



Universitas Negeri Medan
Jurusan Matematika



2024

PROSIDING SEMINAR NASIONAL MATEMATIKA

Transformasi, Rekonstruksi, dan integrasi keilmuan dalam pembelajaran matematika menuju era inovasi dan kolaborasi



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Opening Speech



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TRANSFORMASI, REKONSTRUKSI, DAN INTEGRASI KEILMUAN DALAM PEMBELAJARAN
MATEMATIKA MENUJU ERA INOVASI DAN KOLABORASI

2024

CV. KES

2024

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**TRANSFORMASI, REKONSTRUKSI, DAN INTEGRASI
KEILMUAN DALAM PEMBELAJARAN MATEMATIKA MENUJU
ERA INOVASI DAN KOLABORASI**

Penulis

Peserta Prosiding Seminar Nasional
Matematika 2024



Penerbit
CV. Kencana Emas Sejahtera
Medan
2025

2024

PROSIDING

SEMINAR NASIONAL

MATEMATIKA

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ERA INOVASI DAN KOLABORASI**

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KATA PENGANTAR

Puji syukur kami panjatkan kepada Tuhan Yang Maha Esa atas segala karuniaNya, sehingga Buku Abstrak Prosiding Seminar Nasional Matematika yang diselenggarakan Jurusan Matematika, FMIPA Universitas Negeri Medan. Kegiatan ini mengusung tema Transformasi, Rekonstruksi, dan integrasi keilmuan dalam pembelajaran matematika menuju era inovasi dan kolaborasi dengan keynote speaker Prof. Dr. Syawal Gultom, M.Pd. dan Prof. Dr. Ferra Yanuar, M.Sc. serta Dr. Ani Sutiani, M.Si. sebagai *Opening Speech*. Tujuan kegiatan ini selain menciptakan lingkungan akademik di lingkungan jurusan matematika FMIPA Universitas Negeri Medan, juga menjadi wadah untuk menyebarkan pengembangan ilmu pada bidang matematika dan rumpun ilmu yang berkaitan. Kegiatan yang dilaksanakan pada tanggal 20 November ini diikuti oleh 228 peserta seminar dan 131 pemakalah (*presenter*) yang berasal dari beberapa institusi di tingkat Nasional. Artikel yang diterima terdiri dari dikelompokkan pada 4 bidang; (1) ilmu Komputer; (2) Pendidikan matematika; (3) statistik; dan (4) Matematika. Dari 131 Full Paper yang masuk, selain diterbitkan dalam bentuk prosiding, juga akan diterbitkan pada mitra publikasi jurnal kami; (1) Jurnal Fibonacci: Jurnal Pendidikan Matematika; (2) Journal of Mathematics, Computations, and Statistics; (3) jurnal Zero: Jurnal Sains, Matematika dan Terapan dan (4) Journal of Didactic Mathematics

Kelancaran kegiatan persiapan kegiatan seminar ini telah didukung oleh jajaran pimpinan Universitas Medan, oleh karena itu Kami mengucapkan terima kasih kepada (1) Ketua Senat Universitas Negeri Medan; (2) Rektor Universitas Negeri Medan; (3) Dekan FMIPA Universitas; dan (4) ketua Jurusan Pendidikan. Kami juga mengucapkan seluruh pihak-pihak terkait yang tidak dapat kami sebutkan satu terutama Panitia Pelaksana dan partisipan dalam pelaksanaan seminar Nasional ini. Semoga prosiding Seminar Nasional Matematika ini, dapat memberikan wawasan dan melengkapi kemajuan teknologi pada bidang yang berkaitan dengan Matematika.

