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Integrating Educational Games in Problem-Based Learning to Enhance Conceptual Understanding in Mathematics: A Study of Grade VII Students at MTsN 1 Pekanbaru

Sahra Devi[1], Indah Widiati[2]
[1,2]Mathematics Education, Faculty of Education and Teacher Training, Universitas Islam Negeri Riau, Riau, Indonesia
sahradev16@gmail.com[1] indahwidiatimtk@edu.uir.ac.id[2]

ABSTRACT

This study aims to describe the application of educational games using the Problem Based Learning (PBL) model in mathematics learning to improve the understanding of mathematical concepts of grade VII students of MTsN 1 Pekanbaru. The background of this study is the low understanding of mathematical concepts of students as shown through daily test results data in grade VII.5, where only 48.65% of students achieved the Minimum Completion Criteria (KKM) of 87. This study is a Classroom Action Research (CAR) conducted in two cycles with each consisting of planning, implementation, observation, and reflection stages. The research instruments include teacher and student observation sheets and mathematical concept understanding tests. The PBL model is combined with educational game media in the form of traditional games such as snakes and ladders and setatak. The results of the study showed a significant increase in students' understanding of mathematical concepts. In cycle I, the percentage of student understanding was in the "good" category with an average value of 79.05%, while in cycle II it increased to 89.05% and entered the "very good" category. Thus, the application of educational games based on the PBL model is effective in improving students' understanding of mathematical concepts.

Keywords: Educational Games, Problem Based Learning, Mathematical Concept Understanding, Mathematics, CAR

Corresponding Author:
Sahra Devi[1], Indah Widiati[2,]
Mathematics Education,
Islamic University of Riau,
Jl. Kaharuddin Nasution No.113, Pekanbaru, Riau 2824, Indonesia.
sahradev16@gmail.com[1]indahwidiatikmtk@edu.uir.ac.id[2]

1. INTRODUCTION

As knowledge basic mathematics hold role important in support understanding to field other sciences (Nurmalia et al., 2019: 70) . Science mathematics own mark high usability in help finish various problem in life real (Yolanda & Wahyuni, 2020: 2) . Mathematics emerged from the fruit from the thinking process humans related to ideas, processes, and reasoning abilities (Kusumawardani et al., 2018: 588) . One of the target main from mathematics learning , as listed in Attachment to Minister of Education and Culture Decree Number 58 of 2014 , that is For equip students with ability in understand concepts mathematical in a way In-depth . This includes competence in explaining the relationships between concepts and applying them appropriately to solve problems (Wahyuni & Sholichah, 2022: 66) . Understanding concepts is the main foundation for thinking to solve a problem. (Love et al. , 2019) . From the description above can withdrawn conclusion that mathematics considered as product from exercise think man which focuses on ideas, processes, and reasoning skills.

In mathematics learning, understanding concepts is the main goal to equip students with the ability to explain the relationships between concepts and apply them effectively. in finish problem . Understanding this concept is also an important basis for thinking about solving various mathematical problems. Hadi & Umi Kasum, (2015: 60) states that understanding mathematical concepts is the main basis for thinking in solving various problems, both in mathematics and everyday life. This means that the ability to understand mathematical concepts not only helps solve problems or questions in mathematics lessons, but can also be applied in everyday situations, such as decision-making, time management, or financial calculations.

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Mastering a concept plays a crucial role in helping students analyze problems more deeply and find appropriate solutions. By understanding concepts well, students will be better prepared to learn subsequent material that requires higher-order thinking skills (Ntjalama et al., 2020). However, in practice, one of the main obstacles to mathematics learning is students' poor understanding and application of mathematical concepts.

According to information obtained researchers through interview with Mathematics subject teacher for class VII $_5$ MTsN 1 Pekanbaru on December 23, 2024, information obtained is as following:

