IMPROVING MATHEMATICS LEARNING OUTCOMES THROUGH THE APPLICATION OF PROBLEM-BASED LEARNING MODEL FOR GRADE XI STUDENTS AT UPT SMA NEGERI 1 MAROS

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Abstract

This study aims to improve students' mathematics learning outcomes on Matrix material. This type of research is a classroom action research with two cycles carried out at UPT SMA Negeri 1 Maros in the odd semester of the 2022/2023 academic year. The research subjects were students of class XI MIPA 4 UPT SMA Negeri 1 Maros. The research instruments used were learning devices, evaluation sheets, and observation sheets. The data collection technique in this study was by observation in the form of observation sheets and tests given to the research subjects. In this study, the Quantitative Descriptive Analysis technique was used. Based on the data analysis, the results showed that by using the Problem Basic Learning model on Matrix material there was an increase in student learning outcomes from an average of 92.54 in the initial test to 92.71 in the first cycle and increased to 92.74 in the second cycle with a percentage of 100% completion in the initial test and both cycles. In addition, there was also an increase in student activity in the student activity component from 83.33% in the initial test to 91.67% in cycle I and then increased to 100% in cycle II. In the student attention component from 83.33% in the initial test and cycle I, then increased to 91.67% in cycle II. In the student discipline component from 83.33% in the initial test, and consistently 83.33% in cycle I, then increased to 100% in cycle II. In the student assignment component from 75% in the initial test to 83.33% in cycle I and then increased to 91.67% in cycle II.

Keywords: Basic Learning Problems, Classroom Action Research, Learning Outcomes

INTRODUCTION

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students develop their potential to gain spiritual religious strength, self-control, personality, intelligence, noble morals, and the skills needed by themselves, society and the nation.(Hera, 2018)Education is crucial for preparing the nation's children to face the changing times and survive in their environment.

According to research(Wahyuni et al., 2016)Mathematics is a universal knowledge that underlies the development of modern technology and plays an important role in everyday life. Therefore, mathematics lessons need to be taught to all

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students from elementary school to university level to equip students with the ability to think logically, analytically, systematically, critically, creatively, carefully and consistently as well as the ability to work together (Ministry of National Education, 2006). Mathematics is essentially an exact science that students study at every level of education where it requires students to be able to calculate, solve problems, think critically, think logically, systematically, and also students must be able to understand the mathematical concepts given so that sometimes it makes students feel difficult in solving problems.(Yuntiaji, 2019)whereas according to research(Wigati, 2016)Mathematics is a basic science that plays a very strategic role in the development of science and technology. Besides being a basic science, mathematics is expected to enable students to solve problems in everyday life. Mathematics is a subject taught at every level of education, from elementary school to higher education, both general and vocational. Mathematics in schools is crucial for developing students' thinking patterns. Mathematics shapes the mindset of those who study it, especially students, including logical, analytical, systematic, and critical thinking with great precision (Chrisnaji Banindra Yudha 2014:63).

From the results of observations conducted by researchers at UPT SMA Negeri 1 Maros, researchers found problems with the learning methods used by class XI students of UPT SMA Negeri 1 Maros. It turns out that so far the class teacher who teaches class XI UPT SMA Negeri 1 Maros, especially mathematics subjects, teaches using the classical method. However, according to the teacher, only this method is suitable to be applied. In addition, it was also found that the mathematics learning outcomes of class XI students of UPT SMA Negeri 1 Maros are classified as complete but still need improvement.

Learning Outcomes is an assessment learning initiative focused on building student capacity to meet learning objectives, including the development of affective or cognitive cognition and motor skills. Learning is conducted using authentic learning techniques that utilize tests and non-tests. Unlike using tests to improve cognitive function, non-test techniques are used to improve affective and motor functions.(Yuvita, 2021)

The learning process encompasses both learning and teaching activities, which are inseparable. Learning is a crucial process for changing student behavior and encompasses everything they think and do (Anni, 2006). According to Briggs (in Sugandi and Haryanto, 2006), learning is a set of events that influence students in such a way that they can interact easily with their environment. Therefore, teachers are expected to utilize a variety of learning methods in the learning process to foster students' enthusiasm for learning.

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Problem-based learning is a learning model that utilizes real-world problems. These problems serve as a context for students to learn critical thinking and problem-solving skills, as well as to acquire essential knowledge and concepts from the subject matter (Nurhadi & Senduk, 2003). Problem-based learning is the single most effective teaching method because it encourages students' mental activity to understand specific learning concepts through the context of real-world situations and problems. The goal is to help students overcome problems using problem-solving techniques.

