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ANALYSIS OF PROBLEM SOLVING ABILITY AND INDEPENDENT LEARNING BASED ON IT-ASSISTED PBL AT NURUL AZIZI INTEGRATED ISLAMIC MIDDLE SCHOOL

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ABSTRACT

This research is crucial since students struggle with math. They want to "Analysis of Problem Solving Ability and Independent Learning Based on IT-Assisted PBL at Nurul Azizi Integrated Islamic Middle School" . This study is quantitative quasi-experimental. Fix IT issues Scholars value research and freedom. We tested eighth-graders at Nurul Azizi Integrated Islamic Middle School. Random VIII A and B have 30 students. Control and experimental groups are examined. VIIIB/VIIIA comparison. The control group employed conventional methods, while the experimental group used IT-based problem-based learning. Statistics-based research. A statistical analysis. Sample statistics predict a larger population. Parametric statistics estimates population parameters from distribution assumptions. Test a theory before experimenting. 1) Averages define typical. 2) Consistency unites. Three testable hypotheses tell or foretell. Discuss study results: Math issue-based instruction assists SMP IT Nurul 'Azizi pupils. This was expected as the experimental group scored 82.27 and the control 70. SMP IT Nurul 'Azizi's problem-based learning increases student autonomy more than conventional techniques with a 5% significance threshold (5.793>2.002) and a 2-way significant value (t-tailed) of 0.000. Compared to 74, the experimental group scored 85.83. SMP IT Nurul 'Azizi students' arithmetic problem-solving skills are linked to learning, with a 5% significant level (6.55>2.002) and 2-way t-tailed value of This study uses a two-way ANOVA with $\alpha = 0.05$. At SMP IT Nurul 'Azizi, pupils' arithmetic competency was influenced by their learning model and baseline ability (p-value 0.05). This study uses a two-way ANOVA with $\alpha = 0.05$. The significance threshold is 0.036, below 0.05.
Keywords: Ability, IT, Problem Based Learning, Problem Solving, Learning Independence

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PRELIMINARY

One of the subjects that is crucial to schooling is mathematics. Because it is employed in so many different scientific fields, mathematics is a universal science. Aside from that, mathematics is quite useful in daily life. In addition, the process of solving mathematical puzzles involves applying concepts or ideas that are learned while studying mathematics, which is studied from elementary school through higher education. This is because learning mathematics develops human thinking skills. Thus, a person's cognitive, affective, and psychomotor domains may change as a result of learning mathematics. Susanti (2020) divides mathematics learning objectives into various segments. Learning objectives in math can be divided. (a) Formal objectives, emphasizing organizing reasoning and forming students' personalities; (b) Material goals, emphasizing problem-solving and mathematics application; (c) Mathematical skills that can be used in any situation, such as thinking critically, logically, systematically, being objective, honest, and disciplined in problem-solving.

Hasratuddin (2014) said the mathematics learning process standards outline the basic skills children should learn in school. Process standards include problem solving, reasoning and evidence, communication, relationships, and representations, according to NCTM. The ability to solve difficulties is essential for kids. Students must understand problems, build mathematical models, solve them, and interpret outcomes. In Hadi & Novaliyosi (2019) Indonesia received an average score of 411, ranking 35th out of 46 participating nations, in 2003 TIMSS research, while the global average score was 467. Indonesia received an average score of 397, ranking 36th out of 49 participating nations, as per 2007 TIMSS research. In 2011, Indonesia received an average score of 386, ranking 38th out of 42 participating nations, according to 2011 TIMSS research. The international average score was 500.

Problem solving is a human activity that integrates previously acquired concepts and principles, as per Dahar (Sundayana, 2016). It is not a general ability that can be rapidly acquired. Additionally, Rinny and Indri (Yunus et al., 2021) Issue solving involves applying approaches to solve a problem. According to the experts, students' problem-solving talents are the ability to solve a problem and apply the solution in their daily life. Problem-solving skills in mathematics are required by almost every competency requirement and fundamental competency. Students studying mathematics must learn to solve mathematical issues. Problem-solving skills include identifying known elements, questions, and the sufficiency of required elements, generating mathematical concerns or models, applying problem-solving processes, and explaining or interpreting findings.

