Problem-Based Learning Models on Problem-Solving Ability and Science Learning Outcomes of Human and Environmental Concepts in Elementary Schools

Wahyu Hafiz Bumi Saputra
Universitas Muhammadiyah Makassar
Wahyuhafizbs@gmail.com
Khaeruddin
Universitas Negeri Makasar
Khaeruddin@unm.ac.id
Nurlina
Universitas Muhammadiyah Makassar
Nurlina@unismuh.ac.id

Abstrack

This study examines the effect of the Problem-Based Learning (PBL) model on problem-solving skills and science learning outcomes in fifth-grade students in Gugus III Baranti District, Sidrap. The approach used in this research is quantitative with the type of Quasy experimental design. The design used is the non-equivalent control group. The data collection techniques used in this study are as follows: First, pre-test and post-test, and second, observation. The observation sheet is used to obtain data regarding student activities during learning and classroom conditions during the learning process. Third, documentation is intended to get direct data from the research site. Based on the research results and data analysis, the following conclusions were obtained: First, Positive Effect on Problem-Solving Ability: The PBL model positively affects problem-solving skills on the material of the concept of humans and the environment. The significance value obtained is 0.000, more diminutive than 0.05, indicating that the PBL model effectively improves students' problem-solving ability. Second, Positive Effects on Science Learning Outcomes: The PBL Model also positively impacts science learning outcomes on the same material. The significance value obtained was also 0.000, confirming the effectiveness of the PBL model in improving students' understanding of the concept of humans and the environment. Applying the PBL Model effectively enhanced students' problem-solving skills and science learning outcomes. The significance value that is consistently smaller than 0.05 shows the consistency of the research results.

Keyword: Problem-Based Learning (PBL); Problem Solving; Science Learning Outcomes.

Introduction

Education is central to designing competent human resources (HR). In human resource development, education serves as the main means of gaining experience and knowledge through the learning process, which aims to develop students' potential in terms of knowledge, skills, attitudes, personality, and noble character.[1] Natural Science Education (IPA), in particular, emphasizes providing direct experience to develop students' competence in exploring and understanding the surrounding environment scientifically.[2] This process is directed to "find out" and "do," which ultimately helps students better understand the surrounding nature.[3]

Problem-solving ability is one of the most essential skills for students learning science.[4] Problem-solving is the ability of students to use their thinking process to solve problems through the collection of facts, analysis of information, preparation of various alternative solutions, and selection of the most effective solution.[5] However, the results of international studies such as TIMSS (Trends in International Mathematics and Science Study) show that Indonesian students' achievement and mastery of science knowledge is still far behind. In 2011, Indonesia ranked 40th out of 42 participating countries in science for grades IV and VIII. This data indicates an urgent need to improve problem-solving skills in Indonesian science learning.[6]

Some research results, such as those of Safitri and E Setiyawati,[7] show that a practical learning approach in science provides direct experience and involves students in critical thinking processes and problem-solving. Mifta Aulia Ramadhani's research concluded that the PBL model significantly improved science learning outcomes in

[1] Mohammad Arief, "Manajemen Sumber Daya Manusia Dalam Meningkatkan Mutu Pendidikan (Studi Kasus Di SD Insan Amanah Malang)," *Al-Madrasah: Jurnal Pendidikan Madrasah Ibtidaiyah* 6, no. 1 (2021): 1–13.
[2] Sitiatava Rizema Putra, "Desain Belajar Mengajar Kreatif Berbasis Sains" (Yogyakarta: Diva Press, 2013).
[3] Apriza Fıtrıanı et al., "The Effects of Integrated Problem-Based Learning, Predict, Observe, Explain on Problem-Solving Skills and Self-Efficacy," *Eurasian Journal of Educational Research* 20, no. 85 (2020): 45–64.
[4] Yuli Ifana Sari, Dwiyono Hari Utomo, and I Komang Astina, "The Effect of Problem Based Learning on Problem Solving and Scientific Writing Skills.," *International Journal of Instruction* 14, no. 2 (2021): 11–26.
[5] Ian Thomas, "Critical Thinking, Transformative Learning, Sustainable Education, and Problem-Based Learning in Universities," *Journal of Transformative Education* 7, no. 3 (2009): 245–264.
[6] TIMSS, "TIMSS: Trends In International Mathematics And Science Study," *TIMSS & PIRLS International Study Center*, last modified 2021, https://timssandpirls.bc.edu/timss-landing.html.
[7] DNIL Safitri and E Setiyawati, "The Effect of the Problem-Based Learning Model on Student Activeness in Science Learning. Edunesia: Jurnal Ilmiah Pendidikan, 4 (3), 1122–1135," 2023.

