluded that the use of problem-based learning models with a scientific approach can improve students' ability to comprehend concepts.

Keywords*: *problem-based learning, scientific approach, conceptual understanding

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INTRODUCTION

Education is a key pillar in the development of a country because it serves as a way to produce a generation that is intelligent, flexible, and able to face challenges around the world. The formation of a solid understanding of concepts in students is one of the important goals in the learning process. The ability of students to understand concepts is not just memorizing information or techniques; it is their ability to discover, organize, and use their knowledge in new situations Wyk & Osman (in Suparman et al., 2023). However, the reality on the ground shows that students' conceptual understanding is still an important issue. Many learning practices are still centered on one-way information transfer, lack the cognitive activity of students, and result in superficial understanding or prone to misconceptions (Nurmasyithah et al., 2021).

The low understanding of students' concepts as mentioned by Fatmawati & Abidin (in Lestari et al., 2021) indicates that most students are more likely to show the ability to memorize well but have difficulty explaining concepts in their own language or connecting them to various concepts. These problems are often shown by student learning outcomes with questions based on concept understanding that are still very low. The learning approach is more dominated by lectures and the lack of student participation during learning makes it limited opportunities for students to build their understanding actively (Sugiyanto & Widyantini, 2020). Therefore, choosing a model that can encourage students to understand and actively participate in the learning process is essential for teachers.

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Based on observations and preliminary studies conducted during research activities at SD Negeri Karangjati 04 regarding the condition of students' concept comprehension ability, it was found that the existing learning process taking place at SD Negeri Karangjati 04 showed that students' ability to understand concepts was still low. The low ability to understand students' concepts can be seen from the results of the preliminary study conducted by the researcher on students of class V B as a total of 51.87% and is classified as a low criterion because the percentage of question answers according to the concept comprehension indicators owned by students of classes VA and VB SD Negeri Karangjati 04 has average results, Interpreting indicators with an average of 59.68% of the seven indicators of understanding the concept of the indicator interpreting the percentage value of the other indicators. Which means that most of the students of grade V of SDN Karangjati 04 can interpret a problem. Then the classifying indicator reached an average of 57.74%, exemplifying with an average of 50.45%, summarizing with an average of 53.28%, inferring with an average of 45.24%, comparing with an average of 51.12%, and explaning with an average of 45.61%.

From the results of the analysis of the trial above, the indicator concluded and explained that it had a lower average score compared to the average value of other concept understanding indicators. It can be interpreted that most students are still unable to make a conclusion and provide an explanation of a given problem. And from the total average score of the results of the preliminary study of the VA class and the VB class with an average score of 51.87%, it is proven that the ability of class V students of SD Negeri Karangjati 04 is seen from the completion of problems with indicators of understanding the concept of interpreting, classifying, giving examples, summarizing, summarizing and summarizing and comparing and explaining are still relatively low. Due to the low understanding of students' concepts, appropriate efforts are needed to improve concept understanding so that students can understand the material in depth, be able to apply concepts in various contexts, and improve problem-solving skills. In addition, a good understanding of concepts can increase students' ability to think critically and creatively.

From the problems that occurred in grade V of SD Negeri Karangjati 04, the researcher argued that teachers can apply learning models, learning approaches and learning media that are in accordance with the material to be taught so that learning that is carried out effectively and creatively can help foster students' ability to understand concepts. One of the learning models that can involve students actively participating in learning activities so that the ability to understand concepts is the Problem Based Learning model, which is also called the problem-based learning model. According to Barrows & Keelson (in Hallinger, P. 2019) says that the problem-based learning model requires students to think critically, solve problems, learn independently, and participate in teams. Therefore, the author suggests that the problem-based learning model is one of the learning models that can help students solve concept understanding problems.

Researchers want students to have a better understanding, so it is very necessary to have a learning model with the right learning approach and in accordance with the needs of students. One of the models that can be used is the Problem Based Learning learning model with a scientific approach. The Problem Based Learning Model with a scientific approach in this study is a learning model that begins by confronting students with problems that exist in daily life. In line with the statement of Suparman et al., (2023) who also identified that the Problem Based Learning model based on a scientific approach has succeeded in substantially improving students' understanding of mathematical concepts. The scientific approach is intended to provide understanding to students in getting to know, understanding various materials using a scientific approach, that information can come from anywhere, and not only depend on teachers.