Medan, 7 Februari 2025
a.n Panitia Pelaksana

Dr. Yulita Molliq Rangkuti, S.Si, M.Sc



Thanks To INVITED SPEAKER

Terima kasih kami ucapkan kepada Invite Speaker



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The Effect of The Problem-Based Learning Model on Students' Mathematics Problem Solving Abilities

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Abstrak, tujuan dari penelitian ini adalah untuk menggambarkan bagaimana model pembelajaran berbasis masalah (Problem-Based Learning) meningkatkan kemampuan siswa dalam menyelesaikan masalah matematika. Penelitian ini diklasifikasikan sebagai eksperimen semu (quasi-experiment). Desain penelitian ini menggunakan kelas kontrol dan kelas eksperimen. Metode pengumpulan data menggunakan pre-test dan post-test. Populasi penelitian terdiri dari seluruh 330 siswa kelas 8 di SMP Negeri 6 Medan yang tersebar dalam 11 kelas. Sampel penelitian berjumlah 60 siswa, masing-masing 30 siswa dari dua kelas (kelas 8-J sebagai kelas eksperimen dan kelas 8-I sebagai kelas kontrol). Data penelitian dianalisis dengan uji t, uji homogenitas, dan uji normalitas. Dengan bantuan SPSS, data dinyatakan homogen dan normal. Karena tingkat signifikansi uji t lebih kecil dari 0,05, maka H_0 ditolak dan H_a diterima. Oleh karena itu, dapat disimpulkan bahwa siswa yang diajar dengan menggunakan model pembelajaran berbasis masalah memiliki kemampuan pemecahan masalah matematika yang lebih baik dibandingkan dengan siswa yang diajar dengan model pembelajaran langsung.

Kata kunci: Kemampuan pemecahan masalah matematika; pembelajaran berbasis masalah; efektivitas

Abstract, the purpose of this study is to characterize how the problem-based learning model enhances students' capacity for solving mathematical problems. This study is classified as a quasi-experiment. This study's design makes use of control and experiment classes. Pre-test and post-test data gathering methodology. All 330 pupils in the 8th grade at SMP N 6 Medan, distributed over 11 classes, made up the study's population. 60 students, 30 in each of the two courses (class 8-J being the experimental class and class 8-I being the control class) were included in the study's sample. The t-test, homogeneity test, and normality test were used to assess the research's data. With SPSS's help, the data is homogeneous and normal. Because the test significance level is less than 0.05, H_0 was rejected and H_a was approved. Therefore, it can be concluded that students taught using the Problem-Based Learning model have superior mathematical problem-solving abilities compared to those taught using the direct-instructional model.

Keywords: Mathematics problem solving abilities, problem-based learning, effect

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INTRODUCTION

Education is one of the most crucial parts of a country. It can improve the quality of human resources. The education process and the formation of quality human resources have a logical relationship that cannot be separated because through education, a person is educated and developed in a better direction. One of the lessons learned that students must master is mathematics. Mathematics is a learning that exists at every level in education. Laia & Harefa (2021) emphasize that mathematics is learning that can develop thinking, reasoning, and logic in solving problems in everyday life. However, the importance of mathematics is not directly proportional to what happens in the field, where many students avoid and allergic to mathematic.

There are 5 mathematical abilities that must be mastered by students mentioned by NTCM (2000), namely: 1) mathematical problem solving ability, 2) mathematical connection ability, 3)

mathematical communication ability, 4) mathematical representation ability, and 5) mathematical reasoning ability. It can be seen that problem solving ability is one of the important abilities that must be mastered by students. Setyaningsih & Rahman (2022) added that problem solving ability is one of the higher-level abilities and also the focus of mathematics learning in the 21st century.

Mathematics problem solving ability is the ability to solve a problem or find a solution or answer to a problem. Thamsir, et al (2019) in their research stated that mathematical problem solving can be interpreted as an activity that combines all mathematical skills, knowledge, and reasoning to find a solution to a problem. Therefore, mathematics problem solving ability is a very important ability in learning mathematics. According to Polya (1957), there are four stages in the problem solving process, namely: 1) Understanding the problem, 2) Devising a plan, 3) Carrying out the plan, 4) Looking back. The indicators in this study referring to Polya's stages are presented in Table 1. below.

Table 1. Indicators of Mathematics Problem Solving Abilities

Polya's Stages	Indicators based on Polya's Stages
1. Understanding the problem	Students identify the known and questionable elements in the problem.
2. Devising a plan	Students create a strategy to solve the problem based on the information available.
3. Conducting the plan	Students apply the strategies to solve problems.
4. Looking back	Students interpret the solution resulting from the problem-solving process.