1. Standard Criteria Minimum Completion (KKM) which has set by the school for grade 7 is 87.
2. Learning methods that are often used by teachers in class are *Discovery Learning*, *Project Based Learning*, and usually use the help of learning videos too.
3. Student No too focus on lessons taught by teachers, and a number of from they seen evaporate or chatting with Friend classmates moment learning ongoing
4. Students are embarrassed to ask questions because they're confused about what they really want to know. After several presentations of the material presented by the teacher, students are confused about which part they really want to know. ask because most of them still difficulty in immediately understanding parts of the material.
5. The level of understanding of most students is good and some students are even very good, only a small number or at most half of the students in a class do not understand the mathematics material while the teacher is teaching.
6. Grade 7 students still have limitations in mathematical literacy, so that in moment question mathematics served by the teacher in form question story It becomes difficult for them to understand the question and it is also difficult to find what problem needs to be solved in the question.
7. Students do not fully understand draft base from material mathematics, things This cause student No do exercise question, so that they difficulty for understand different questions from examples given.
8. Students are too afraid to learn mathematics, so they don't understand the concept and find it difficult to explain the concept again.

Based on results observations made on December 23, 2024 conditions in Class VII.5 MTsN 1 Pekanbaru, where the KKM is quite high (87), is not fully achieved by all students due to various factors. The learning methods used, such as *Discovery Learning* and *Project- Based Learning,* are innovative, but students often lack focus during learning. They tend to have difficulty understanding the material, especially because their mathematical literacy is still low, which is seen from their inability to understand story problems. Students are also embarrassed to ask questions because they do not clearly understand which part is confusing them. Some students have a good understanding, but there are about half of the students who have difficulty understanding basic mathematical concepts due to a lack of practice questions and fear of mathematics lessons. This results in them being unable to apply concepts to everyday life.

Table 1.Completion Data Student Based on Student UH Results Class VII.5 MTsN 1 Pekanbaru

Category	Amount Student	Percentage
Completed (≥ 87)	18	48.65%
No Completed (< 87)	19	51.35%
Total	37	100%

Source : Guru mata lesson Mathematics Class VII.5 Mtsn 1 Pekanbaru

Of the 37 students, only 18 students (48.65 %) completed it, while 19 students (51.35%) had not. achieve KKM. Results This show that a number of big students Still difficulty in absorb material lessons, so that required approach more teaching capable increase quality learning next.

The 2022 PISA results show that the pandemic has had a global impact on learning outcomes, with average mathematics literacy scores declining. by 21 points. However, Indonesia managed to suppress the

score decline to only 13 points, better than the international average. Furthermore, Indonesia's ranking in the 2022 PISA (Philosophy of International Student Assessment) improved by 5-6 positions compared to 2018, reflecting the resilience of the education system in overcoming learning loss due to the pandemic . (Ministry of Education, Culture, Research, and Technology, 2023 : 8) . This shows that despite facing challenges, education in Indonesia continues to strive to recover and develop.

Seeing the situation and conditions that have been described, a learning approach is needed that encourages students to be more involved in a way direct in the learning process teaching . The learning model applied needs to provide ample opportunities for students to express mathematical ideas, develop thinking skills, and provide opportunities for them to develop problems given by the teacher (Wahyuni & Sholichah, 2022: 67) . One of the learning models that can encourage activity student is a *Problem Based Learning* (PBL) learning model .

PBL is a learning method where students learn through problem solving, thinking collaboratively in groups, and using relevant information to solve the problem (Syawaly & Hayun, 2020: 42) . *The Problem Based Learning* (PBL) model emphasizes activity learning that focuses on problem solving. Some of the advantages of implementing the PBL model include: (1) reducing student learning difficulties through group learning, (2) developing communication skills through presentation activities and discussions of work results, (3) having scientific activities in groups, (4) understanding the material through the context of existing problems, (5) increasing student insight optimally through learning activities, and (6) helping students develop skills in solving everyday problems (Rahmadani et al., 2023: 130) . In the PBL model, the teacher plays a role as facilitator on duty guide as well as supervise activity Study students , so that capable push participation active And strengthen interaction they during the learning process ongoing (Portuna et al., 2025) . The PBL model is seen effective in help student increase understanding against draft mathematics. Effectiveness This appear Because in application of the model , students pushed For in a way independent look for solution , do analysis , as well as finish problems faced (Ariawan & Zetriuslita, 2023) . Based on presentation previously, it can be concluded that PBL is a learning method that emphasizes problem-solving through group work, the use of relevant information, and the development of communication skills. This model helps students understand material in real-world contexts, increases insight, and trains skills in solving everyday problems.