According to Arsyad, A. (2018) in his book entitled Learning Media, he argues that everything that can be used to channel messages from sender to receiver so that it can stimulate students' thoughts, feelings, attention, and interests in such a way that the learning process occurs is a definition of teaching aids. He also said that learning media must be able to create effective and efficient communication, as well as involve students' senses to strengthen understanding. Therefore, in the implementation of the Problem Based Learning (PBL) model, the researcher will later apply the use of learning media to help students in receiving the learning materials taught, namely by using media in the form of teaching aids.

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Based on the above problems, to help improve students' ability to understand concepts, they need to apply learning models, approaches in learning and learning media that are varied, innovative and interactive. So, against the background of the existing problems, the author wants to conduct a research experiment with the title "Differences in Students' Concept Understanding with Problem Based Learning Models Through Scientific Approaches in Grade V Elementary School Students."

LITERATURE REVIEW

Problem Based Learning is a learning model designed so that students have the ability to collaborate with friends to discuss solving a problem and will gain knowledge gained through a process of solving their own problems. According to the opinion, Problem Based Learning is a learning model that is based on many problems that require authentic investigation, namely investigations that require real solutions to real problems. In line with that, Hosnan (2014) stated that Problem Based Learning is a learning model that uses a learning approach to an authentic problem, so that students can assemble their own knowledge, develop higher skills, make students more independent and make students confident. Simangunsong et al., (2024)

According to Amir (2016), it is explained that Problem Based Learning has a characteristic where in teaching activities, students seek problem solving through group activities and then students report the results of problem solving. characteristics of Problem Based Learning through the prioritization of independent learning in learning activities. While Barrow & Liu (in Wardani, 2023) state that Problem Based Learning has characteristics, namely:

1) Student-centered learning
2) Authentic problem-oriented learning
3) Information obtained from one's own findings
4) Learning in groups
5) Teachers as facilitators

The learning syntax with the Problem Based Learning model according to Arends (in Fitria et al., 2022) is as follows:

1) Student orientation on the problem
2) Organizing students to learn
3) Guiding individual and group investigations
4) Develop and present works
5) Analyze and evaluate the problem-solving process

According to the opinions of Imas Kurniasih and Berlin Sani (2014: 29), the santific approach is a learning process that is designed in such a way that students actively construct concepts, laws or principles through the stages of observing (to identify or find problems), formulate problems, propose or formulate hypotheses, collect data with various techniques, analyze data, draw conclusions and communicate the concepts, laws or principles found. The scientific approach is a learning approach that in every learning activity involves students in observing, questioning, reasoning, trying, or concluding or communicating the knowledge they have obtained. This scientific approach also trains students in finding a solution to a problem with reasoning and knowledge based on steps in a scientific approach that has been determined scientifically and systematically.

According to Rusman, (2015) said that there are several steps of scientific approach that have been designed to encourage students to deepen students' understanding and skills. Here are the steps of the scientific approach:

1) Observe
2) Ask
3) Gathering information/trying/experimenting
4) Reasoning/associating/processing information
5) Communicate

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In line with that, Safitri, H.B., & Putra, L. V., (2022) stated in the research conducted that applying a scientific approach in the learning process can help improve students' ability to solve problems because scientific approaches can train students in critical thinking and deepen students' understanding skills. In addition, research conducted by Irmalisa, Putra. P., & Nasriadi. A., (2024) said that the application of the Problem Based Learning learning model with a scientific approach can improve students' understanding of concepts.

According to Anderson et al. in (Abdillah & Anggara, 2021) it is stated that understanding concepts is the activity of restating , giving examples, and relating various concepts that have been learned. Therefore, the ability to understand concepts is the ability of students to understand a concept or fact and can answer in their own sentences without changing the meaning of the concept in question. Meanwhile, according to (Apriliyana et al., 2023) understanding concepts is a very important skill in learning, students can improve and develop their abilities by understanding the material given. Anderson & Krathwohl in (Rahayu & Suryani, 2022) also argue that there are 7 indicators on the ability to understand concepts, namely:

1) Interpreting or *interpreting*
2) Exemplifying
3) Classifying
4) *Summarizing*
5) Inferring
6) Comparing
7) Menjelaskan *(explaining)*

The Problem Based Learning *(PBL) learning model* is one of the learning models that relates knowledge to contextual problems in daily life. In the application of this learning model, it is hoped that students can think and understand the concept of solving the problems they face so that they can build knowledge independently or in groups. The scientific approach is a student-centered approach to the scientific method designed to enhance students' activeness and skills in the science process. The application of *the Problem Based Learning* (PBL) model through a scientific approach is expected to increase students' understanding of concepts in solving a problem. The achievement of the planned learning goals is inseparable from the role of teachers, students, the learning media used and the learning environment.

