

Analysis of IT-Assisted PBL-Based Problem Solving Ability at Nurul 'Azizi Integrated Islamic Middle School

Muhammad Fadhil Hidayat Siregar^{1*}

¹Departement of Mathematics Education, State University of Medan, Indonesia

*Corresponding Author: fadhilhidayat96@gmail.com

ABSTRACT

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Quantitative and quasi-experimental methods were employed in the investigation. Help with IT issues from a technical standpoint Scholars hold freedom and education in high regard. We administered these tests to eighth graders at Nurul Azizi Integrated Islamic Middle School. Thirty pupils make up each of the two VIII B and VIII A Random classes. The study established two groups: one to serve as a control and another to serve as an experimental group. Compare and contrast VIIIA with VIIIB. The control group used more traditional methods, while the experimental group used problem-based learning based on information technology. a research project having a strong emphasis on numerical data and statistical analysis. A statistical analysis was conducted. To estimate or predict something about a broader population, sample statistics can be utilized. Using assumptions about the data's underlying distribution, parametric statistics involves drawing conclusions about population parameters. A hypothesis is tested before any experiments are conducted. 1) The term "normality" describes a state of being typical or adhering to an average or standard. 2) Homogeneity is the attribute of being consistent or having the same makeup or nature throughout. 3) A hypothesis is a theory or prediction that can be investigated by observation or experimentation. The following results came from the study's investigation and discussion: The use of issue-based learning at SMP IT Nurul 'Azizi improves pupils' math problem-solving skills. This result was not unexpected, considering that the control group only managed 70 on average, whereas the experimental group averaged 82.27. Based on a 2-way significant value (t-tailed) of 0.000 and a 5% significance level ($5.793 > 2.002$), the problem-based learning strategy used by SMP IT Nurul 'Azizi enhances students' autonomy when compared to traditional methods. Compared to the experimental class, the control group had a lower average score of 74.70 and an average score of 85.83. This research employed a two-way ANOVA with an $\alpha = 0.05$ significance level. Students' ability to learn mathematics independently at SMP IT Nurul 'Azizi was influenced by their learning model ($p\text{-value} < 0.05$) and their baseline mathematical aptitude (high, medium, or poor). This research employed a two-way ANOVA with an $\alpha = 0.05$ significance level. With a significance level of 0.036, the final result is lower than the presumption of significance (0.05).

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A. INTRODUCTION

An integral part of every well-rounded education should be mathematics. Mathematics is a universal science since it is used in so many other scientific domains. Aside from that, everyday life can benefit greatly from mathematics. Mathematical riddles require the application of concepts and ideas learned throughout mathematics education, which begins in elementary school and continues through college.. This is so because mastering mathematics enhances cognitive abilities in people. So, learning mathematics may alter a person's cognitive, emotive, and psychomotor domains.

The learning objectives for mathematics are broken down into different sections by Hudojo (Susanti, 2020). Formal goals include developing pupils' personalities and organizing reasoning. (a) Material goals emphasize math and problem-solving skills. (c) It is possible to use mathematical abilities in any situation. These include critical, logical, systematic thinking as well as objectivity, honesty, and discipline in problem-solving.

Typical mathematical learning standards outline the skills and knowledge that students should have at graduation. Issue resolution, reasoning and evidence, communication, connections, and representations are all part of the process standards listed by the National Council of Teachers of Mathematics (NCTM). It is

imperative that students prioritize the development of their problem-solving skills. Understanding problems, building mathematical models, solving them, and explaining the outcomes are all skills that students should strive to develop. According to Hasratuddin (2014), Indonesia ranked 35th out of 46 nations in the 2003 TIMSS research, with an average score of 411, whereas the global average score was 467. Out of the 49 nations that took part in the 2007 TIMSS research, Indonesia was ranked 36th with an average score of 397. Of the 42 countries that took part in the 2011 TIMSS, Indonesia earned the lowest average score at 386, compared to 500 worldwide. Studies conducted by Hadi and Novalyosi (2019).

In order to solve problems, people use what they've learnt in the past, says Dahar (Sundayana, 2016). It's not the kind of thing you can learn on the fly. In addition, according to Rinny and Indri (2018), problem solving entails identifying the core issues and then developing and implementing strategies to address those issues. So, it's reasonable to assume that students' problem-solving abilities consist of being able to figure out a solution and then use it in real life, based on the viewpoint of the experts cited before. As stated by Yunus et al. (2021).