A learning model is a framework that provides a systematic overview for implementing learning to help students learn in specific goals to be achieved. This means that the learning model is a general overview but still focuses on specific goals (Thabroni, 2020a), while the learning model used at UPT SMA 1 Maros is a direct learning model. According to Arends, (Ni'mah & Mintohari, 2013) the direct learning model is a teaching approach specifically designed to support students' learning processes related to well-structured declarative and procedural knowledge that can be taught with a gradual, step-by-step activity pattern.

Based on observations made at UPT SMA Negeri 1 Maros regarding the direct learning process implemented by teachers, it is less effective because the learning model seems monotonous, causing students to get bored with mathematics learning, thus students pay less attention to the teacher's explanation during the learning process. This has an impact on students' mathematics learning outcomes at UPT SMA Negeri 1 Maros.

Based on the theories above, the relevance between the concept or theory and the problem, according to the problems obtained at the UPTState Senior High School 1 MarosAs stated above, it is known that one way that can be taken to improve students' mathematics learning outcomes is by using the PBL learning model, where PBL type learning is a learning model that confronts students with practical problems as a basis for learning or in other words, students learn through problems. Problem-based learning activities enable students to develop their own skills in solving a problem, thus the PBL learning model is expected to improve students' mathematics learning outcomes at UPT.State Senior High School 1 Maros.

RESEARCH METHODS
   A. Types of research

      This research is a classroom action research (ADR) because it was conducted to solve learning problems in the classroom, implemented in two cycles. Classroom action research is a practical research conducted to identify factual problems faced by teachers as a means of examining learning management activities.(Rahayu & Mustika, 2021). Classroom action research is a form of reflective research that involves taking specific actions to improve or enhance

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classroom learning practices in a more professional manner. The success of the actions taken can be determined through student activities during learning and teacher activities in managing learning in the classroom using practice methods. Teacher and student activities in the learning process are said to be successful if every aspect is in the minimum good category. The actions in this research are also declared successful if students have met the indicators of research success in cycles I and II. The indicator of research success in cycle I is that students can operate matrices. The indicator of research success in cycle II is that students can determine determinants and inverses of matrices.

B. Research Subjects
The subjects studied were class IX MIPA 4 UPT SMA Negeri 1 Maros with a total of 36 students consisting of 12 male students and 24 female students.

C. Research Instruments

This data collection was carried out during the learning process using the following techniques:
1. Observation
   Observation in the form of an observation sheet
2. Written test
   Written tests in the form of content questions given to students at the end of the cycle to determine student learning outcomes.
3. Interview
   These interviews were conducted with several students based on their written test scores and willingness to be interviewed during the research.
D. Data analysis

The data analysis techniques used in this study are as follows:
1. Descriptive Statistical Analysis
2. Inferential Statistical Analysis

RESULTS AND DISCUSSION

A. Implementation Results
Classroom Action Research (CAR) with the Problem Based Learning model shows that there is an increase, although not significant, after learning using the Problem Based Learning model in mathematics subjects in class XI MIPA 4.

Table 2 Statistics of Initial Test Result Values

Statistics	Mark
Number of students	36
minimum competency	75

Completed	36
Not finished	0
The highest score	100
Lowest value	80
Range of values	20
Average value	92.54
Standard deviation	7.73

Table 2 shows that the mathematics learning outcomes obtained by students in the initial test have an average value (mean): 92.54 and a standard deviation (standard deviation) of 7.73. This indicates that the students' learning outcomes have been completed because they obtained a score above the KKM (Minimum Completion Criteria) of 75, where 36 students who completed the total number of 36 students. In other words, no students experienced incompleteness. The table above also shows that the highest score obtained in the initial test was 100 while the lowest score was 80 and the range of values was 20.

From this data, if the mathematics learning outcomes are grouped by category (level), then the distribution of values obtained is as presented in table 3 below:

Table 3 Distribution of Initial Test Score Frequency

Score	Category	Frequency	Percentage
90-100	Very high	21	60
80-89	Tall	15	40
65-79	Currently	0	0
55-64	Low	0	0
0-54	Very low	0	0
	Amount	36	100
	Completed	36	100
	Not finished	0	0

From table 3 shows that the average mastery of mathematics learning of students is in the very high category because they get an average score of 92.54 from the KKM of 75. With a percentage of completion of 100%, it means that students who have completed learning are 36 students out of a total of 36 students. Therefore, students who are in the incomplete category are 0 (none). The table above also shows that students who are in the very high category get a score of 90-100 totaling 21 students with a percentage of 60%. Furthermore, students who are in the high category get a score of 80-89 totaling 15 students with a percentage of 40%. Meanwhile, students

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who are in the medium category get a score of 65-79 with a percentage of 0% (none), students who are in the low category get a score of 55-64 with a percentage of 0% (none), likewise students who are in the very low category get a score of 0-54 with a percentage of 0% also none.

