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The Effect of Mathematical Logical Intelligence, Mathematical Connections, and Learning Interest on Students' Mathematical Problem Solving Ability

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A B S T R A C T

Mathematical problem solving is a high-level thinking skill that needs to be developed in mathematics learning. However, there is a gap in the integration of logical-mathematical intelligence, mathematical connections, and learning interests holistically, because learning tends to focus more on memorization than contextual problem solving. This study aims to analyze the influence of logical-mathematical intelligence, mathematical connection ability, and learning interests on students' mathematical problem solving abilities. This study uses a quantitative method with data analysis techniques using SPSS 23. The research locations include SD Negeri Bojong 01, SD Negeri Bojong 02, and SD Negeri Bojong 03 in Bojong District, Tegal Regency, with a population of all grade IV students and a sample of 124 respondents. The results of the study indicate that: (1) there is a significant influence between logical-mathematical intelligence and students' mathematical problem solving abilities; (2) there is a significant influence between mathematical connection ability and students' mathematical problem solving abilities; (3) there is a significant influence between learning interests and students' mathematical problem solving abilities; and (4) there is a significant simultaneous influence between logical-mathematical intelligence, mathematical connection ability, and learning interests on students' mathematical problem solving abilities. These findings emphasize the importance of a holistic approach in mathematics learning to improve students' problem-solving abilities.

Keywords: *Learning Interest, Logical Mathematical Intelligence, Mathematical Connections, Problem Solving Abilities*
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INTRODUCTION

The development of civilization encourages the world of education to always improve the quality of learning and talent of the nation's next generation. This is the role of education in creating a competent next generation and is expected to be able to answer the nation's challenges and problems in the era of technological development. Education prepares students to contribute to social life and in the world of work which is a major challenge in the 21st century in accordance with the duties and functions of national education (Yuliana et al., 2023). Problem solving is part of a very important need because in the learning process so that it is possible for students to gain experience in using the knowledge and skills they have to apply to solving problems faced daily and non-routine problems. Rahmadi in Davita and Pujiastuti (2020) stated that mathematical problem solving is one of the mathematical activities that is considered important, both by teachers and students at all levels.

Mathematical logical intelligence is a person's ability to think logically, analyze problems, and use mathematical concepts to solve problems. Irawan et al (2016) state that mathematical logical intelligence is the ability to think systematically and logically based on

effectiveness and good reasoning. People who have good mathematical logical intelligence tend to have critical, analytical, and logical thinking skills. This intelligence involves several aspects, including the ability to use numbers well and perform correct reasoning, solve problems using logical thinking skills, and the ability to recognize logical patterns and relationships in certain data or situations.

Mathematical connection ability is one of the fundamental abilities that must be possessed by students in learning mathematics. Low mathematical connection skills can affect students' understanding of an idea, topic, or material in mathematics (Jiah et al., 2023). Mathematical connection ability allows a person to understand mathematics more deeply and apply it more broadly. By developing this ability, students can relate mathematical concepts to the real world and solve problems more effectively.

Awaliyah and Fitrianna (2023) in Yuliati (2021) define interest in learning as a person's interest in being fully involved in something by pouring all his thoughts and attention to gain knowledge and achieve an understanding of the knowledge he demands without any external coercion. Based on some of these definitions, it is concluded that interest in learning mathematics is a student's interest in learning mathematics so that he is actively involved and gives his attention during the learning process and feels happy in doing so.

Based on the problems that have been described, this study has several objectives, namely: (1) to determine whether mathematical logical intelligence affects students' mathematical problem solving ability, (2) to determine whether mathematical connection ability affects students' mathematical problem solving ability, (3) to determine whether interest in learning mathematics affects students' mathematical problem solving ability, (4) to determine whether mathematical logical intelligence, mathematical connection ability, and interest in learning simultaneously affect students' mathematical problem solving ability.

METHOD

This research is a quantitative study aimed at exploring the effect of mathematical logical intelligence, mathematical connection ability, and learning interest on students' mathematical problem-solving abilities. The independent variables in the study include mathematical logical intelligence, mathematical connection ability, and interest in learning, while the dependent variable is students' ability to solve mathematical problems. The research was conducted at three schools in Bojong District, Tegal Regency, namely Bojong 01, Bojong 02, and Bojong 03 State Elementary Schools. The study population consisted of all fourth-grade students in the district, and the research sample included 124 students selected for participation. Data was collected using test instruments and questionnaires, with the test instruments measuring mathematical problem-solving ability, logical intelligence, and connection ability, while the questionnaire assessed students' interest in learning mathematics.