Almost all competence standards and core competencies stress the importance of problem-solving skills in mathematics. The ability to solve mathematical problems is a crucial skill for mathematicians. Experts in resolving complex issues. They can also design mathematical issues or compile mathematical models, apply problem-solving techniques, and explain or interpret their findings.

The actuality and the current reality, however, are inversely proportional. Sabirin (2011) claims that students' shortcomings in question analysis, problem-solving oversight, and outcome evaluation stem from these shortcomings. One of the main causes of the poor ability to solve mathematical problems is ineffective learning, especially when it comes to missing class periods. (Pratiwi and others, 2023).

According to the children's initial evaluations mentioned above, they are still not proficient in solving arithmetic problems. The study carried out by Padillah Akbar et al. (2018) supports this claim by demonstrating that students' problem-solving skills remain inadequate. The data reveals that 48.75% of students have attained a particular level of competency in understanding the problem, 40% in coming up with a solution, 7.5% in problem-solving, and 0% in checking (Akbar et al., 2018). Rinny and Indri (2018) (Yunus et al., 2021) subsequently demonstrated that pupils' mathematics problem-solving abilities were comparatively deficient. The better time management skills of female responders compared to male subjects had an impact on this.

Rohpinus Sarumaha (2022) asserts that students' problem-solving abilities are still deficient. This is due to students' focus on previously studied problems rather than their comprehension of the challenges, their inability to develop mathematical concepts, their inability to answer problems without a proper strategy, their lack of experience with different problem types, particularly those that combine two or more mathematical concepts, their propensity for memorization, their inability to comprehend number patterns from object configurations, and the routine nature of the problems they studied. Adhyan, Rahmah, and Sutirna, 2022

According to Rudnick, one needs to educate themselves on the latest developments in order to address these problems. Applying newly acquired information, understanding, and skills to address problems in unfamiliar situations is the process of problem solving. Laman, Gracya, et al. (2019). As such, problem-solving skills are essential to the learning process. In order to optimize learning, which impacts one's ability to solve mathematical puzzles, one needs to understand the concepts of accuracy, perseverance, and tolerance.

This study is crucial since it tackles the problems that students encounter in mathematics, as previously shown. Scholars are eager to carry out a study. "Analysis of Problem Solving Ability Based on IT-Assisted PBL at Nurul Azizi Integrated Islamic Middle School".

B. RESEARCH METHODS

In this quantitative study, we used a quasi-experimental methodology. This research delves at the topic of problem-based learning with the help of information technology (IT). The Nurul Azizi Integrated Islamic Middle School in Suka Maju, Kec. Medan Johor, Medan City, North Sumatra 20148 was the site of the research, which took place throughout the 2023–2024 academic year. In the fall of 2023–2024, namely in the months of September and October, the present study was conducted at Nurul 'Azizi Integrated Islamic Middle School with eighth graders.

Participants in this research are eighth graders of Nurul Azizi Integrated Islamic Middle School. For this investigation, eighteen students were randomly selected from both VIII A and VIII B. Research experimental and control courses were the next to be chosen. Class VIII A serves as the control group for Class VIII B in this study. When it came to learning, the experimental group leaned on problem-based technologies, while the control group stuck to traditional teaching techniques.

The format of the article citation in the paper should be followed carefully by the author; for example, if there are two authors, the format should be "Alberto and Jun (1992)" instead of "Alberto (1993)" for the first author. Write "Alberto et al. (1990)" with a note indicating that the point should come after "al," not after "et," if there are three or more writers. If page numbers are included in the in-text citation format, the author must take into account the following requirements. Use the notation "p." for a single referenced page number, and "pp." for multiple pages. For instance, according to Russeffendi (2005, p. 52), in quasi-experimental research, the circumstances of the subjects are accepted by the researchers and their group is not chosen at random.

Everyone in the community is being studied and analyzed. During the even semester of the 2019/2020 academic year, 160 students from 6 classes at SMP Negeri 1 Tambangan made up the population. Students' cognitive levels at the formal operational stage were considered to arrive at this conclusion (Ruseffendi, 2006). The sample is a good representation of the population, according to Sugiyono (2012) (pp. 118-200). Probability sampling is used to choose samples for this study. Simple random sampling is used to take the samples. Two classes were used for the research sample. One, VIII-1, had 26 students using the discovery learning paradigm as an experimental group. The other, VIII-2, had 26 students receiving the standard teaching as a control group.

Preparation, execution, analysis, and report writing make up this research. Detailed information about the study methods can be found in Figure 1 below.

