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Article

Implementation of PBL Model to Train Problem-Solving Skills of Kuala Lumpur Indonesian Schools' Students

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ABSTRACT

This research aims to determine students' problem-solving skills using the problem-based learning model assisted by Wordwall. This research was a quasi-experimental research posttest-only design. Samples were taken using saturated sampling techniques. The data collection method used a problem-solving skills test (posttest) and student response questionnaires. The results of the hypothesis test obtained a significance of 0.766 > 0.05, which means H_0 was accepted. Based on the research results, it can be concluded that there is a difference in the problem-solving skills of students using the problem-based learning model compared to the conventional model using discovery learning, as seen from the average problem-solving aspects, although the differences are not significant. The students' response toward PBL assisted by Wordwall was positive. This research can be useful for developing a body of knowledge and a basis for other researchers' research, especially regarding the use of problem-based learning models assisted by wordwall game media to improve students' problem-solving abilities. Apart from that, research also provides new experiences for students in solving problem-based questions.

INTRODUCTION

In the last decade, there have been fundamental changes in the realm of education, accompanied by the integration of technology in the learning process. This transformation creates new grounds for exploration and innovation in teaching methods. This research aims to deepen understanding of the implementation of the problem-based learning (PBL) model, an approach that has been proven effective in encouraging students to be actively involved in solving real problems related to the curriculum. The focus is on the application of the PBL model supported by Wordwall media in training problem-solving skills for Indonesian School Kuala Lumpur (SIKL) students. Improving problem-solving skills is very important because it contributes to developing students' abilities to deal with problems (Agustriyani et al., 2023; Fitriani & Fadly, 2022; Wahyu Ariyani & Prasetyo, 2021).

According to Sudirman (A Usman, Asyhari; Fitria, Endang, 2021; Putri & Wahyudi, 2020; Sumiantari et al., 2019), the way to present lesson material in problem-solving is to make the problem a starting point for discussion to be analyzed and synthesized in finding solutions to problems or answers by students. Therefore, learning must involve students actively in the process of observation and experimentation, not just listening to the teacher's explanation. Following the Indonesian Curriculum, the teacher's role is as a facilitator and not as a learning resource, and the student's role is to solve scientific problems and not just receive knowledge (Lase & Lase, 2020; Nurlizawati, 2019; Rahmi & Angraina, n.d.). In this way, education can be a forum for students to provide broad insight and knowledge to solve everyday life problems. In its implementation, teachers can apply appropriate learning models in line with the stages of problem-solving according to Polya, one of which is the Problem-Based Learning (PBL) model (Muliadi & Mislaini, 2023; Polya, 1973; Sulastri & Pertiwi, 2020).

PBL is a problem-solving-based learning model that is student-centered. This problem-based learning model will introduce students to a problem or situation that must be solved using the knowledge and skills they have (Muhammad et al., 2021). Through this PBL model, students can be active and enthusiastic in practicing their ability to solve problems found in their surroundings, so in its application, this PBL model also provides changes in the learning process where teacher-centered learning becomes student-centered learning (Rahayu & Ismawati, 2019).

Problem-based learning is known as a learning strategy that empowers students to face real challenges, which can ultimately strengthen their conceptual understanding and critical skills (Anugraheni, 2019; Suharyat et al., 2022; Zuhri, 2023). Changes in the learning process require teachers to continue to be creative so that learning is centered on students. Teachers need to design learning that is interesting and fun so that students are encouraged to actively play a role in the learning process. Technological advances can be utilized in the learning process, where technological advances can be used as an alternative for teachers in delivering material using ICT-based learning media (Octaviana et al., 2023; Ramdhan & Ramliyana, 2023). One of the multimedia learning tools that can be used is Wordwall. Wordwall is a web-based interactive learning platform that allows teachers to create engaging learning activities such as quizzes, puzzles, and interactive games with a variety of customizable templates, such as puzzles and tests, that support intelligent and engaging teaching for students (Nenohai et al., 2022; Octaviana et al., 2023; Pinta et al., 2024). In research conducted by Marissa, utilizing the Wordwall educational game media is better with a completeness rate of 90% than before the implementation of learning with a completeness level of 73.33% and Another study by Ardista concluded that wordwall media and the application of the problem-based learning (PBL) learning model could improve student learning outcomes (Kartika et al., 2023; Octaviana et al., 2023).