However, the reality is inversely proportional to the existing reality. According to Sabirin (Pratiwi et al., 2023), the weakness in solving student problems is their weakness in analyzing questions, monitoring the solution process, and evaluating the results. The ineffective learning, particularly the absence of class hours, is also a contributing factor to the low capacity to solve mathematical problems. The children's initial evaluations performed above indicate that their problem-solving abilities in arithmetic are still insufficient. This assertion is corroborated by the research conducted by Akbar et al (2018), which revealed that students' problem-solving abilities continue to be subpar. This is evident in the percentage of students who have achieved a certain level of proficiency in each indicator: 48.75% in comprehending the problem, 40% in devising a solution, 7.5% in solving problems, and 0% in checking. Subsequently, Rinny and Indri illustrated that students' mathematical problem-solving capabilities were relatively inadequate. This was influenced by the superior time management of female respondents in comparison to male subjects (Yunus et al., 2021).

According to Rohpinus Sarumaha, We used 10 National Examination (UN) questions that class XI students had studied. National Examination questions meet national requirements as good measuring tools. For problem solving, a multiple-choice test with five answers is employed, whereas for learning independence, a questionnaire is used (Adhyan & Sutirna, 2022). Problem-solving is key to learning. Learning and solving mathematical riddles require precision, tenacity, and patience. Positive thinking and problem-solving are needed by kids. Independent learning must be part of student identities. Math students gain from independence. Math independence, according to Reski, is learning without outside influence. Independent learning is driven by intrinsic motivation (Aprila & Fajar, 2022). According to Adila Putri, independence in learning is a condition of independent learning activities that does not depend on other people, has the will, initiative and is responsible for solving one's own learning problems (Arif et al., 2021).

In 2019, Sartika Lya Diah Pramesti underscored the importance of the problem-based learning model, stating that students' problem-solving abilities are superior to those in expository learning when they employ polya stages in hands-on activity-based Problem Based Learning (Ningrum, 2020). The learning independence of class V students at UPT SD Negeri 170 Putemata, Luwu Regency can be improved by the implementation of the Problem Based Learning paradigm, as discovered by Yunus et al. (2021). The aforementioned explanation suggests that the PBL paradigm has the potential to enhance the learning independence and problem-solving abilities of students (Yunus et al., 2021). Learning media, especially IT-based media, can help students study independently and solve problems. Many instructional websites exist today. As shown, students struggle with math, making this research crucial. Researchers are interested in conducting a study "Analysis of Problem Solving Ability and Independent Learning Based on IT-Assisted PBL at Nurul Azizi Integrated Islamic Middle School".

METHODS

This is quantitative quasi-experimental study. This study examines IT-assisted problem-based learning independence and problem-solving. Nurul Azizi conducted this 2023/2024 academic year research. Integrated Islamic Learning media, especially IT-based, helps pupils study and solve problems independently. Instructional websites abound today. Math is difficult for pupils, making this research vital.In general, this research has three stages: preparation, implementation, and final. In carrying out research, the research stages can be seen in Figure 1 as follows.