elementary schools. Rahma Rizky Sukma's research[8] explains that PBL improves problem-solving skills in human and environmental science concepts. Mukhibatul Ilma's research[9] concludes that a relationship exists between PBL and student literacy.

Some research results above illustrate that the problem-based learning (PBL) model is one of the most effective methods for achieving learning objectives. PBL encourages students to learn through observation of natural phenomena, practical experience, and direct interaction with the surrounding environment. However, there are still gaps in the implementation of PBL in some schools, especially in Indonesia, especially in terms of consistency and effectiveness of implementation, as well as the lack of adequate support from teachers and curriculum, especially for elementary grades.

More targeted efforts are needed to address these gaps and implement the problem-based learning (PBL) model in the science curriculum. This includes more intensive training for teachers, developing relevant teaching materials, and continuous evaluation to ensure the method's effectiveness. By implementing PBL, students are expected to develop better problem-solving skills and ultimately improve their achievement in science studies.

The main objective of this study is to evaluate the Problem-Based Learning Model on Problem Solving Ability and Science Learning Outcomes of Human and Environment Concepts in Elementary School. The specific objectives of this research are to identify factors that support the successful implementation of PBL and measure the improvement of students' problem solving skills after applying this method in science learning.

The research is expected to contribute insights to education development in Indonesia. By identifying and overcoming obstacles in the implementation of PBL, this study's results are expected to significantly contribute to improving the quality of science education in Indonesia. In addition, this research also aims to provide practical recommendations for educators and policymakers to improve teaching methods and increase students' academic achievement in science.

[8] Rahma Rizky Sukma, Dina Prasetyowati, and Mei Fita Asri Untari, "IMPLEMENTASI MODEL PROBLEM BASED LEARNING UNTUK MENINGKATKAN HASIL BELAJAR IPAS KELAS IV," *Didaktik: Jurnal Ilmiah PGSD STKIP Subang* 9, no. 2 (2023): 4166–4177.

[9] Mukhibatul Ilma and Fitria Eka Wulandari, "Problem Based Learning (PBL) Model on Students' Environmental Literacy Ability in Elementary School Natural Science Lessons," *Indonesian Journal of Education Methods Development* 21, no. 2 (2023): 10–21070.

Research methods

A quantitative approach in this study aims to determine the effect of problem-based learning models on science literacy skills, activities, and student science learning outcomes. The type of research used in this research is an experimental design, and the design used is the non-equivalent control group.[10] The quasi-experimental design provides two treatments in two research groups. This study consisted of two groups: the first group received the Problem-Based Learning model, called the experimental class, and the second group used the conventional learning model, called the control class. These two classes were not randomly selected. Data collection techniques. First. In the pilot test, the experimental class was given learning using the problem-based learning model, and the control class was given treatment using conventional learning.

The data collection techniques used in this study are pre-test and post-test. Tests were used to collect data on problem-solving skills and science learning outcomes. The type of test used was a written test in the form of a description. The instrument's validity was tested through content validity involving experts in education and science to ensure that the test covers all aspects to be measured. Instrument reliability was tested using internal reliability tests, such as Cronbach's Alpha coefficient, to ensure consistency of measurement results.