Problem-based learning is known as a learning strategy that empowers students to face real challenges, which can ultimately strengthen their conceptual understanding and critical skills. By utilizing the advantages of Wordwall media as an interactive tool, this research aims to enrich students' learning experiences and facilitate collaboration between them. Based on the results of interviews with class VII science teachers at the Kuala Lumpur Indonesian Middle School, students' problem-solving abilities have never been measured or trained. In one of the previous studies by Yudi Cahyo, it was stated that the discovery learning model was more effective than the problem-based learning model in terms of learning outcomes(Oktaviani et al., 2018; winoto & Prasetyo, 2020). This research complements previous research to prove that the problem-based learning model is comparable to or better

than discovery learning, especially in the context of Indonesian education abroad, in terms of students' problem-solving abilities.

METHODS

This research is a quasi-experiment with a posttest-only Nonequivalent Groups design. The research was carried out at the Kuala Lumpur Indonesian School. The population in this study was all students in class VII of the Kuala Lumpur Indonesian School Middle School, which consisted of 2 classes with a total of 43 students. The sample was taken using a saturated sampling technique. The design can be seen in Figure 1.

Experiment	X	O_1
Control	Y	O_2

Figure 1. Research Design

Explanation :

X : treatment with the PBL learning model
Y : treatment with a conventional learning model
O_1 : experimental class posttest
O_2 : control class posttest

The data collection method uses a problem-solving skills test (posttest) and a student response questionnaire after being given treatment. The problem-solving skills test is in the form of a reasoned multiple-choice question consisting of four questions. Posttests and student questionnaires are important instruments for measuring students' problem-solving abilities, which have been validated by experts. This validation ensures that the questions and statements in the questionnaire reflect real situations and measure essential critical abilities, so that the test results can be relied on in academic and professional contexts. Indicators of problem-solving skills, according to Polya (Reski et al., 2019), are as follows :

Table 1. Indicators of Problem-Solving Ability According to Polya

Problem-Solving Ability Indicators	Aspects
Understand the problem	• Identify known information • Identify what is being asked
Plan a Solution	• Determine the strategy or plan that will be used
Carry out the plan	• Implement the strategy or plan used
Review	• Recheck the answer

Posttests in the experimental and control classes were analyzed using descriptive statistics and inferential statistics. Descriptive statistical analysis is used to describe the average post-test score, while inferential statistical analysis is used to test hypotheses using the SPSS 22. Descriptive analysis by looking at the average problem-solving skills of students categorized based on Arikunto's modification in the following Table 2 (Dirmansyah & Febriyandi, 2023) :

Table 2. Criteria for Problem-Solving Skills

Score	Category
0-30	Unable
31-60	Capable
61-100	Very Capable

The inferential statistical analysis for hypothesis testing of post-test data uses parametric statistics. Before carrying out the parametric test, a prerequisite test is carried out where the data must be normally distributed and homogeneous. Parametric statistics use the t-test with an independent sample t-test to compare the average of the experimental class after being treated with the PBL model and the control class after conventional learning. The following are the steps carried out by researchers in this research :

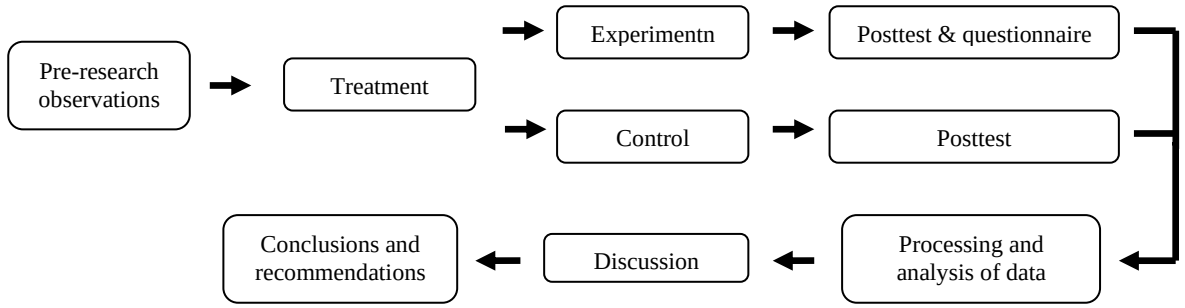

Figure 2. Steps of Research

The first step taken in designing the problem-based learning (PBL) model is to explain contextual problems that are relevant to the material. The material used by researchers is Physical and Chemical Changes in Natural Science Subjects in Class VII Junior High School. The issue of the cleanliness of the school and home environment is a topic that is raised in the first stage of PBL. Students are asked to analyze the problems explained by the teacher and hold discussions to find solutions. The teacher guides the investigation, which leads to making briquettes from dried leaves as one of the solutions that is investigated and developed to present the results. In the final step, the teacher evaluates learning and strengthens it with related learning theories.