Description of Cycle I Results

Table 4 Statistics of Cycle 1 Result Values

Statistics	Mark
Number of students	36
minimum competency	75
Completed	36
Not finished	0
The highest score	100
Lowest value	80
Range of values	20
Average value	92.71
Standard deviation	6.93

The table above shows that the mathematics learning outcomes obtained by students in cycle I have an average value (mean): 92.71 and a standard deviation (standard deviation) of 6.93. This indicates that student learning outcomes have increased in completeness because they obtained a score above the KKM, namely 75, where 36 students who completed the total number of 36 students. In other words, no students experienced incompleteness. The table above also shows that the highest score obtained in the initial test was 100 while the lowest score was 80 and the range of values was 20.

From this data, if the mathematics learning outcomes are grouped by category (level), then the distribution of values obtained is as presented in table 5 below.This :

Table 5 Distribution of Frequency of Cycle I Values

Score	Category	Frequency	Percentage
90-100	Very high	21	60
80-89	Tall	15	40
65-79	Currently	0	0
55-64	Low	0	0
0-54	Very low	0	0

	Amount	36	100
	Complete	36	100
	Not finished	0	0

From table 5 shows that the average mastery of mathematics learning of students is in the very high category because it obtained an average score of 92.71 from the KKM of 75. With a percentage of completion of 100%, it means that students who have completed learning are 36 students out of a total of 36 students. Therefore, students who are in the incomplete category are 0 (none). The table above also shows that students who are in the very high category get a score of 90-100 totaling 21 students with a percentage of 60%. Furthermore, students who are in the high category get a score of 80-89 totaling 15 students with a percentage of 40%. Meanwhile, students who are in the medium category get a score of 65-79 with a percentage of 0% (none), students who are in the low category get a score of 55-64 with a percentage of 0% (none), likewise students who are in the very low category get a score of 0-54 with a percentage of 0% also none.

Table 6 Statistics of Cycle II Result Values

Statistics	Mark
Number of students	36
minimum competency	75
Completed	36
Not finished	0
The highest score	100
Lowest value	80
Range of values	20
Average value	92.74
Standard deviation	7.35

The table above shows that the mathematics learning outcomes obtained by students in cycle I have an average value (mean): 92.74 and a standard deviation (standard deviation) of 7.35. This indicates that student learning outcomes have increased in completeness because they obtained a score above the KKM, which is 75, where 36 students who completed the total number of 36 students. In other words, no students experienced incompleteness. The table above also shows that the highest score obtained in the initial test was 100 while the lowest score was 80 and the range of values was 20.

From this data, if the mathematics learning outcomes are grouped by category (level), then the distribution of values obtained is as presented in table 7 below:

Table 7 Distribution of Frequency of Cycle II Values

Score	Category	Frequency	Percentage
90-100	Very high	23	65.71
80-89	Tall	13	34.29
65-79	Currently	0	0
55-64	Low	0	0
0-54	Very low	0	0
	Amount	36	100
	Tu ntas	36	100
	Not finished	0	0

From table 7 shows that the average mastery of mathematics learning of students is in the very high category because they get an average score of 92.74 from the KKM of 75. With a percentage of completion of 100%, it means that students who have completed learning are 36 students out of a total of 36 students. Therefore, students who are in the incomplete category are 0 (none). The table above also shows that students who are in the very high category get a score of 90-100 totaling 23 students with a percentage of 65.71%. Furthermore, students who are in the high category get a score of 80-89 totaling 13 students with a percentage of 34.29%. Meanwhile, students who are in the medium category get a score of 65-79 with a percentage of 0% (none), students who are in the low category get a score of 55-64 with a percentage of 0% (none), likewise students who are in the very low category get a score of 0-54 with a percentage of 0% also none.