Second, observation in this study was intended to obtain data on students' learning process and classroom conditions during the learning process regarding active participation and attention to learning by using a problem-based model. Researchers used validated observation sheets to record student activities and classroom conditions. The observation sheet includes specific indicators such as frequency of asking questions, discussion involvement, and attention to the material presented. Observations were conducted by researchers and research assistants trained to ensure consistency and objectivity of measurement.

Third, documentation includes data relevant to the research, including books used during learning, school regulations, reports on learning activities, and other data supporting research results analysis. This documentation was used to enrich the data obtained from tests and observations and to ensure the validity of the data collected.

[10] Julie Quick and Susan Hall, "Part Three: The Quantitative Approach," *Journal of perioperative Practice* 25, no. 10 (2015): 192–196.

Application of Problem-Based Learning Model on Human and Environmental Concept Material for Class V Students of Gugus III Kec. Baranti

Learning with a problem-based learning model involves students actively understanding the concepts and principles of a material because the characteristics of this learning propose problems for students. With this problem, students can be trained to continue solving problems that arise in their immediate environment. The recapitulation table of the percentage of learning model implementation by students is shown in the following table:

Table 1.1
Implementation of Learning Model Teacher Activity

No	Meetings	Teacher's Activity		
		Problem-Based Learning		
		Rate	Percentage	Categories
1	Meetings 1	42	52%	Medium
2	Meetings 2	52	65%	Good
3	Meetings 3	55	68%	Good
4	Meetings 4	59	75%	Good
5	Meetings 5	66	82%	Good

Based on the table above, it can be seen that the implementation of the problem-based learning model by the teacher reached a percentage of 52% for the first meeting and increased in the second meeting, which was a percentage of 65% and the third meeting increased with a percentage of 68%, the fourth meeting increased with a percentage value of 75% and the fifth meeting increased with a percentage value of 82%. Implementing the problem-based learning model was an excellent predicate from the five meetings. This means that the problem-based learning model's learning process went well and followed the stages that must be carried out.

The calculation is also supported by the results of empirical observations made at each meeting. In classes that use the problem-based learning model, students do not

receive all the information the teacher provides but actively seek information about the material they learn. This is supported by Archana Mantri, who stated that the increase in problem-solving ability and cognitive learning outcomes of students through learning with problem-based learning models is also suspected because the problem-based learning model is principled that students not only acquire knowledge but also know how to apply knowledge in real situations.[11]

The problem-based learning model can improve problem-solving skills and learning outcomes because problem-based learning is a learning model directed at real-life problems that require students to be able to solve existing problems.[12] Students are expected to use their thinking skills. Authentic problem-solving is the goal of problem-based learning. Students are expected to find solutions to the problems they face.

In this study, the material about the problem of the concept of humans and the environment presented in LKK, which contains problems related to the problem of the concept of humans and the environment in everyday life and is sourced from news from the mass media, is chosen so that the problems used are genuinely authentic or commonly seen or experienced by students in everyday life.

In this learning process, students are more active in finding their information with their group friends from books, the internet, or based on their own experiences. At the same time, the teacher acts as a facilitator or guide for students.[13] In solving the problem, students exchange ideas with their groupmates to share ideas on how to solve specific problems, thus strengthening students' problem-solving skills and intuition. This is supported by Sudarman, who states that the problem-based learning model is a learning model that uses real-world problems as a context for students to learn critical thinking and problem-solving skills, as well as acquire knowledge and concepts from educational materials.[14]