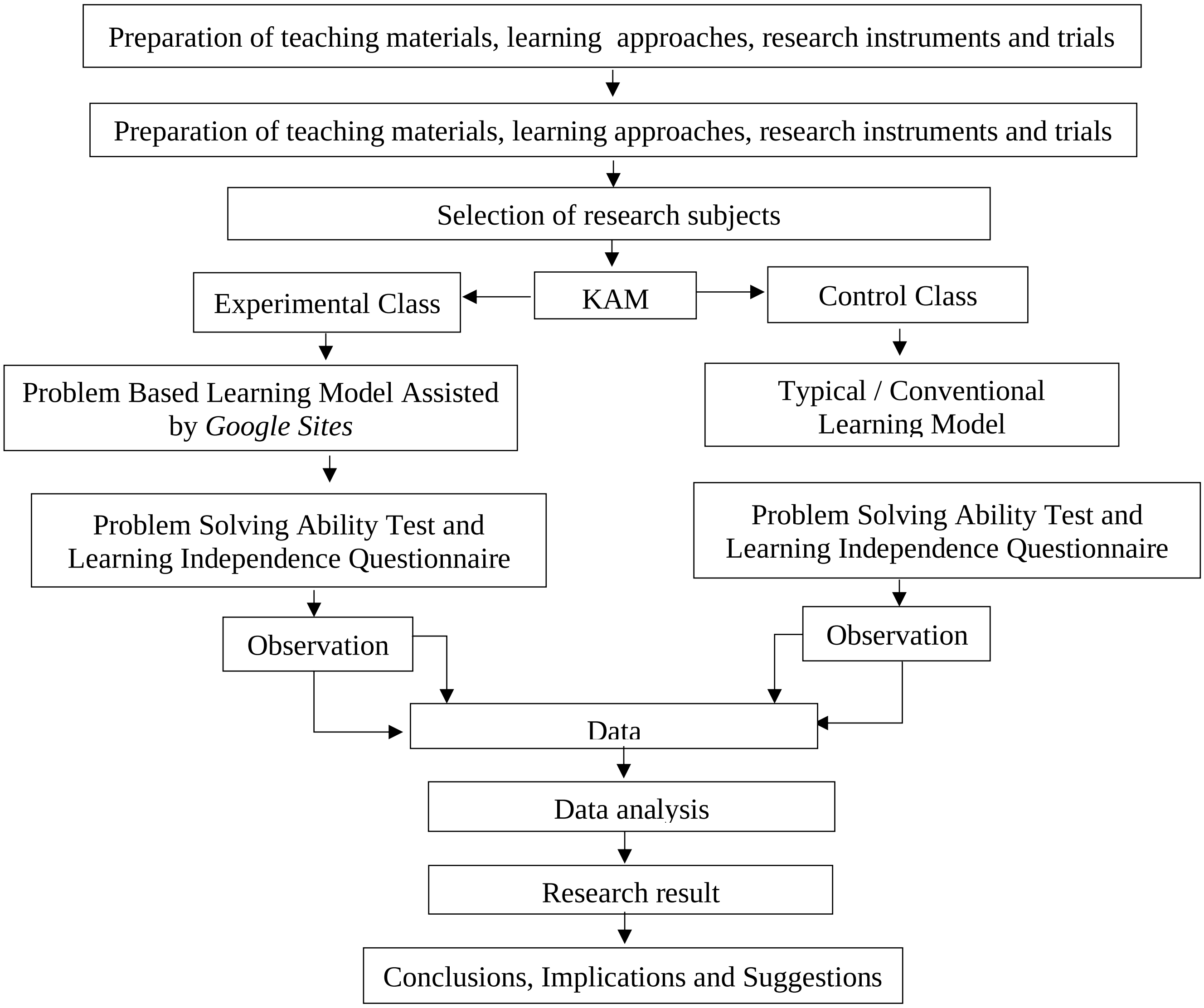

Figure 1. Research Procedure (Dhaniawaty et al., 2018)

Data analysis technique

In this research, researchers used quantitative data analysis techniques. This quantitative data was analyzed using statistical analysis. Before testing the hypothesis, the prerequisites for proving the hypothesis are tested, namely as follows.

(1) Normality test

The normality test is one of the prerequisite tests to fulfill the assumption of normality in parametric statistical data analysis. To test whether the sample came from a normally distributed population or not, the Kolmogorov Smirnov normality test was used using SPSS 26. The hypotheses tested were:

H_0: The sample comes from a normally distributed population

H_1: The sample comes from a population that is not normally distributed.

The population is normally distributed if that means $significance > 0.05$ H_1rejected so H_0

(2) Homogeneity Test

The homogeneity test is carried out to see the similarity of several parts of the sample, namely whether the variance of samples taken from the same population is uniform or not. The following is the formula for calculating the variance of the population as follows.

$$(1)\ \sigma^2 = \frac{\sum X^2 - \frac{(\sum X)^2}{N}}{N}$$ (Syahputra, 2016)

After obtaining the variance, the hypothesis that will be tested is as follows:

$H_0 : {\sigma_1}^2 = {\sigma_2}^2$ It meansboth populations have the same variance

$H_1 : {\sigma_1}^2 \neq {\sigma_2}^2$ It meansthe two populations do not have the same variance

Information :