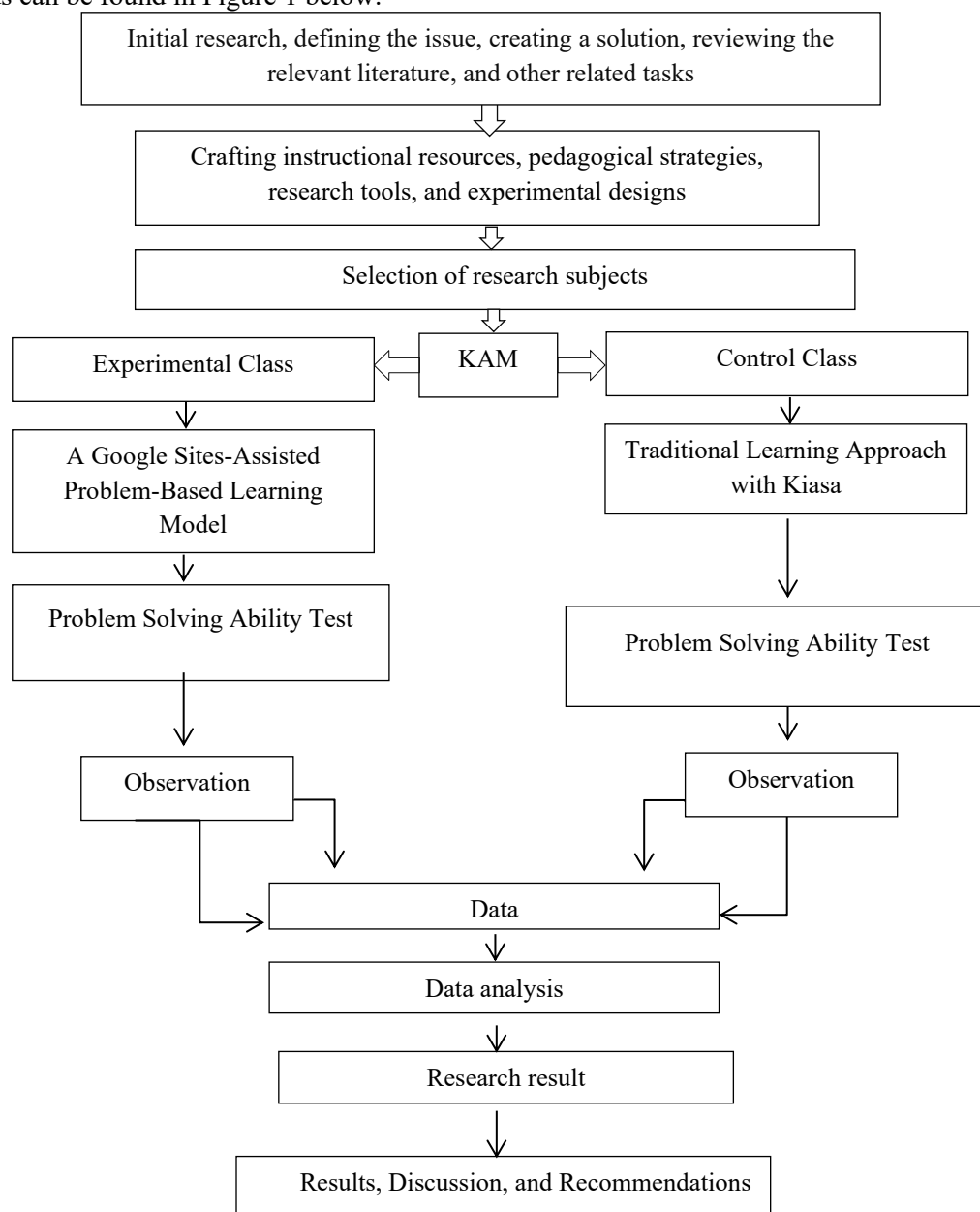


Figure 1. Research Procedure

C. RESULT AND DISCUSSION

Numerous types of data will be gathered for this project, such as the following: (1) the outcomes of tests that gauge pupils' beginning mathematical ability; (2) the findings of examinations that The ability of pupils in the control and experimental groups to solve mathematical problems.

1. Student Initial Mathematics Ability Test Results.

To ensure class equity in the study sample and to ascertain the kids' pre-learning capacities, the first math ability test is administered. For a summary of the results from the descriptive analysis of the students' original math ability data, see Table 1.