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[11] Archana Mantri et al., "Designing Problems for Problem-Based Learning Courses in Analogue Electronics: Cognitive and Pedagogical Issues," *Australasian Journal of Engineering Education* 14, no. 2 (2008): 33–42.
[12] Reny Murni Hidayati and Wagiran Wagiran, "Implementation of Problem-Based Learning to Improve Problem-Solving Skills in Vocational High School," *Jurnal Pendidikan Vokasi* 10, no. 2 (2020): 177–187.
[13] Anna Jarrotul Khoiriyah and Husamah Husamah, "Problem-Based Learning: Creative Thinking Skills, Problem-Solving Skills, and Learning Outcome of Seventh Grade Students," *JPBI (Jurnal Pendidikan Biologi Indonesia)* 4, no. 2 (2018): 151–160.
[14] S Sudarman, "Problem Based Learning: Suatu Model Pembelajaran Untuk Mengembangkan Dan Meningkatkan Kemampuan Memecahkan Masalah.[Problem Based Learning: A Learning Model for Developing and Improving Problem Solving Skills]," *Jurnal Pendidikan Inovatif* 2, no. 2 (2007): 68–73.

This study shows that the implementation of the problem-based learning model by the teacher reached a percentage of 52% for the first meeting and increased at the second meeting to a percentage of 65% and the third meeting increased with a percentage of 68%, the fourth meeting increased with a percentage value of 75% and the fifth meeting increased with a percentage value of 82%.

Implementing the problem-based learning model was an excellent predicate from the five meetings. Meanwhile, the implementation of the learning model of the problem-based learning model by students reached a percentage of 41% for the first meeting and experienced an increase in the second meeting, namely a percentage of 49%. The third meeting increased by 56%, the fourth meeting increased by 73%, and the fifth meeting increased by 82%. Implementing the problem-based learning model was an excellent predicate from the five meetings. This means that the problem-based learning model's learning process went well and followed the stages that must be carried out.

All steps of the problem-based learning model show that the roles of teachers and students are clear enough to allow students to actively participate in learning actively actively, allowing problem-solving skills and learning outcomes to develop. This aligns with Rusman's opinion that the problem-based learning model can better facilitate problem-solving, communication, teamwork, and interpersonal skills.[15] Likewise, Marde Christian's findings show that trying to find solutions to problems and the accompanying knowledge produces significant knowledge. Looking for solutions to problems independently will provide concrete experience, and this experience can be used to solve similar problems because the experience provides meaning for students.[16]

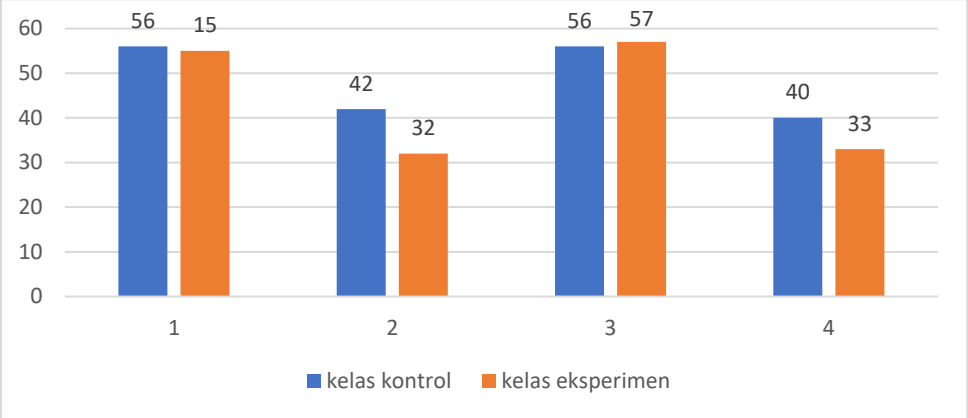
Analysis of pre-test and post-test results in experimental and control classes for humans and the environment.

Data on the results of the pre-test and post-test conducted in the Experiment class can be seen in the table below:

Table 1.2 Descriptive Statistics of Pre-test and Post-Test Data Results
Problem Solving Ability of Experimental Class and Control Class

[15] Rusman, *Model-Model Pembelajaran: Mengembangkan Profesionalisme Guru* (Rajawali Pers/PT Raja Grafindo Persada, 2011).
[16] Marde Christian Stenly Mawikere, "Model-Model Pembelajaran," *EDULEAD: Journal of Christian Education and Leadership* 3, no. 1 (2022): 133–139.