${\sigma_1}^2$: variance of experimental class scores

${\sigma_2}^2$: variance of control class scores

The test criteria are:

If the value is , then it is accepted and rejected $significance\ < 0.05 H_0 H_1$

If the value then both populations have the same variance $significance\ > 0.05$

(3) Hypothesis testing

The statistical hypothesis test used was a two-way ANOVA with a significance level of 0.05.In this research there are four statistical hypotheses that will be tested. The statistical model of this research experiment is as follows (Syahputra, 2016):

$$(2)\quad Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \varepsilon_{k(ij)}\ ;$$
$$(3)\quad i = 1,2,3; j = 1,2\ ; k = 1,2, \dots n$$

Information:

Y_{ijk} : dependent variable score of the kth student, at the iKAM, who received learning j

μ : actual average score

α_i : influence of the ith KAM (low, medium and high)

β_j : the influence of the jth learning model (Problem based learning and ordinary/conventional)

$(\alpha\beta)_{ij}$: the effect of the interaction between the i-th KAM and the j-th learning model

$\varepsilon_{k(ij)}$: experimental deviation from the kth student at the ith KAM who received the jth lesson

There are assumptions that must be met and should be tested statistically:

1. The population tested is normally distributed
2. The variance or variety and the population tested are the same
3. The samples are not related to each other

To be more focused, below is presented in Table 1 the relationship between the problem formulation, research hypothesis and the type of statistical test that will be used.

Table 1. Relationship between Problem Formulation, Hypothesis, and Statistical Tests

No.	Formulation of the problem	Statistical Hypothesis	Statistic test
1	Are there differences in the ability to understand mathematical concepts based on students' initial mathematics abilities?	$H_0 : \alpha_i = 0$ $H_1 : \alpha_i \neq 0$	TWO WAY ANOVA
2	Are there differences in independence in mathematics learning based on students' initial mathematics abilities?	$H_0 : \alpha_i = 0$ $H_1 : \alpha_i \neq 0$	
3	Is there a difference in the problem solving abilities of students who are given the problem based learning model and students who are given the regular/conventional learning model?	$H_0 : \beta_j = 0$ $H_1 : \beta_j \neq 0$	
4	Is there a difference in the learning independence of students who are given the problem based learning model and students who are given the regular/conventional learning model?	$H_0 : \beta_j = 0$ $H_1 : \beta_j \neq 0$	
5	Is there an interaction between students' initial mathematics abilities and students' problem solving abilities?	$H_0 : (\alpha\beta)_{ij} = 0$ $H_1 : (\alpha\beta)_{ij} \neq 0$	
6	Is there an interaction between students' initial mathematical abilities and students' learning independence?	$H_0 : (\alpha\beta)_{ij} = 0$ $H_1 : (\alpha\beta)_{ij} \neq 0$	

(Zaki & Saiman, 2021)

Next, after carrying out the t test with the following formula.

$$(4)\quad t_{hit} = \frac{M_1 - M_2}{\sqrt{\frac{SS_1+SS_2}{n_1+n_2-2}\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} \qquad \text{(Sugiyono, 2020)}$$

Information :

M_1 : average score of the experimental class

M_2 : average score of the control class

SS_1 : Sum of squares of experimental classes

SS_2 :Sum of squares of control class

n_1 : number of experimental class samples

n_2 : number of control class samples

The t test is used to answer problem formulations 1 and 2, namely whether the problem solving abilities of students who are given the problem based learning model are better than students who are given the regular/conventional learning model, whether the learning independence of students who are given the problem based learning model is better than those of students who are given the problem based learning model. who are given the usual / conventional learning model.

RESULTS AND DISCUSSION

This study will collect a variety of data, including the following: (1) the results of assessments that measure students' initial mathematical proficiency; (2) the results of evaluations that measure The mathematical problem-solving capabilities of students in both the control and experimental groups and (3) the findings of the learning independence survey, which was given to students in the experimental and control groups.

(1) Student Initial Mathematics Ability Test Results.