Table 1 An Account of the First-Year Math Skills of the Students.

Class	Ideal Score	N	$x_{\min}$	$x_{\max}$	$\bar{x}$
Controls	100	30	31	79	61.93
Experiment		30	34	88	65.73

a. Normality Test of Students' First-Semester Math Proficiency

The first math aptitude test's SPSS 25 normality calculation summary is displayed in Table 2. :

Table 2 Normality Test Results of Students' Initial Mathematics Ability Test

Tests of Normality		Kolmogorov-Smirnova		
	Class	Statistics	Df	Sig.
Initial_Ability	Controls	.153	30	.071
	experiment	.137	30	.159

Table 2 shows that in order to accept H_0 , we need to find a mean significant value for the in-class controls that is greater than 0.05. The experimental group also produced significance levels; accepting H_0 requires a mean value greater than 0.05. The students' first math exam scores were based on those in the control group, but the experimental group's scores are representative of a normally distributed population according to this measure of normalcy.

b. Homogeneity Test of Students' First-Time Math Proficiency

Following the normality test, the experiments and controls in the learning group will be subjected to a homogeneity of variance test at a significance level of 0.05. The theories that will be examined include: $H_0: \sigma_1^2 = \sigma_2^2$: In other words, the variance is the same in both groups; $H_1: \sigma_1^2 \neq \sigma_2^2$: According to the data shown above, this indicates that the two groups in question do not share a common variance: σ_1^2 : experimental class performance dispersion; σ_2^2 : variance of control class scores.

The test measures show that the data variance for both groups is consistent if the significance value is more than 0.05. But if 0.05 isn't big enough to be meaningful, it indicates that there is inconsistency in the data variance for both groups. We used SPSS 25 to conduct the Levene test and determine each student's level of consistency in solving mathematical problems. The results are displayed below.:

Table 3 Initial Mathematics Ability Test Homogeneity Test

Test of Homogeneity of Variances		Levene Statistics	df1	df2	Sig.
Initial_Ability	Based on the mean	.034	1	58	.855
	Based on the median	.001	1	58	.977
	Based on the median and an adjusted df	.001	1	56,282	.977
	Based on the reduced mean	.002	1	58	.883

Significant at the 0.05 level, with a value of 0.855, as shown in Table 3. This demonstrates that the data categories have a reasonable variance. Therefore, the results suggest that the experimental and control groups' variances are similar.

2. Outcomes of the Mathematical Problem Solving Ability Students in the Experiment Class and the Test of Control Class

The problem-solving skills test that was given to both groups at the end of the class had identical types of questions. A total of sixty students were given the post-test; thirty were assigned to the experimental group and thirty to the control group.

According to the post-test results, the experimental class and control class had the following scores: lowest ($X_{\min}$), highest ($X_{\max}$), average ($\bar{x}$), and standard deviation (SD), as indicated in table 4 below.

Table 4 Data from the Post Test on Mathematical Problem Solving Capabilities

Class	Ideal Score	Post test data			
		$x_{\min}$	$x_{\max}$	$\bar{x}$	elementary school
Controls	100	53	84	70.00	9.20
Experiment		69	95	82.27	7.17

The specifics of the posttest passing score criterion can be found in Table 5. In terms of student-to-problem-solving capacity, the experimental group outperformed the control group with a score of 69 out of 53. The experimental group of pupils proved to be far more adept at solving mathematical problems than the control group, with aptitude scores of 95 and 84, respectively. However, when it came time for the posttest, the control group only achieved 70.00 on the mathematical problem-solving ability section, whereas the experimental group averaged 82.27. Thus, compared to the control group, the experimental group outperformed them.

Based on the KAM category, the posttest results for mathematical problem-solving abilities are summarized in Table 5, which is located below.

Table 5 Post-Test Analysis of KAM-Based Problem-Solving Capabilities

KAM Category	Class Average	
	Controls	Experiment
Tall	81.83	90.38
Currently	69.35	81.88
Low	55.50	70.60

Table 6, which is grouped according to the KAM classification, shows the mean scores for each class: high, medium, and low. The control group averaged 81.83 on the high problem-solving aptitude scale, whereas the experimental group averaged 90.38. Furthermore, the median score for the control group was 69.35 and for the experimental group it was 81.88. Scores of 55.50 and 70.60 were given to the low category in the control group. Table 6 summarizes the students' initial ability groupings and displays the degree to which the pupils' skills were categorized.