Statistics	Control		Experiment	
	Pre Test	Post Test	Pre Test	Post Test
Sample Size	21	21	19	19
Maximum Score	72	80	75	92
Minimum Score	65	75	65	87
Standard Deviation	3.151	2.082	3.727	2.262
Average	69.14	76.67	70.00	90.68



Comparison Chart of Pre-test Scores for Each Criterion of Problem Solving Ability

Based on the results of the analysis show that the descriptive statistics of the pre-test and post-test student problem-solving ability scores on the material of the concept of humans and the environment obtained results, namely in the experimental class, the average value of 70.00 from the students' solving ability before the application of the Problem-Based Learning (PBL) learning model, namely with the lowest value of 65 and the highest value of 75, after being treated using the Problem-Based Learning learning model obtained an average value of 90.68 students' problem-solving ability, namely with the lowest value of 87 and the highest value of 92. In the control class, the average value in the pre-test was 69.14, and in the control class, the post-test value was 76.67.

The independent sample t-test test results show that the degree of freedom (df) is 38 with a sig value obtained. (2-tailed) is 0.000, sig value. 0,000 < 0,05. It can also be

seen from the acquisition of the account value of 20.411> table value of 1.2913. So, it can be stated that Ha is accepted, and H0 is rejected. Based on the hypothesis criteria from the independent sample t-test, it can be concluded that there is a difference in problem-solving ability between the experimental class and the control class after using the problem-based learning model.

Thus, it can be concluded that the problem-based learning model affects the problem-solving ability of the concept of humans and the environment of grade V students in Gugus III Kec. Baranti.

The Effect of Problem-Based Learning Model on Science Learning Outcomes of Grade V Students in Gugus III Kec. Baranti

After analyzing descriptive statistics on the experimental class taught using the Problem-Based Learning learning model and the control class taught without using the Problem-Based Learning learning model, it can be seen the difference in the student-solving ability of the experimental class and control class in the following table:

Gain Score Distribution

N-Gain Value	Category
g>0,7	High
0,3≤g≤0,7	Medium
g<0,3	Low

Table of Ngain of Problem Solving Ability

	Ngain	
	Experimental class	Control class
Mean	0, 6917	0, 2380
Category	Medium	Category

Based on the results of the analysis, it shows that the descriptive statistics of the pre-test and post-test science learning outcomes scores on the material of the concept of humans and the environment obtained results, namely in the experimental class, the average value of 72.48 of science learning outcomes before the application of the Problem-Based Learning (PBL) learning model, namely with the lowest value of 62 and the highest value of 80, after being treated using the Problem-Based Learning learning

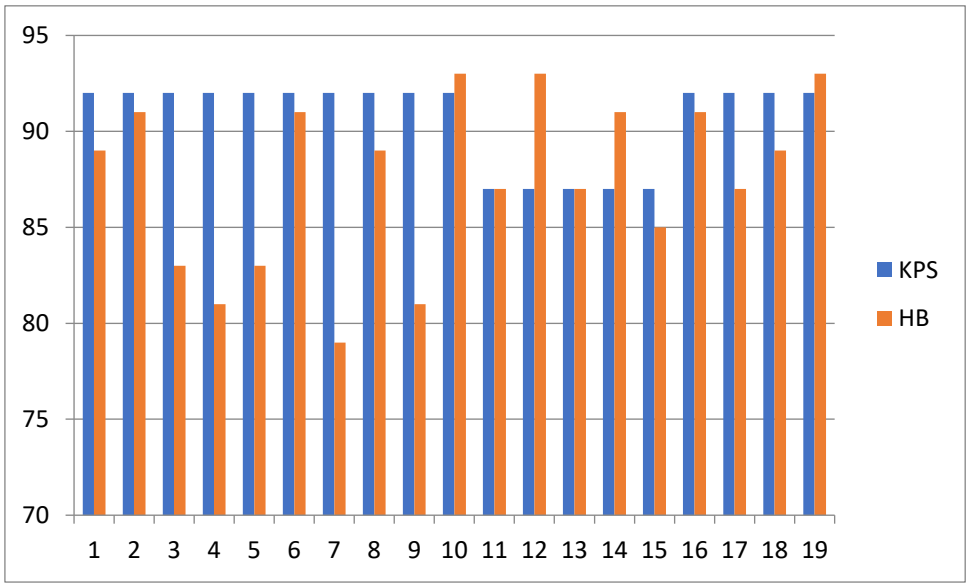
model obtained an average value of 87.29 science learning outcomes, namely with the lowest value of 79 and the highest value of 93. In the control class, the average value in the pre-test is 69.38, and the control class's post-test value is 70.95.