The initial mathematics ability examination of the students is utilized to ensure the class equality of the research sample and to identify the students' pre-learning capabilities. Table 2 below provides a synopsis of the findings derived from the descriptive analysis conducted on the initial mathematics aptitude data of the students:

Table 2. Description of Students' Initial Mathematics Ability Results

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

(a) Normality Test of Students' Initial Mathematics Abilities

Table 3 shows the SPSS 25 normalcy calculation summary of the initial maths aptitude test:

Table 3. 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

Based on table 3 above, relevance of in-class controls value obtained 0.071 which mean significant value > 0.05 then H0 is accepted. Likewise in the experimental class, significance values were obtained0.159 which mean significant value > 0.05then H0 is accepted. Thus, from this normality test, The experimental class is sample data from a normally distributed population, while the students' initial mathematics test data was obtained from the class controls.

(b) Homogeneity Test of Students' Initial Mathematics Abilities

Following the normality test, a homogeneity of variance test will be conducted on the learning group controls and experiments at a significance level of 0.05 and the hypotheses to be tested are: $H_0: \sigma_1^2 = \sigma_2^2$ It means both populations have the same variance. $H_1: \sigma_1^2 \neq \sigma_2^2$ It meansThe two populations do not have the same variance, with the following information: σ_1^2: variance of experimental class scores; σ_2^2: variance of control class scores.

The test measures are as follows: if the significance value > 0.05, it means that the data variance of both groups is consistent. On the other hand, if the significance value < 0.05, it means that the data variance of both groups is not consistent. Using SPSS 25, we administered the Levene test to find out how consistently proficient each student was at completing mathematical problems. The findings are shown below.:

Table 4. Homogeneity Test of Students' Initial Mathematics Ability Test

Test of Homogeneity of Variances

		Levene Statistics	df1	df2	Sig.
Initial_Ability	Based on Mean	,034	1	58	,855
	Based on Median	,001	1	58	,977
	Based on Median and with adjusted df	,001	1	56,282	,977
	Based on trimmed mean	,002	1	58	,883

Table 4 indicates that the significance value is 0.855, which > 0.05. This indicates that there is no variance difference between the data categories, which is acceptable. Consequently, Based on the data, it appears that the control and experimental classes have similar variances.

(2) Results of the Mathematical Problem Solving Ability Test of Control Class and Experiment Class Students.

At the end of the class, both groups took the problem-solving ability test, which used the same question styles. The post-test was administered to a total of sixty students, with thirty each assigned to the experimental and control groups.

Based on data from the post test results, the lowest score was obtained (x_{min}), highest score (x_{max}) average score ($\overline{x}$) and standard deviation (SD) for the control class and experimental class as shown in table 5 below:

Table 5. Post Test Result Data for Mathematical Problem Solving Ability

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

Table 5 contains specific information on the minimum score required for the posttest. The experimental class demonstrated a higher level of performance, with a student-to-problem-solving ability of 69, compared to 53 for the control class. The experimental group consists of pupils who have a significantly greater aptitude for solving mathematical problems compared to the control group, their aptitude is 95, whereas the control group's is 84. In the same vein, the experimental group's average posttest score for their mathematical problem-solving abilities was 82.27, while the control group's score was only 70.00. Consequently, the experimental group exhibited superior performance in comparison to the control group. Table 6 below provides a summary of the posttest outcomes pertaining to mathematical problem-solving capabilities, organized by the KAM category:

Table 6. Post Test Description of Problem Solving Ability Based on KAM

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

The mean scores for each class are presented in table 6, which is categorised as high, medium, and low according to the KAM classification. The control group's mean problem-solving aptitude was 81.83 in the high category, whereas the experimental group's was 90.38. Furthermore, the control group achieved a median score of 69.35, while the experimental group achieved a score of 81.88. The control group's low category achieved scores of 55.50 and 70.60. Table 7 provides a summary of the initial ability groupings for students, indicating the degree of grouping for students' abilities:

Table 7. Criteria for Grouping Student Problem Solving Abilities Based on KAM

KAM Value Interval	The number of students		Percentage		KAM Category
	Controls	Experi ment	Controls	Experim ent	
THUR ≥ $\bar{x}$+SD	6	8	20%	26.6%	Tall
$\bar{x}$ – SD < THU < $\bar{x}$+SD	20	17	67%	57%	Currently
THUR ≤ $\bar{x}$ – SD	4	5	13%	16.6%	Low

Table 7 groups problem-solving abilities by KAM. In the control class, KAM was used to group problem-solving abilities: 6 (20%), 20 (67%), and 4 (13%). The experimental class grouped issue-solving abilities by KAM, with 8 students (26.6%) in the high category, 17 in the middle (57%), and 5 in the low category. 16.6%).