Table 6 Standards for Classifying Students' Problem-Solving Skills Using KAM

KAM Value Interval	The number of students		Percentage		KAM Category
	Controls	Experiment	Controls	Experiment	
$THUR \geq \bar{x} + SD$	6	8	20%	26.6%	Tall
$\bar{x} - SD < THUR < \bar{x} + SD$	20	17	67%	57%	Currently
$THUR \leq \bar{x} - SD$	4	5	13%	16.6%	Low

The problem-solving abilities are arranged based on KAM in Table 6. In the control class, KAM was used to split the problem-solving abilities of the following groups: 6 (20%), 20 (67%), and 4 (13%). KAM was utilized to categorize the problem-solving abilities of the experimental class; 8 students (26.6%) were classified as high performers, 17 as medium performers (57%), and 5 as low performers (16.6%).

The results of classifying students' problem-solving skills are shown in Table 7, which also includes the total number of students in each experimental and control class who were categorized as high, medium, or low. As the table illustrates, there were noticeable differences between the experimental and control groups in every category.

Upon examining the larger picture, it becomes evident that traditional methods of instruction have an impact on students' engagement with and capacity to solve mathematical issues. Two methods for performing the analysis of variance (ANOVA) will be used

a. Normality Test of Mathematical Problem Solving Ability.

A overview of the normality calculations for mathematical problem-solving ability tests conducted using SPSS 25 may be seen in Table 7 below.

Table 7 Assessments of Students' Capacity to Solve Mathematical Problems: Results of a Normality Test

Tests of Normality				
	Class	Kolmogorov-Smirnova		
		Statistics	Df	Sig.
	Controls	.143	30	.121
Problem solving skills	Experiment	.141	30	.134

If the class controls' significance value is more than 0.05, the null hypothesis (H_0) is accepted, as shown in Table 8. Similar degrees of significance were observed in the experimental group's results; a mean value higher than 0.05 signifies the acceptance of H_0 . Students' ability to solve mathematical problems was evaluated in both the experimental and control groups using test data; however, the results of the normality test showed that the experimental group used data from a normally distributed population.

b. Homogeneity Test of Students' Mathematical Problem Solving Abilities

The control and learning group will undergo a homogeneity of variance test following the normalcy test, with a significance level of 0.05. The following hypotheses will be evaluated in light of this test $H_0: \sigma_1^2 = \sigma_2^2$. The variance of both populations is equivalent $H_0: \sigma_1^2 \neq \sigma_2^2$. It denotes Given the following data, it is clear that the two populations' variances are different: σ_1^2 : experimental class performance dispersion; σ_2^2 : variance of control class scores.

According to the test requirements, both populations exhibit homogenous group data variance if the value is greater than 0.05, and non-homogeneous data variance if the value is less than 0.05. Here are the results of using SPSS 25 to find out how similar students' Levene test scores are when it comes to solving mathematical problems.

Table 9 Test of Students' Ability to Solve Mathematical Problems in a Consistent Manner

Test of Homogeneity of Variances					
		Levene Statistics	df1	df2	Sig.
Problem solving skills	Based on the mean	3,594	1	58	,063
	Based on the median	3,845	1	58	,055
	Based on the median and with an adjusted df	3,845	1	57,851	,055
	Based on the reduced mean	3,734	1	58	,058

The statement that there is no variance difference across data groups must be believed, given the value of 0.063 shown in Table 9 is larger than 0.05 and is considered significant. A lack of statistical significance between the experimental and control groups' data variances follows.

To establish the study sample class's equivalency and students' aptitudes, the Early Mathematical Ability Test is given to them before the learning process starts. The learning objectives were descriptively analyzed using data from students' Early Mathematical Ability, as shown in Table 1.

D. CONCLUSION AND SUGGESTIONS

Students at SMP IT Nurul 'Azizi who are taught mathematics using a problem-based learning paradigm outperform those who are taught using a traditional approach, according to the evaluation and debate of this research. This is because, on average, the experimental group outperformed the control group. Moreover, in contrast to traditional education. Pupils' initial mathematical aptitude (high, medium, or poor) interacts with various teaching strategies at SMP IT Nurul 'Azizi to influence their ability to solve mathematical puzzles.

It takes time to create media and introduce learning when employing student-centered learning and IT support, so it is envisaged that teachers will be able to maximize preparation and learning during the implementation phase. To reduce flaws in the learning process, learning models and learning media should be implemented and modified in accordance with the content and circumstances of the learning environment..

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