METHOD

The research method that will be used in this study is the experimental Quantitative Method. According to Sugiyono (2016), quantitative research methods are data collection to test hypotheses on certain samples using instruments where the data analysis is statistical. This study uses *a Quasi Experimental Design* with a *Nonequivalent Control Group Design design*.

In this study, the population used was all students of SD Negeri Karangjati 04 in the 2024/2025 school year and the research sample used was the VA class and the VB class of SD Negeri Karangjati 04. In this study, the independent variable is the Problem Based Learning learning model through a scientific approach. Meanwhile, the related variable (dependent) of this study is the understanding of students' concepts. The data collection techniques carried out are test and non-test techniques. The data analysis techniques in this study are validity tests, reliability tests, difficulty level tests, and differentiating power tests. Meanwhile, the prayarat test used is a normality test, a homogeneity test, and a hypothesis test using an independent sample t-test. The results of the research are expected to improve students' understanding of concepts by using the Problem based Learning model through a scientific approach.

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RESULTS AND DISCUSSION

Normality Test

The normality test is carried out to find out whether the data used is normally distributed or not. In this study, the results of the Shapiro-Wilk test were used because the number of research samples was <50 respondents. The basis for decision-making in this statistical test is that if the value of sig. (significance) > 0.05, then the data is distributed normally, but if the value of sig. (significance) < 0.05, then the data is not normally distributed.

Table 1. Normality Test Results

Tests of Normality

Class	Shapiro-Wilk			**Information**
	Statistic	Df	Sig.	
Pretest Experiment	.959	21	.506	Usual
Postest Experiment	.974	21	.811	Normal
Pretest Control	.936	21	.182	Normal
Postest control	.942	21	.239	Normal

Based on the data from the results of the Shapiro-Wilk normality test above, the following conclusions can be drawn:

1. For the experimental class pre-test with a significant value of 0.506 > 0.05, the data can be interpreted as normally distributed.
2. Post-Test of the experimental class with a significant value of 0.811 > 0.05, the data can be interpreted as normally distributed.
3. Pre-Test control class with a significant value of 0.182 > 0.05, the data can be interpreted as normally distributed.
4. Pre-Test control class with a significant value of 0.239 > 0.05, the data can be interpreted as normally distributed.

Homogeneity Test

To find out whether the data used in the research is homogeneous or not, it is necessary to conduct a homogeneity test. According to Permata et al, (2024) argue that the homogeneity test is one of the important basic procedures in conducting statistical analysis, and is a prerequisite for knowing the viarians equations of a research data. The decision-making criteria are carried out by looking at the significance of the calculation results, if the significance value is > 0.05, then the data has a homogeneous variance, on the other hand, if the significance value is < 0.05, it can be concluded that the data is not homogeneous.

Table 2. Homogeneity Test Results

Test of Homogeneity of Variance

		Levene Statistic	f1	df2	Itself.	Information
Post-test scores	Based on Mean	2.832		43	.100	Homogeneous
	Based on Median	2.813		43	.101	
	Based on Median and with adjusted df	2.813		36.853	.102	
	Based on trimmed mean	2.861		43	.098	

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In the table above, the Based on Mean value with a significance value of 0.100 can be seen. Which means that the significance value is 0.100 > 0.05, so it can be concluded that the value of the experimental class posttest and the control class posttest have similarities or homogeneous research data.

Hypothesis Test (Independent Sample T-Test)

The independent sample t-test is used in statistics to test whether or not there is a significant difference in the average post-test results between the experimental class and the control class. The basis for independent sample t-test decision-making is as follows:

1. If the value of Sig. < 0.05 then Ho is rejected and Ha is accepted. This means that there is a significant difference between the experimental class and the control class.
2. If the Sig. value > 0.05 then Ho is accepted and Ha is rejected. This means that there is no significant difference between the experimental class and the control class.