Based on table 7, data from grouping students' problem solving abilities, you can observe the percentage and number of students who obtained high, medium and poor categories for each control class and experimental class. The experimental and control divisions demonstrated variations in each category, as evidenced by the table.

An analysis of the whole picture demonstrates that traditional learning techniques have an impact on students' interaction and mathematical problem-solving skills. A two-way analysis of variance (ANOVA) will be performed.

(a) Normality Test of Mathematical Problem Solving Ability

Table 8 below provides a summary of the normality calculations performed on mathematical problem-solving aptitude tests utilizing SPSS 25:

Table 8. Normality Test Results of Students' Mathematical Problem Solving Ability Tests

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

Based on table 8, in class controls significance value obtained 0.121 which mean significant value > 0.05 then H0 is accepted. Likewise in the experimental class, significance values were obtained 0.134 which mean significant value > 0.05 then H0 is accepted. The normality test indicated that the classroom control group used the test data to assess the students' mathematical problem-solving ability, whereas the experimental group used sample data from a population that followed a normal distribution.

(b) Homogeneity Test of Students' Mathematical Problem Solving Abilities

Following the normality test, a homogeneity of variance test will be conducted on the learning group control and experiments at a significance level of 0.05. The hypotheses that will be assessed using this test are as follows: $H_0: \sigma_1^2 = \sigma_2^2$ The variance of both populations is equivalent ; $H_1: \sigma_1^2 \neq \sigma_2^2$ It means The two populations do not have the same variance, with the following information: σ_1^2: variance of experimental class scores; σ_2^2: variance of control class scores.

The test criteria are if the value is significant > 0.05 then both populations have homogeneous group data variance and if the value significant < 0.05 then both populations have non-homogeneous data variance. The outcomes of employing SPSS 25 to compute the homogeneity of students' mathematical problem-solving capabilities via the Levene test are as follows:

Table 9. Homogeneity Test of Students' Mathematical Problem Solving Ability Test

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

Table 9 indicates that the significance value is 0.063, which indicates significance > 0.05 so that H_0 in order to believe the statement that there is no variance difference between data groups. Consequently, it is possible to infer that the variance of the data in the experimental and control classes is equivalent.

(3) Results of the Learning Independence Questionnaire for Control Class and Experiment Class Students

Table 10 illustrates the lowest score (x_{min}), greatest score (x_{max}) average score ($\overline{x}$) and standard deviation (SD) for the control and experimental classes as a result of the cognitive independence questionnaire :

Table 10. Post Test Results Data for Mathematics Learning Independence

Class	Ideal Score	Post test data			
		x_{min}	x_{maks}	$\overline{x}$	elementary school
Controls	100	54	85	74.70	7.13
Experiment		71	93	85.83	6.06

Table 10 illustrates the minimum score on the posttest that evaluates students' independence in mathematical learning. Conversely, the experimental group achieved a score of 71, while the control group achieved a score of 54. Consequently, the experimental group demonstrated superior performance in comparison to the control group. The rate at which the control group resolves mathematical problems is 85, while the rate at which the experimental group does so is 93. The experimental group therefore performs superiorly to the control group. In the same vein, the experimental group's average posttest score for their mathematical problem-solving abilities was 85.83, whereas the control group's was 74.70. Consequently, the experimental group exhibited superior performance in comparison to the control group.