Considering the findings of the researcher's interviews with one of the mathematics teachers of SMP N 6 Medan, it is known that there are a large number of students of SMP N 6 Medan who are still unable to solve mathematical problems. The teacher explained that the learning conducted in the classroom is direct instructional model which is teacher-centered learning that made students less active in learning. Student just got the information, write, remember and do the exercise. The teacher also said that students are confused to solve problems if given outside the example even though the form of the problem is the same.

This is supported by the facts that exist when researchers made initial observations by giving diagnostic tests to 26 students in class 8-D SMP N 6 Medan to measure mathematics problem solving abilities. Based on the students' answer sheets, 17 students (65.4%) were classified as very low, 6 students (23.1%) were classified as low, and 3 students (11.5%) were classified as medium. This shows that students' mathematics problem solving abilities are still said to be very lacking or inadequate. One of the causes of the problem is the learning model that is carried out during learning. Based on these situations and conditions, it is very necessary to have a learning model that can improve students' mathematics problem solving skills considering the importance of these abilities.

One of the learning models that have received attention from educators is the Problem-Based Learning (PBL) Model (Syamsidah, 2018). PBL is an innovative learning model that uses problems as the basis for concept information (Isrok'atun & Rosmala, 2019). Hafidloh (2020) added that PBL is a learning model based on contextual problems and requires students to solve problems to obtain mathematical concepts. The Department of National Education (in Nurdin & Adrianoni, 2016) said that PBL is a learning model that teaches students how to solve issues and think critically by using problems as a context. Based on the opinions, it can be concluded that Problem-Based Learning is an innovative learning model that presents problems to students to be solved in order to build acquire mathematical concepts.

Presenting students with real-world, significant problem scenarios that can act as catalysts for research and inquiry is the cornerstone of problem-based learning model (Arrends, 2009). The main principle of PBL is the use of real problems that are open ended problems, namely problems that have many answers or solution strategies and are not well structured which cannot be solve directly as a means for students to develop knowledge, critical thinking skills and problem solving (Sofyan, et al, 2017). Ibrahim & Nur (in Al-Tabany, 2017) stated that PBL consists of five main stages, namely: 1) Orienting students towards the issues; 2) Organizing students; 3) Guiding student investigation in individuals and groups; 4) Developing and presenting result; and 5) Evaluating and concluding the problem solving process. Table 2. will explain in detail these five steps.

Table 2. Syntax of PBL

Phase	Teacher Activity
Orienting students towards the issues	The teacher encourages students to actively participate in problem-solving exercises while outlining the learning objectives and the preparations that are required.
Organizing students	Teacher organizes students in determining and identifying concepts about the problem and organizing learning tasks related to the problem.
Guiding students investigation in individual and groups	To help pupils comprehend and solve problems, the teacher guides them collect pertinent data and carry out experiments.
Developing and presenting result	The teacher helps students share assignments with their group members and helps them plan and prepare relevant work, such as reports.
Evaluation and concluding the problem solving process	The teacher assists students in reflecting on or assessing their research and the methodology they employ

There have been several previous studies indicating that the Problem-Based Learning model improves problem solving skills Research conducted by Sari (2021) on students in class 11-MIA SMA Al-Ulum Terpadu Medan showed that the average percentage of students' mathematical problem solving ability increasing by 13.2% from 68.16% in cycle I to 81,36% in cycle II. So it is clear that using the Problem-Based Learning model can help students become more adept at solving mathematical problems. Research carried out by Situmorang, et al (2022) on students in class 8 SMP Gajah Mada Medan showed that the results of the calculation of the correlation coefficient test obtained $t_{value} > t_{tabel}$ yaitu $13.634 > 1.695$ which means that there is a strong relationship between the PBL model and students' mathematic problem solving abilities. Research carried out by Elita, et al (2019) on students in class VIII MTS. N Semerah Kerinci found that there were differences in the experimental and control class with an average value of 72.58 for the experimental class dan 65.00 for the control class, so it can be concluded that the learning using the PBL has an effect on student' mathematical problem solving abilities.

The purpose of this study is to ascertain whether students who are taught using the Problem-Based Learning model are better at solving mathematical problems than students who are taught using the Direct Instructional methodology, as stated in the above description.