To analyze the data, the study employed multiple linear regression analysis using the SPSS 23 application. This statistical method was used to determine the individual and collective impact of the independent variables—mathematical logical intelligence, mathematical connection ability, and learning interest—on the dependent variable, which is the students' ability to solve mathematical problems. By applying this analysis, the study aimed to reveal both the partial and simultaneous effects of these factors on students' mathematical problem-solving abilities, providing insights into which aspects are most influential in enhancing mathematical learning outcomes.

FINDINGS AND DISCUSSION

To determine the effect of mathematical logical intelligence, mathematical connection ability, and interest in learning mathematics on students' mathematical problem solving ability, multiple linear regression analysis was used. In this study, multiple regression analysis aims to determine the regression equation that describes the relationship between mathematical logical intelligence, mathematical connection ability, and interest in learning to students' mathematical problem solving ability.

The regression model is illustrated as follows: independent variables include mathematical logical intelligence, mathematical connection ability, and interest in learning mathematics, while the dependent variable is problem solving ability, with E as the residual variable representing other factors that affect Y but are not studied. The relationship between mathematical logical intelligence, mathematical connection ability, and interest in learning is correlational. Meanwhile, the relationship between mathematical logical intelligence, mathematical connection ability, learning interest and problem solving ability is causal. There are two tests that need to be done in multiple regression analysis, namely the classical assumption test and the model feasibility test. The classical assumption test consists of normality test, autocorrelation test, multicoloniarity test, and heteroscedasticity test. While the model feasibility test (Goodness of fit model) consists of model reliability test (F test) and regression coefficient test (t test) then the coefficient of determination and finally model interpretation.

Table 1. Multiple linear regression analysis results using SPSS 23

Model	*Unstandardized*		*Standardized*	*t*	*Sig.*
	B	***Std. Error***	**Beta**		
Constant	11,734	2,991		3,923	0,000
Mathematical Logical Intelligence	0,230	0,058	0,293	3,959	0,000
Mathematical Connection	0,445	0,061	0,500	7,307	0,000
Interest in Learning	0,209	0,048	0,219	4,366	0,000

Based on Table 1 in the Unstandardized Coefficients section, the value of B = 11.734 indicates that if all independent variables (mathematical logical intelligence, mathematical connection, and interest in learning) are 0, then the predicted value of problem solving ability is 11.734. t = 3.923, Sig. = 0,000: This constant value is statistically significant ($p < 0.05$), which means the constant value is reliable.

In the independent variable of mathematical logical intelligence, the value of B = 0.230 which means that every one unit increase in mathematical logical intelligence will increase problem solving ability by 0.230 units, assuming other variables remain constant. The Beta value = 0.293 indicates that in the standardized coefficient, mathematical logical intelligence has a moderate influence on problem solving ability compared to other variables. Furthermore, obtained t value = 3.959, Sig. = 0.000, this coefficient is statistically significant ($p < 0.05$). mathematical logical intelligence has a significant influence on problem solving ability, with a relative contribution of 29.3% of the total variability of problem solving ability explained by the regression model.

In the independent variable of mathematical connection, the value of B = 0.445 which means that every one unit increase in mathematical connection will increase problem solving ability by 0.445 units, assuming other variables remain constant. Beta value = 0.500 indicates that in the standardized coefficient, mathematical connection has the greatest influence on problem solving ability compared to other variables. Furthermore, the value of t = 7.307 and Sig. = 0.000, this coefficient is statistically significant ($p < 0.05$). mathematical connection has a significant influence on problem solving ability, with a relative contribution of 50.0% of the total variability of problem solving ability explained by the regression model.

In the independent variable of interest in learning, the value of B = 0.209 which means that every one unit increase in interest in learning will increase problem solving ability by 0.209 units, assuming other variables remain constant. The Beta value = 0.219 indicates that in the standardized coefficient, learning interest has the smallest effect on problem solving ability compared to other variables. Furthermore, the t value = 4.366 and Sig. = 0.000, this coefficient is statistically significant ($p < 0.05$). learning interest has a significant influence on problem solving ability, with a relative contribution of 21.9% of the total variability of problem solving ability explained by the regression model.