The outcomes of the mathematics learning independence survey among students are successively presented in Table 10, categorized by KAM:

Table 11. Description of Learning Independence Based on KAM

KAM Category	Class Average	
	Controls	Experiment
Tall	82.67	92.43
Currently	75.00	85.95
Low	61.25	73.75

Table 11 illustrates the average learning independence score of mathematics students who classify each class according to the KAM (Knowledge, Attribution, and Moderate) system. As illustrated in The experimental class has a mean level of student learning independence of 92.43, while the control class has a mean level of 82.67 for the high category (Table 11). Furthermore, the control group obtained a median score of 75, whereas the experimental group achieved a score of 85.95. The control group's low category achieved a score of 61.25, while the experimental group's score was 73.75. The subsequent summary of student learning independence is correlated with the categorisation of students' initial abilities into categories, as illustrated in Table 11:

Table 12. Criteria for Grouping Student Learning Independence Based on KAM

KAM Value Interval	The number of students		Percentage		KAM Category
	Controls	Experiment	Controls	Experiment	
THUR $\geq \bar{x}$+SD	3	7	10%	23.3%	Tall
$\bar{x}$ – SD < THU < $\bar{x}$+SD	23	19	76.6%	63.3%	Currently
THUR $\leq \bar{x}$ – SD	4	4	13%	13.3%	Low

The KAM-based classification of student learning independence is shown in Table 12. In the control group, the problem-solving abilities were classified according to KAM as follows. Three pupils (10%) were classified as high, 23 (76.6%) as medium, and four (13.3%) as low. In contrast, the experimental class was classified based on KAM's assessment of students' learning independence: seven students (23.3%) had high learning independence, nineteen students (63.3%) had medium learning independence, and four students (13.3%) had low learning independence.

(a) Normality Test of Student Mathematics Learning Independence

Table 12 below provides a summary of the normality calculations performed on the mathematics learning independence questionnaire using SPSS 25:

Table 12. Normality Test Results for Mathematics Learning Independence

Tests of Normality

		Kolmogorov-Smirnova		
	Class	**Statistics**	**Df**	**Sig.**
Independence_Learning	Controls	,150	30	,083
	Experiment	.153	30	,069

According to the outcomes of the Kolmogorov-Smirnov normality test presented in Table 13, the obtained class control significance value was 0,083 which mean significant value > 0.05 then H0 is accepted. Likewise in the experimental class, significance values were obtained 0,069 which mean significant value > 0.05 then H0 is accepted. After conducting this normality test, it was determined that the data acquired from the experimental class and the classcontrols is a sample population that is normally distributed.

(b) Homogeneity Test of Independent Mathematics Learning

Following the completion of the normality test, the learning group control and experiments will undergo a homogeneity of variance test with a significance level of 0.05. The subsequent hypotheses will be investigated: $H_0: \sigma_1^2 = \sigma_2^2$: Meaning that the variance is the same for both populations$H_1: \sigma_1^2 \neq \sigma_2^2$: The variances of the two populations are not identical., with the following information: σ_1^2: variance of ratings in experimental classes; σ_2^2: variance of scores in the control class.

The test criteria are if the significant value > 0.05 then both populations have homogeneous group data variance and if the significant value < 0.05 then both populations have non-homogeneous data variance:

Table 14. Homogeneity Test of Mathematics Learning Independence Test

Test of Homogeneity of Variances

		Levene Statistics	df1	df2	Sig.
Independence_Learning	Based on Mean	,703	1	58	,405
	Based on Median	,399	1	58	,530
	Based on Median and with adjusted df	,399	1	55,865	,530
	Based on trimmed mean	,583	1	58	,448

Based on Table 14, it demonstrates that the significance value is 0.405 which means significant > 0.05 so that H_0 so that stating there is no difference in variance between data groups can be accepted. Based on the findings, it can be inferred that the data variance mathematics learning independence questionnaire is comparable between control and experimental groups.

CONCLUSION

From the analysis and discussion of this research, a diverse array of audiences are derived: (1) At SMP IT Nurul `Azizi, students who are provided with a problem-based learning paradigm demonstrate superior mathematical problem-solving abilities in comparison to those who receive traditional instruction. This is predicated on the fact that the experimental class's average score exceeds that of the control group. Furthermore, compared to conventional learning, students at SMP IT Nurul 'Azizi demonstrate greater learning independence when given a problem-based learning paradigm. Students' exposure to different learning methods at SMP IT Nurul 'Azizi interacts with their starting mathematical talents (high, medium, or low) to shape their capacity to solve mathematical problems. Finally, students' starting mathematics ability (high, medium, or low) and the learning models they are exposed to interact to impact their independent mathematics learning at SMP IT Nurul 'Azizi.

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