RESULTS AND DISCUSSION

The data obtained from this research is quantitative in the form of posttest scores on problem-solving abilities and student response questionnaire results. Description of posttest score data for students in different experimental and control classes. The average score of the experiment class is higher than the control one. In this research, the results obtained were the average score of students' problem-solving skills based on aspects of the problem-solving indicators as follows:

Table 3. Average Score of Problem-Solving Skills in Each Indicator

Aspects in Problem-Solving Ability Indicators	PBL		Conventional	
	Average	Criteria	Average	Criteria
Identify known information	68	Very Capable	68	Very Capable
Identify what is being asked	48	Capable	52	Capable
Determine the strategy or plan that will be used	72	Very Capable	58	Capable
Implement the strategy or plan used	72	Very Capable	72	Very Capable
Recheck the answer	50	Capable	42	Capable
Average	**61,6**	**Very Capable**	**58,4**	**Capable**

Based on the description of the posttest results, the average posttest score for students in the experimental class was 61.6, while in the control class the average score was 58.4. This shows that the experimental class has a higher average posttest score for problem-solving skills than the control one. The difference in the average posttest score for problem-solving skills in the experiment and control classes can be seen in Table 3. The results of this research are consistent with several studies that have been conducted by previous researchers, namely Bettri (Yustinaningrum et al., 2022) and Ricardus (Jundu et al., 2018). The results of the research show that the problem-solving skills of students taught using the PBL model are better than those of students taught using the conventional model.

The conventional learning model in this research uses the discovery learning model, as this learning model is usually used by teachers in everyday learning. In both PBL and conventional models, the average student is poor in the aspect of identifying what is being asked and the aspect of checking back on the answers written. This can be seen in Table 4,

where the average score of students in these two aspects falls into the "capable" criteria based on Table 3, namely the criteria for problem-solving ability. As for the PBL model, students obtain into the "very capable" category in the aspects of identifying what is known, determining plans, and implementing plans. In contrast to the conventional model in the control class, the aspect of "determining a plan" by students is still within the "capable" criteria. Overall, the average problem-solving ability of students in the experimental class with the PBL model was in the "very capable" criteria, while in the control class with the discovery learning model, it was in the "capable" criteria. The difference in problem-solving ability criteria between the experiment and control classes is caused by the different treatments given; this is in line with previous research by (Febrianti et al., 2019; Pristianti & Prahani, 2023). The results of the data and analysis are also in line with previous research, which states that the PBL model assisted by game media can improve students' problem-solving abilities (Ismail et al., 2023; Nirwana et al., 2024; Zuhri, 2023). Arrauanlebok and Widyowati's research shows that choosing the right model and using fun learning media is the problem-based learning model. combined with interactive media, has a positive effect on student activity and learning outcomes (Arruanlebok et al., 2023; Putri Widyowati et al., 2023).

Prerequisite tests in the form of normality and homogeneity tests are carried out before hypothesis testing (T-test). The normality test is used to determine whether the data for each group is normally distributed or not. The following Table 4 are the results of the normality test in the experiment and control classes :

Table 4. Normality Test Results

Class	Kolmogorov-Smirnov		
	Statistic	**df.**	**Sig.**
Experimental Posttest	.162	18	.200
Control Posttest	.166	25	.074

Based on Table 4, the significance value in the experimental and control classes is more than 0.05, which means the data for both classes is normally distributed. The results of the data homogeneity test are as follows :

Table 5. Homogeneity Test Results

	Levene Statistic	**df1**	**df2**	**Sig.**
Based on Mean	.090	1	41	.766

The results of the homogeneity test based on Table 5 show that the data is homogeneously distributed. This is because the significance of the p-value is 0.766, which means it is greater than 0.05, so the data is homogeneous. After testing the prerequisites and declaring the data to be normally distributed and homogeneous, hypothesis testing can then be carried out.

Hypothesis testing is used to see the differences between classes with a problem-based learning model and classes with a conventional learning model in students' problem-solving skills. The t-test used is the independent sample t-test. The results of the independent sample t-test are as follows:

Table 6. Independent Sample T-test

		T-test for quality of mean's		
		T	**df**	**sig. (2-tailed)**
Posttest Score	Equal variances assumed	.188	41	.852

The results of hypothesis testing in Table 6 show that the p-value is 0.852, so H_0 is accepted. So the problem-solving skills of students in classes that use PBL learning models are not significantly different from those of students who take conventional learning. The absence of significant differences in problem-solving abilities in the experimental and control

classes on students' problem-solving abilities is contrary to the research results of Delima (Manik & Sinuraya, 2019) and Bettri (Yustinaningrum et al., 2022), which concluded that the application of the PBL model in the classroom improves problem-solving skills better than control classes with conventional learning.