METHODS

This kind of study is referred to as quasi-experimental. This research was carried out at SMP N 6 Medan located at Jl. Bahagia No. 42, Teladan Timur, Medan Kota Sub-district, Medan, North Sumatera in the odd semester of the 2024/2025 School Year. The population of this study was students in class 8 SMP N 6 Medan 2024/2025 School Year which divided into eleven class as many as 330 students. Purposive sampling was used to collect data for this research. The sample of this study was 8-I students as the control class and 8-J students as the experimental class. Each class consisted of 30 students.

Problem-Based Learning model is the independent variable, and Mathematics Problem Solving Abilities is the dependent variable. The research design is Nonequivalent Control Group Design, which involves two non-randomly selected groups that are then administered a pretest to ascertain whether the experimental group and the control group differed (Sugiyono, 2019). The design used is described in Table 3. below.

Table 3. Research Design

Class	Pre-test	Treatment	Posttest
Experiment (E)	O_1	X_1	O_3
Control (C)	O_2		O_4

The test of students' aptitude for solving mathematical problems served as the research tool for this investigation. A written test consisting of four questions describing the System of Linear Equations of Two Variables was utilized in this study to gauge students' aptitude for solving mathematical problems. The Table 4. is a rubric for scoring students' mathematics problem solving ability (Cahyadi, et al, 2023).

Table 4. Mathematics Problem Solving Ability Scoring Rubric

Indicator	Steps of Problem Solving	Score
Identifying what is known and asked in the problem	Do not write down any information at all	0
	Write down the wrong information	1
	Write down some of the required information correctly	2
	Write down all the required information correctly	3
Creating a strategy to solve the problem	Do not plan the solution at all	0
	Make a plan that could not be implemented	1
	Make a correct but incomplete plan	2
	Make a plan in accordance with the procedure and led the correct solution	3
Applying the strategy to solve the problem Interpreting the results	No answer at all	0
	Do not implement the strategy correctly	1
	Implement the strategy correctly but get the wrong solution	2
	Implement the strategy correctly and get the right solution	3
Interpreting the results	No interpretation of results	0
	Interpreted the results obtained by making conclusions.	1

The normality and homogeneity tests, which are pre-requisite for testing the data and testing hypotheses, were employed in this investigation. This study's normality test was aided by SPSS software, and the data is considered normally distributed if the significance value is greater than 0.05. This study's homogeneity test, which was aided by SPSS software, indicated that the two sample group had distinct variances if the significance value was greater than 0.05. With the use SPSS software, the independent sample t-test is the hypothesis testing method employed. In hypothesis testing, the significance level is set at 0.05..

RESULT AND DISCUSSION

This study used a sample of two classes and was carried out in class VIII of SMP N 6 Medan. There are 60 samples in total, with 30 students in class VIII-J serving as the experimental class and 30 students in class VIII-I serving as the control class. This study sought to ascertain how the Problem-Based Learning model affected students' capacity to solve mathematical problems. The prerequisite material is repeated to the students as the first learning exercise. Furthermore, the researcher gave students a problem related to the System of Linear Equations of Two Variables in real life then gave students the opportunity to respond to the problems given. Furthermore, students

will be formed into several groups and continued by giving treatment. The experimental class was taught with Direct-Instructional model. The data in this study were collected by giving a description test to students then the data were processed using the IBM SPSS Statistic application.

Before being given treatment, the experimental class and control class were given a pretest of mathematics problem solving ability at first. Statistic of pretest data of experimental and control classes are presented in Table 5. below.

Table 5. Pretest Score Distribution for the Experimental and Control Class

Experimental Class		Control Class	
Score Interval	Frequency	Score Interval	Frequency
2.5-7.5	7	5-9	3
8-13	7	9.5-13.5	8
13.5-18.5	4	14-18	7
19-24	6	18.5-22.5	7
24.5-29.5	2	23-27	2
30-35	4	27.5-31.5	3
<i>n</i>	30	<i>n</i>	30
$\bar{x}$	15.917	$\bar{x}$	16.417
SD	8.6474	SD	7.2422

Additionally, posttest questions were administered to assess students' mathematical problem-solving skills after they were given distinct treatments for the two sample classes – the experimental class received the Problem-Based Learning model, while the control class received the Direct-Instructional model. The data shown in the Table 6. Below is based on the research findings.