Table 8 Statistics of Student Learning Outcomes in the Initial Test, Cycle I and Cycle II

Statistics	Initial test	Cycle I	Cycle II
The number of Siawa	**36**	**36**	**36**
Kkm	**75**	**75**	**75**
Completed	**36**	**36**	**36**
Percentage completion	**100**	**100**	**100**
Not finished	**0**	**0**	**0**
Percentage of incomplete	**0**	**0**	**0**
The highest score	**100**	**100**	**100**

Lowest value	**80**	**80**	**80**
Range of values	**20**	**20**	**20**
Average value	92.54	92.71	92.74
Standard deviation	7.73	6.93	7.35

The table above shows a consistent increase in learning outcomes using the PBL model for class XI MIPA 4 students of UPT SMA Negeri 1 Maros. In the initial test, the KKM score was 75 and the standard deviation was 7.73 and the average score was 92.54 with the highest score of 100 and the lowest score of 80, resulting in a range of 20. Where all students experienced completeness with a percentage of 100%. This means that 36 students experienced completeness and no students experienced incompleteness (0%). In cycle I, the KKM score was 75 and the standard deviation was 6.93 and the average score was 92.71. Where there is no change in terms of the number of completeness and incompleteness, namely 35 students who completed and 0 (no) students who experienced incompleteness and the highest, lowest and range of values are 100, 80 and 20 respectively. Likewise in the percentage of completeness and incompleteness, namely 100% complete and 0% incomplete. Furthermore, in cycle II the KKM value of 75 and the standard deviation of 7.35 and the average value of 92.74 also did not change like the initial stage and cycle I in terms of the number of completeness and incompleteness, namely 35 students who completed and 0 (no) students who experienced incompleteness and the highest, lowest and range of values are 100, 80 and 20 respectively. Likewise in the percentage of completeness and incompleteness, namely 100% complete and 0% incomplete.

Table 9 Student Activities in the Initial Test, Cycle I and Cycle II

Observation Components	Initial Test		Cycle I		Cycle II	
	Score	**Presentation**	**Score**	**Presentation**	**Score**	**Presentation**
Student Activity	10	83.33	11	91.67	12	100
Student Attention	10	83.33	10	83.33	11	91.67
Discipline	10	83.33	10	83.33	12	100
Assignment	9	75	10	83.33	11	91.67

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Based on the results of observations in the process of implementing the research, an increase in student activity was obtained, namely in the component of student activity observation, there was an increase from 83.33% in the initial test to 91.67% in cycle I, then in cycle II it increased to 100%. In the component of student attention observation, there was consistency in the initial test and cycle I, namely 83.33%, then in cycle II it increased to 91.67%. In the component of discipline observation, there was also consistency in the initial test and cycle I, namely 83.33%, then in cycle II it increased to 100%. In the assignment component there was also an increase, namely from 75% in the initial test to 83.33% in cycle I, then in cycle II it increased to 91.67%.

B. Discussion

From the description of the research results above, it shows that the results of learning mathematics on matrix material using the modelProblem Based Learning in class XI MIPA 4 UPT SMA Negeri 1 Maros shows that there is an increase in learning outcomes, although not significantly.namely in the initial test the average value was 92.54 to 92.71 in cycle I, then in cycle II it also increased to 92.74. In addition to improving mathematics learning outcomes, mathematics learning activities using the modelProblem Based Learningalso increased. The increase in student activity is as follows.

1. Student learning activity occurred during the lesson. This was indicated by active participation in taking notes, asking questions, and proposing ideas or opinions, which was categorized as good in cycle I and very good in cycle II.
2. Students' attention during learning. This is indicated by students being calm, focused, and enthusiastic in participating in mathematics lessons, which falls into the good category in cycle 1 and the very good category in cycle II.
3. There has been a change in discipline, as evidenced by student attendance in learning, which has risen to the excellent category in cycles I and II.
4. Students' activeness was evident in completing assignments. This was indicated by students submitting all assigned assignments, completing them on time, and following instructions, categorizing them as good in cycle I and excellent in cycle II.

The results of this study are in line with relevant research which shows that the application of the PBL learning model can improve student learning outcomes.(Rerung et al., 2017). In addition, Problem-Based Learning (PBL) is an innovative learning model that provides active learning conditions for students. The Problem-Based Learning model can increase student engagement. This increase in student engagement can be seen in the PBL learning stages. During the stages of organizing and guiding

individual/group experiences, students engage in discussions and exchange information with each other within the group.(Dewi & Amirudin, 2016)

CONCLUSION AND SUGGESTIONS
A. Conclusion
From this study, it can be concluded that the learning outcomes of mathematics students on matrix material using the Problem Based Learning learning model in class XI MIPA 4 UPT SMA Negeri 1 Maros showed an increase in learning outcomes, although not significantly, it can be seen in the results of the cycle I and cycle II tests. In additionincreased mathematics learning outcomes, mathematics learning activities using the Problem Based Learning model also increased.