The independent sample t-test test results show that the degree of freedom (df) is 38 with a sig value obtained. (2-tailed) is 0.000, sig value. 0,000 < 0,05. It can also be seen from the acquisition of the count value of 12.323> table value of 1.2913. So, it can be stated that Ha is accepted, and H0 is rejected. Based on the hypothesis criteria from the independent sample t-test, it can be concluded that there are differences in science learning outcomes between experimental and control classes after using the problem-based learning model.

Thus, it can be concluded that the problem-based learning model affects the science learning outcomes of the concept of humans and the environment of grade V students in Gugus III Kec. Baranti.

The relationship between problem-solving ability and science learning outcomes of human and environmental concepts of grade V students in Gugus III Kec. Baranti.

Based on the analysis results, the relationship between problem-solving ability and the science learning outcomes of the concepts of humans and the environment of grade V students in Gugus III Kec can also be seen. Baranti can be seen in the following graph:



Relationship graph of problem-solving ability and learning outcomes

Based on the results of research and previous research, problem-solving skills and student learning outcomes increase because, in problem-based learning, students learn directly through the problems found and try to find the steps to solve the problem to get the solution.

Conclusion

Based on the results of the research and data analysis that has been carried out, it can be concluded that first, the Problem-Based Learning (PBL) model has a positive effect on problem-solving skills in the concept material of humans and the environment of grade V students in Gugus III Kec. Baranti, Sidrap. This is indicated by the significance value of 0.000, which is smaller than 0.05. Second, the Problem-based Learning (PBL) model also positively affects science learning outcomes regarding the material of human and environmental concepts of grade V students in Gugus III Kec. Baranti, Sidrap. This can be seen from the significance value of 0.000, which is smaller than 0.05. Third, overall, the Problem-based Learning (PBL) model positively affects problem-solving ability and science learning outcomes on the material of human and environmental concepts of grade V students in Gugus III Kec. Baranti, Sidrap. This is evidenced by the consistent significance value of 0.000, which is smaller than 0.05. Thus, applying the Problem-based Learning (PBL) model has been proven effective in improving students' problem-solving skills and science learning outcomes regarding human and environmental concepts.

This study provides an overview of the effect of the problem-based learning model on students' problem-solving ability and learning outcomes. However, some limitations need to be considered in interpreting the results of this study: First, this study involved 19 students in the experimental class and 21 students in the control class. The small sample size may limit the ability to generalize the findings of this study. Future studies should use larger samples for more representative results; secondly, the study was conducted in Gugus III, Baranti sub-district. The specific school context, culture, and learning environment may have influenced the results. Similar research in different locations is needed to understand whether the findings are generally applicable; thirdly, other variables can influence learning outcomes, such as student motivation, learning styles, and parental support. Future research should consider these factors to provide a more comprehensive picture of the effectiveness of the problem-based learning model.

Considering these limitations, this study can be a basis for further research and development of school learning practices—especially those related to problem-based learning models on problem-solving skills.

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