In addition to learning models, media are needed that can support the learning process to attract students' interest, motivate them, and prevent them from getting bored. boredom during learning. With thus interest as well as motivation student in Study can grow better, reduce boredom, and make things easier understanding draft. Intended media One of them is the educational *game.* According to Yunus et al., (2015: 59) *game* is a form activities that involve game or competition , game often depicted in the form of activities that have arrangement still or part directed , usually intended For entertainment And sometimes used as tool learning . According to Amami Pramuditya et al., (2017: 77) *A game* is a type of activity in the form of a game or competition. *Games* can be interpreted as as a structured or semi-structured activity, usually done for entertainment and sometimes used as a learning tool. According to Vitianingsih, (2017: 25) One of the main advantages of educational *games* is their ability to visualize real-world problems. In this regard, educational concepts can be presented in a more interactive and engaging manner, motivating students to actively participate in the learning process. In connection with the above [15] put forward that educational game encourage desire know participant educate to something topic as well as given the chance For explore it more in . The motivation that arises No solely Because award external or confession from other people, but Also Because given award intrinsic.

Based on the background that has been described, the researcher is interested in carrying out research with the title **"Integrating Educational Games in Problem-Based Learning to Enhance Conceptual Understanding in Mathematics: A Study of Grade VII Students at MTsN 1 Pekanbaru".**

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2. RESEARCH METHOD

This research was designed as a Classroom Action Research (CAR) involving two cycles, where each cycle covered the stages of planning, implementation, observation, and reflection (Susilowati, 2018). The study took place at MTsN 1 Pekanbaru with participants from class VII.5 during the second semester of the 2024/2025 academic year.

The instructional tools included teaching modules, student worksheets, textbooks, and assessment instruments. Data were gathered through written tests, classroom observations, and documentation. The tests assessed students' understanding of mathematical concepts, while observation sheets were employed to monitor the activities of both teachers and students.

For data analysis, a descriptive approach was applied. Quantitative data were analyzed by comparing students' test results across the two cycles, whereas qualitative data described the teaching and learning processes in the classroom. The criteria for success were determined by an individual minimum score of 87 and a class mastery level of at least 75%. Improvements from one cycle to the next served as indicators of the intervention's effectiveness.

3. RESULTS AND DISCUSSION

The increase in understanding of mathematical concepts in cycle I and cycle II can be observed through the results of understanding of mathematical concepts in cycle I, by comparing the level of understanding of concepts from the cycle II mathematics test of class VII.5 students of MTsN 1 Pekanbaru. The following analysis presents a picture of the increase in understanding of mathematical concepts of class VII.5 students of MTsN 1 Pekanbaru in both cycles.

Analysis of the Achievement of KPM Indicators in the Mathematical Concept Understanding Test I

The results of the test in cycle I were obtained through the implementation of the final test of cycle I (Mathematical Concept Understanding Test I). Through this test, it is hoped that the limits of students' understanding of abilities in understanding mathematical concepts have improved. An analysis of the results of the final test of cycle I (Mathematical Concept Understanding Test I) is presented in Table 2. below:

Table 2. Classification of the Quality of Students' Understanding of Mathematical Concepts in Cycle I

No.	Indicator	Understanding Draft Mathematical		
		Total Score	KPM %	Classification of Understanding
1	Restating the concept.	135	91.22	Very good
		97	65.54	Enough
2	Classify objects according to certain properties (according to the concept).	103	69.54	Enough
		126	85.14	Good
3	Provide examples and non-examples of the concept.	124	83.78	Good
	AMOUNT	585	79.05	Good

Source: Data processed by researchers

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The results of cycle I include the final test of cycle II, namely the Mathematical Concept Understanding Test II. This test is intended to determining the level of students' ability to understand mathematical material conceptually has improved. The analysis of the final test results in cycle II is presented in Table 3 below.