Based on the results of the description and data analysis above, it can be seen that there are differences in the problem-solving skills of students taught using the PBL model and the discovery learning model as a conventional learning model. This can be seen from the values in each aspect of the problem-solving indicators in both classes, which show that the average value of the class with the PBL model is generally higher than the class with the discovery learning model. The non-significant difference between the experimental and control classes could occur because both classes were treated with a learning model that both aimed to train students' problem-solving skills. So that both the experiment and the control class experienced an increase in problem-solving skills. This is in line with the study of Sani (Chodijah et al., 2019) that learning with the PBL model and discovery learning do not have the same steps, but both have the same learning process, namely by focusing more on learning for students to work together to solve problems. In other research, it is also stated that problem-based learning and discovery learning models both have good effectiveness in improving problem-solving and critical thinking skills (Aprilianingrum & Wardani, 2021; Hanifah & Indarini, 2021; Septiyowati & Prasetyo, 2021).

The results of the questionnaire data analysis of student responses to PBL learning assisted by the Wordwall game in the experimental class are as follows :

Table 7. Student Response Questionnaire

Response Questionnaire Criteria	Frequency			
	Strongly Disagree	**Don't Agree**	**Agree**	**Strongly Agree**
Skills	1	2	10	5
Liveliness	1	3	10	4
Excitement	2	2	8	6
Percentage	**7,4%**	**12,9%**	**51,9%**	**27,8%**

Most of the students' responses from the experimental class showed positive responses, where more than half tended to agree that the Wordwall game media in learning using the PBL model made students more skilled and active, and learning was enjoyable. This can be seen in Table 7, where >70% of 18 students agree that the PBL learning model assisted by The wordwall game is an interactive media platform that is relevant to dual coding theory. The wordwall game platform offers various types of educational games, such as quizzes, matching, pairing, anagrams, random words, word searches, and grouping which words with this media can be used, which helps students understand lesson material more effectively (Alam et al., 2023). Apart from that, students also agreed that the learning that took place was not boring and felt fun. This is an alternative to increasing student participation in learning because, with the Wordwall game media, students are challenged to answer quickly and compete with their friends. Students can also see who is in the top 10 positions at the end of the question-taking session in the Wordwall game. So that it makes students even more enthusiastic about getting the top position. Based on analysis using a Likert scale, the overall student response shows that the qualifications are acceptable. These results are in line with the results of previous research, where the application of the Problem-Based Learning (PBL) learning model assisted by wordwall game media can help students be more active and skilled and help students solve problems, thereby improving their learning outcomes (Frada et al., 2024; Nadia et al., 2022; Octaviana et al., 2023).

The existence of this research can enrich the learning experience of students, where the Wordwall game as a learning medium can change students' passive participation into active and independent ones and allow them to seek information from various sources because the

teacher acts as a guide, not as the only source of knowledge and information. Apart from that, this research also enriches the learning experience of students in working on test questions with problem-solving indicators, which they have never done before. So, this research can be a new experience for students and can measure their problem-solving skills. Edgar Dale's cone theory of experience (Sari, 2019) describes that 'the further down students go, the greater the level of experience gained, the greater the level of understanding and mastery of knowledge. One of the indicators of problem-solving also requires students to be able to write down what is known and what is asked. This is an important factor in David Paul Ausubel's learning theory, which is related to meaningful learning. As Dahar argues, meaningful learning is a process of linking new information to relevant concepts contained in a person's cognitive structure (Trianto in Basyir et al., 2022).

CONCLUSION

Based on this research, it can be concluded that the application of the PBL model assisted by Wordwall game media can help to train the problem-solving skills of class VII students at the Kuala Lumpur Indonesian Middle School. This can be shown by the average score of the students' problem-solving ability test with a score of 61.6, which is included in the Very Capable criteria. Apart from that, this research also provides meaningful learning experiences for students. The results of the student response questionnaire showed a positive response, where more than 75% of students agreed that the PBL model assisted by Wordwall game media could help students be more active and skilled and support fun and challenging learning so that students do not feel bored. The PBL learning model, assisted by word wall game media, can be an alternative for teachers to carry out active and fun learning as well as train problem-solving skills. In future research, especially in learning using the PBL model, it must consider its suitability to the learning material and its context in students' lives. So, students will be more interested when the learning is close to them and useful for their lives. Apart from that, researchers can create pretest and posttest questions with descriptive questions to see students' problem-solving abilities, and it is not recommended to use multiple-choice questions.

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