Table 3. Results of Independent Test Sample T-test and Average Post-Test Experimental Class and Control Class

Group Statistics

	Class	N	Mean	Hours of deviation	Std. Error Mean	Sig. (2-tailed)
Value	Postest (Experiment)	21	90.33	3.276	.715	.000
	Postest (Control)	24	78.21	5.047	1.030	.000

The table above is the result of an independent sample t-test from the results of the hypothesis test, it can be seen that the value of sig. The calculation on the experimental class and the dick class each has a value of 0.000 < 0.05 then H0 is rejected and Ha is accepted. In addition, it also shows the average or mean results of the experimental class post-test and the control class post-test, in the experimental class post-test results the average score is 90.33 and the control class is 78.21. From these results, it can be concluded that the average score of the experimental class is greater than the average score of the control class so that there is a difference in the average quality of learning between the experimental class and the control class with a difference of 12.12. So it can be concluded that learning using the problem-based learning model through a scientific approach is able to improve students' concept comprehension skills when compared to learning that only uses the problem-based learning model so that there is a difference in the results of concept comprehension skills between the experimental class and the control class.

Discussion

Based on the results of data analysis, it can be seen that classes that apply the Problem Based Learning learning model through a scientific approach have a higher difference in concept understanding skills compared to classes that only use the Problem Based Learning learning model without using a scientific approach. This is supported by research that PBL can improve students' concept comprehension ability, and the application of PBL is more effective in improving students' concept comprehension skills than ordinary lecture methods. The application of the problem-based learning model with a scientific approach can improve students' understanding of concepts. In addition, research conducted by those who say that student learning outcomes can be better if they use the Problem-based learning model with a scientific approach. Meanwhile, the results of the study argue that the application of a scientific approach can improve students' understanding of concepts compared to classes that apply conventional approaches. This is also in line with the research conducted by that scientific approaches are effectively used to improve students' understanding of concepts.

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(Rizqi & Yulianawati, 2020) (Putra et al., 2024) (Wulandari & Prayito, 2023) (Wulandari & Prayito, 2023) (Harso & Fernandez, 2019)

According to the application, the problem based learning model will be more effective in increasing students' perseverance, responsibility, hard work, cooperation, care, and tolerance. Supporting statements are also from those who state that Problem Based Learning in general, if applied, will have a positive impact on increasing student activity, critical thinking, student understanding and student learning outcomes because Problem Based Learning is stated in accordance with the characteristics in basic education. (Sutika et al., 2023) (Samsudin et al., 2021) So, the ideal learning outcomes of students depend on the learning model that will be used by the teacher (Cahyanti et al, 2024).

Therefore, teachers need to choose learning models and approaches that are appropriate and can involve students in learning process activities. The selection of learning models such as the Problem Based Learning model can be collaborated with a scientific approach so that it can be one of the right choices to improve students' understanding of concepts and create a more active classroom atmosphere.

CONCLUSIONS AND RECOMMENDATION

The results of the study show that the application of the Problem Based Learning model through a scientific approach has a significant difference in students' understanding of concepts. This is evidenced by the results of the Independent Sample T-Test which is shown by a significant difference in values between the experimental class and the control class. It can be seen that the sig. calculated value in the experimental class and the dick class have a value of 0.000 < 0.05 respectively, then H0 is rejected and Ha is accepted. In addition, it also shows the average or mean results of the experimental class post-test and the control class post-test, in the experimental class post-test results the average score is 90.33 and the control class is 78.21. From these results, it can be concluded that the average score of the experimental class is greater than the average score of the control class so that there is a difference in the average quality of learning between the experimental class and the control class with a difference of 12.12.

Students' ability to understand concepts can be seen from their activeness and involvement in the aspects of interpreting, giving examples, classifying, summarizing, summarizing and summarizing them, comparing, and explaining during the learning process. Student involvement during learning can be the key to achieving the expected learning goals because students can be trained in improving their ability to understand concepts. So it can be concluded that learning using the Problem Based Learning model through a scientific approach is able to improve students' concept comprehension skills when compared to learning that only uses the Problem Based Learning model so that there is a difference in the results of concept comprehension skills between the experimental class and the control class.

Based on the results of this study, it is suggested that teachers who want to improve students' understanding can use the Problem Based Learning model through a Scientific Approach so that students can participate and be active in learning activities. For students to always follow the learning process properly and be actively involved during learning activities in order to create effective and efficient learning so that it can increase students' understanding of concepts. For other researchers, it is necessary to prepare more carefully so that the research is carried out optimally and as expected and this research can be used as a reference if you want to use the Problem Based Learning model in the future.

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