Table 6. Posttest Score Distribution for the Experimental and Control Class

Experimental Class		Control Class	
Score Interval	Frequency	Score Interval	Frequency
40-50	4	35-45	1
51-61	1	46-56	9
62-72	11	57-67	9
73-83	3	68-78	6
84-94	8	79-89	2
95-105	3	90-100	3
<i>n</i>	30	<i>n</i>	30
$\bar{x}$	73.083	$\bar{x}$	64.250
SD	15.9158	SD	14.8433

From the acquisition of student pretest data, the average scores in the experimental and control classes were 15.917 and 16.417, respectively. While the posttest data of students in the experimental class has an average of 73.083 and in the control class of 64.250. Furthermore, normality and homogeneity test were carried out on the experimental class and control classes. The test criteria if the sig. value obtained more than 0.05 then it is concluded that the data is normally distributed. Based on the normality test processing, the results obtained are presented in Table 7. below.

Table 7. Normality Test Result

Instrument	Sig.	Result
Pre Experimental	0.125	Normal
Pre Control	0.140	Normal
Post Experimental	0.113	Normal
Post Control	0.170	Normal

Based on the results of data processing with the IBM SPSS application, it is known that all sig. values of each instrument are greater than 0.05 so that all pretests (0,310) and posttests (0,368)

in both experimental and control classes are normal. Furthermore, the homogeneity test was carried out. The homogeneity test in the experimental and the control classes is shown in Table 8. that the homogeneity test shows a significance value are more than 0.05 which indicated that the two sample groups have the same variance. Furthermore, hypothesis testing was carried out using the independent sample t-test and the Sig. (2-tailed) of 0.030 is less than 0.05, indicating that H_0 is rejected and H_a is accepted, according to the results of the hypothesis test in Table 9. This demonstrates that pupils taught using the Problem-Based Learning model and those taught using the Direct-Instructional model differ significantly in their capacity to solve mathematical problems.

Based on the findings of hypothesis testing using independent sample t-test, it is found that the mathematics problem solving abilities of students taught with the Problem-Based Learning model is superior than students taught with the direct instructional learning. This is based on testing using the t-test which found that there was a significant difference. A significant difference indicates the effect of treatment on one of the variables. This is in accordance with Salkind (2017) saying that significant differences can be interpreted as the influence or effect of the treatment applied. This also agrees with Sudjana (2002) who said that a significant difference in the averages indicates that the observed difference among the samples is unlikely to have occurred by chance; rather, there is a factor causing this difference.

The Problem-Based Learning model is not new in improving students' mathematics problem solving abilities. Setyaningsih & Rahman (2022) showed a significant difference between the control class and the experimental class, where the average post-test scores in the experimental and control class, where the average post-test scores in the experimental and control classes were 80 and 62.20, respectively. This shows that the research conducted by the researcher is not good. This is because the students studied had lower pretest scores in both the experimental and control classes. Elita, et al (2019) showed a significant average difference where the average scores in the experimental and control classes were 72.58 and 65 respectively. This shows that the research conducted by researchers is better.

The Problem-Based Learning model was applied to affect the students' mathematics problem solving abilities in class 8 SMP N 6 Medan, which was classified as low based on the results observed at school. This problem-based learning model has a syntax, which guides students to solve problems with the information they get individually or in groups. So that it can hone students' abilities in solving mathematics problems based on what they understand or find in everyday life.

The way problem-based learning model has an effect occurs because the stage of problem-based learning model. The first stage is orienting students towards the issues. This stage attracts students' attention to begin to understand the issue and think about how to solve it. The second stage is organizing students. This stage trains students in identifying the elements in the problem and analyzing ways to solve the problem. The third stage is guiding student investigations to solve problems. This stage trains students in devising the plan to solve the problem. The fourth stage is developing and presenting the results of problem solving. This stage trains students in carrying out the strategies to solving the problems. The fifth stage is evaluating and concluding the problem solving process. This stage trains students to conclude and interpret the solution obtained from the problem solving process.

CONCLUSION

It may be inferred from the analysis and hypothesis testing results that students taught using the Problem-Based Learning model are more adept at solving mathematical problems than students taught using the Direct-Instructional model. This is demonstrated by the sig. 003 < 0.05 result. After that, H_a is approved and H_0 is rejected.

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