Table 3. Classification of the Quality of Students' Understanding of Mathematical Concepts in Cycle II

No.	Indicator	Understanding Draft Mathematical		
		Total Score	KPM %	Classification of Understanding
1	Restating the concept.	137	92.57	Very good
		135	91.22	Very good
2	Classify objects according to certain properties (according to the concept).	135	91.22	Very good
		127	85.81	Very good
3	Provide examples and non-examples of the concept.	125	84.46	Good
	AMOUNT	659	89.05	Very good

Source: Data processed by researchers

After analyzing each indicator, the average understanding of mathematical concepts at the initial score, TKPM I and TKPM II is presented as follows:

Table 4. Classification of the Quality of Students' Understanding of Mathematical Concepts in Cycle II

	TKPM I	TKPM II
Total score all over student	585	659
Average	79.05	89.05
Criteria	**Good**	**Very good**

Source: Data processed by researchers (Appendix H)

Referring to the data presented in table 4.3 above, shows that students' understanding of mathematical concepts as a whole, both from the initial test scores to TKPM I and from TKPM I to TKPM II. The most striking improvement was seen in the average KPM score between cycles I and II. This improvement occurred because the learning process in cycle I was not fully implemented as expected. Several students still struggled to understand the material, the classroom atmosphere was less than conducive, and the learning process did not fully align with the plan outlined in the module.

In contrast, during the second cycle, the learning process proceeded according to the plan and expectations outlined in the module. Students began to become accustomed to using educational *games* using the PBL model implemented by the teacher. They also demonstrated greater commitment to learning activities and did not engage in activities outside the context of the lesson. Evidence of this improvement was evident from observations of teacher and student activities, as well as from the increase in total student scores. These findings indicate that improving the implementation of learning demonstrate a beneficial

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influence on students cognitive ability to absorb mathematical concepts through the application of educational games with the Problem Based Learning model.

To assess the extent to which become the steps of the *Problem-Based Learning model* , using the educational *game* that has been designed , align with actual classroom implementation, we can analyze findings from using teacher and student observation sheets. This information is presented in the following table, which contains the findings obtained through the analysis of teacher and student actions in each cycle during the learning activities.

Table 5. Analysis of teacher observation sheets

Meeting	indicator						Amount	POG	CATEGORY
	1	2	3	4	5	6			
Meeting 1	3	1	3	3	3	3	16	88.89	Good
Meeting 2	3	2	3	3	3	3	17	94.44	Very good
Meeting 3	3	2	3	3	3	3	17	94.44	Very good

Source: Data processed by researcher (Appendix C)

Teacher observations showed improvement and consistency in the implementation of learning. The score of meeting 1 was 88.89 % (good) increased to 94.44% (very good) in meetings 2 and 3. This indicates the effectiveness of the teacher's learning approach and strategies.

Table 6. Analysis of Student Observation Sheets

Meeting	indicator							Amount	POST	CATEGORY
	1	2	3	4	5	6	7			
Meeting 1	2	3	3	3	2	2	1	16	76.19	Enough
Meeting 2	2	3	3	3	2	2	1	16	76.19	Enough
Meeting 3	2	3	3	3	2	2	3	18	85.71	Good

Source: Data processed by researcher (Appendix C)

Although not significant, there was an improvement in student activity at the third meeting , indicating that they were becoming accustomed to implementing educational *games* using the PBL model. However, student engagement still needs to be improved for optimal results.

Based on the analysis results, the average student's KPM for all indicators also increased. This can be seen from the average score of mathematical concept understanding in cycle II which increased from cycle I. The average score of the mathematical concept understanding test in cycle I was 79.05% with a good level of understanding, and the average score of the mathematical concept understanding test II was 89.05% with a very good level of understanding. This means that in this action, students' mathematical concept understanding increased after the implementation of educational *games* using the PBL model during the activity

Refers to analysis of the teacher observation sheet, there was an improvement and consistency in practice implementing teaching strategies. The score in the first meeting reached 88.89 % with a good category and increased to 94.44% with a very good category in the second and third meetings. This reflects that the learning approach and strategies implemented by the teacher were running effectively. Analysis of the student activity sheet also showed an improvement during the learning process. Which is seen from the first and second meetings obtained a score of 76.19 % with a sufficient category, and the third meeting reached a score of 85.71% with a good category. Although not significant, there was an improvement in student activity in the third meeting. This indicates that students are starting to get used to the implementation of educational *games* using the PBL model. However, student engagement still needs to be improved.

4. CONCLUSION

If we look at the findings that have been analyzed obtained from data analysisin this study, it was the findings of this study indicate that education *games* using the PBL model can improve the learning process and increase the understanding of mathematical concepts of class VII.5 MTsN 1 Pekanbaru students during teaching and learning activities in the even semester in the year 2024/2025 academic year on the material of plane shapes and data analysis.

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