Table 2. Multiple linear regression variable coefficients

Variable	Coefisien β	Error Standard
Constant	11,734	2,991
Mathematical Logical Intelligence	0,230	0,058
Mathematical Connection	0,445	0,061
Interest in Learning	0,209	0,048

Based on Table 2 shows the coefficient is a form of a regression equation that can be written as follows.

$$\hat{Y} = 11{,}734 + 0{,}230X_1 + 0{,}445X_2 + 0{,}209X_3 + e$$

Normality Test

The normality test is carried out to ensure that the residuals in the regression model fulfill the assumption of normality. A good regression model is to have a normally distributed residual value. Normality tests can be done with the histogram test, normal P Plot test, Chi Square test, Skewness and Kurtosis or Kolmogorov Smirnov test, Shapiro-wilk test and so on. In this study, the normality test used the Kolmogorov-Smirnov and Shapiro-Wilk methods.

Tabel 3. The Result of Residual Normality Test

Kolmogorov Smirnov	0,200	Criteria > 0,05	Normal Distributed
Shapiro-Wilk	0,056		Normal Distributed

The analysis results in Table 3 show that the significance value for the Kolmogorov-Smirnov test is 0.200 > 0.05 so that the residuals are normally distributed. Meanwhile, the significance value for the Shapiro-Wilk test is 0.056 > 0.05 indicating that the residuals are normally distributed. Based on the normality test on the residuals, the significance value for the Kolmogorov-Smirnov test is 0.200, while the significance value for the Shapiro-Wilk test is 0.056. This means that the residuals in the regression model fulfill the normality assumption of the significance value because in both tests the value is greater than the significance level of 0.05, it can be concluded that the residuals in the regression model are normally distributed. This shows that the assumption of normality in regression analysis has been met, so that the results of regression analysis can be interpreted validly. The normality test that meets these criteria strengthens the reliability of the regression model used in the study to explain the effect of mathematical logical intelligence, mathematical connection, and learning interest on mathematical problem solving ability of elementary school students.

Autocorrelation Test

A regression model can be said to be good when it is free from autocorrelation. Autocorrelation tests that can arise due to sequential observations over time and are related to each other (Ghozali, 2016). This problem arises because the residuals are not free from one observation to another. The autocorrelation test aims to show the correlation of members of observations sorted by time or space (Ajija, 2011). The autocorrelation test aims to test

whether in a linear regression model there is a correlation between confounding errors in period t and errors in the previous period. If there is a correlation, it is called an autocorrelation problem. This problem arises because the residuals (confounding errors) are not free from one observation to another.

Autocorrelation symptoms can be detected using the Durbin-Watson test by determining the Durbin-Watson value (d). The autocorrelation test is only performed on time series data and does not need to be performed on cross section data such as in a questionnaire where all variables are measured simultaneously. How to do the autocorrelation test with Durbin-Watson can be done by finding the dL and dU values of the t-table based on the number of research samples and then determining whether the research data has an autocorrelation problem based on the decision-making criteria.

The autocorrelation test is carried out to determine whether the regression model is free from autocorrelation. In this study, the autocorrelation test was carried out using the Durbin-Watson method. Based on the results of multiple linear regression analysis, the following results are obtained.

$n = 124$
$d = 1{,}905$
$dL = 1{,}6577$
$dU = 1{,}7567$
$4 - dL = 4 - 1{,}6577 = 2{,}3423$
$4 - dU = 4 - 1{,}7567 = 2{,}2433$

Because dU<1.905<4-dU, H0 is accepted, meaning that there is no autocorrelation which is an indication that the assumption of residual independence has been met.

Multicollinearity Test

The multicollinearity test aims to test whether the regression model found a correlation between the independent variables. A good regression model should not have a correlation between the independent variables. To determine the presence of multicollinearity in the regression model, it can be seen from the Variance Inflation Factor (VIF) and Tolerance values. If Tolerance > 0.1 and VIF < 10 indicates that there is no multicollinearity problem in the model.