B. Suggestion
Teachers should be able to apply the problem-based learning model as an alternative in teaching mathematics lessons so that learning is not monotonous and passive so that students are less interested in learning.

BIBLIOGRAPHY
Deliana, T. (2019). Journal of Education Partners (JMP Online). 3(10), 1331–1343.

Dewi, S., & Amirudin, A. (2016). Application of Problem Based Learning Model to Improve the Activeness and Social Skills of Fifth Grade Students at Sdn Tangkil 01 Wlingi. Jurnal Pendidikan, vol.1, 281–288.

Hera, R. (2018). The Effect of Problem Solving Learning Model on Student Learning Outcomes in Heat Material. Genta Mulia, IX(1), 147–156. https://repository.ung.ac.id/skripsi/show/421413045/pengaruh-model-pembelajaran-problem-solving-terhadap-hasil-belajar-siswa-pada-materi-kalor.html

Lahu, EP, Enggar, O. :, Lahu, P., & Sumarauw, JSB (2017). Analysis of Raw Material Inventory Control to Minimize Inventory Cost on Dunkin Donuts Manado. Analysis of Raw Material Inventory Control… 4175 Jurnal EMBA, 5(3), 4175–4184. http://kbbi.web.id/optimal.

Nurhasanah, L. (2009). Improving Junior High School Students' Strategic Competence through the PBL (Problem Based Learning) Model. Thesis at FPMIPA UPI Bandung: Unpublished.

Nurmaily. (2021). Application of the Discovery Learning Model to Improve Mathematics Learning Outcomes on the Probability Material of Class XII Iis 2 Man 1 Students in Banda Aceh. Education and Community Service, 2(2), 189–196.

Rahayu, R., & Mustika, I. (2021). APPLICATION OF DISCOVERY LEARNING METHOD LEARNING TO WRITING PROCEDURE TEXT IN VOCATIONAL. 4(2), 114–120.

Rerung, N., Sinon, ILS, & Widyaningsih, SW (2017). APPLICATION OF THE PROBLEM-BASED LEARNING (PBL) MODEL TO IMPROVE LEARNING OUTCOMES. 06(April), 47–55. https://doi.org/10.24042/jipf

Risdianto, H., Kelas, PT, Petualangan, P., & Gamma-pi, J. (2021). Gamma-Pi: Journal of Mathematics and Applied Mathematics. 3, 22–27.

Sardiman. 2007. Interaction and Motivation in Teaching and Learning. Jakarta: Raja Grafindo Persada.

Supriyanto, B. (2014). Implementation of Discovery Learning to Improve Learning Outcomes of Grade VI B Students in Mathematics Subject Topic of Circumference and Area of Circles at SDN Tanggul Wetan 02, Tanggul District, Jember Regency. Pancaran, 3(2), 165–174.

Turmuzi, M. (2021). Improving Student Learning Outcomes at SMPN 1 Mataram on Quadratic Equations Through the Discovery Learning Model Combined with the Scientific Approach in the 2019/2020 Academic Year. 4, 359–368.

Wahyuni, Anggraini, & Rochamimah, S. (2016). Application of the Exercise Method to Improve Student Learning Outcomes on Function Limit Material in Class XI IPA of Alkhairat Kalukubula Senior High School. Tadulako Electronic Journal of Mathematics Education, 3(3), 247–261.

Wigati, S. (2016). Improving Mathematics Learning Outcomes on the Topic of Trigonometry Through Problem-Based Learning Models in Class X-7 Semester 2 of Sma 15 Semarang in the 2015/2016 Academic Year. Jkpm, 3(September), 1–8.

Yuntiaji, DA (2019). Analysis of Students' Difficulties in Solving Mathematics Problems Based on Ideal Problem Solving on Function Limit Material. MAJAMATH: Journal of Mathematics and Mathematics Education, 2(2), 102. https://doi.org/10.36815/majamath.v2i2.396

Yuvita, K. (2021). Implementation of the Discovery Learning Model to Improve the Activeness and Mathematics Learning Outcomes of Fifth Grade Students.... Global Edu, 4(1), 5–6.

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