Table 4. Tolerance and VIF values for each variable

Variables	*Tolerance*	VIF	Description
Mathematical Logical Intelligence	0,298	3,361	No Multicollinearity Occurs
Mathematical Connection	0,347	2,879	No Multicollinearity Occurs
Interest in Learning	0,647	1,546	No Multicollinearity Occurs

Based on Table 4, it shows that in mathematical logical intelligence, the Tolerance value is 0.298 and the VIF value is 3.361. Tolerance shows the level of correlation between mathematical logical intelligence and other independent variables. In mathematical connection, the Tolerance value is 0.347 and the VIF value is 2.879. This value indicates that there is no multicollinearity problem. In learning interest, the Tolerance value is 0.647 and the VIF value is 1.546. This value indicates that there is no multicollinearity problem. So, it can be concluded that all independent variables which include mathematical logical intelligence, mathematical connection, and interest in learning have Tolerance and VIF values within a safe range. The Tolerance and Variance Inflation Factor (VIF) values of the three variables show that there is no multicollinearity problem in this regression model, with the tolerance value of each variable being above 0.1 and VIF below 10. This confirms that

each independent variable in the model has a contribution to the dependent variable without a high correlation between the independent variables.

Heteroscedasticity Test

Heteroscedasticity test aims to test whether in the regression model there is an inequality of variance from residuals or other observations. There are several ways to determine the presence or absence of heteroscedasticity in a regression model, but in this study using the Glejser Test.

Table 5. Heteroscedasticity Test Results

Variables	*Sig.*	Description
Mathematical Logical Intelligence	0,503	No heteroscedasticity
Mathematical Connection	0,267	No heteroscedasticity
Interest in Learning	0,357	No heteroscedasticity

Based on Table 5, it shows that this test uses the Glejser test method whose value is seen from the significance on the variables of mathematical logical intelligence, mathematical connection, and learning interest has a sig. value greater than 0.05, so it can be said that the data does not occur heteroscedasticity.

F Test (Model Reliability Test)

The F test in regression analysis is used to assess the significance of the regression model as a whole. This test aims to determine whether the independent variables entered into the model together have a significant effect on the dependent variable.

Table 6. F Test Results

F	*Sig.*
164,830	0,000

Based on the ANOVA analysis results in Table 6, the F value obtained is 164.830 with a significance value of 0.000. Because the significant value of F <0.05, H0 is rejected and H1 is accepted. This means that all independent variables have a significant influence on the dependent variable or it can be said that the regression model used in this study is statistically significant. So, the independent variables which include mathematical logical intelligence, mathematical connection, and interest in learning, together make a significant contribution to mathematical problem solving ability.

Test t (Regression Coefficient Test)

The t test in regression analysis is used to test the hypothesis of the effect of the independent variable on the dependent variable. The t test aims to determine whether there is a significant relationship from each independent variable to the dependent variable in the study.

Table 7. T Test Results

Variables	**Sig.**	Description
Mathematical Logical Intelligence	0,000	Has a significant relationship to problem solving ability
Mathematical Connection	0,000	Has a significant relationship to problem solving ability
Interest in Learning	0,000	Has a significant relationship to problem solving ability

Based on Table 7, it is known that the significance value on mathematical logical intelligence is 0.000 <0.05 so that mathematical logical intelligence has a significant relationship to problem solving ability, the significance value on mathematical connections is 0.000 <0.05 so that mathematical connections have a significant relationship to problem solving ability, and the significance value on learning interest is 0.000 <0.05 so that learning interest has a significant relationship to problem solving ability. This shows that partially mathematical logical intelligence, mathematical connection, and interest in learning have a significant relationship to problem solving ability.

Coefficient of determination (R2)

The coefficient of determination (R2) is a number that indicates how well the statistical model predicts the results. The coefficient of determination is also known as R square. In multiple regression, the coefficient of determination used is Adjusted R2.

Table 8. Value of the Coefficient of Determination (R2)

R	*R Square*	*Adjusted R Square*	*Std. Error of the Estimate*
0,897	0,805	0,800	5,015

The regression analysis results in Table 8 provide information on the quality of the model used to explain the effect of the independent variables on the dependent variable.
The R value of 0.897 indicates a very strong relationship between mathematical logical intelligence, mathematical connection, and interest in learning with mathematical problem solving ability. The higher the R value, the stronger the relationship between the independent variable and the dependent variable. The R Square value of 0.805 indicates that 80.5% of the variability in mathematical problem solving ability can be explained by the independent variables, namely mathematical logical intelligence, mathematical connection, and interest in learning. The remaining 19.5% is explained by other factors outside the model.

The Adjusted R Square value of 0.800 provides a more accurate estimate by considering the number of variables in the model. Adjusted R Square is usually used to avoid bias in models with many independent variables. This value remains high, indicating that the model has good quality in explaining the dependent variable. The standard error value of 5.015 shows the average prediction error of the model on the value of mathematical problem solving ability. The smaller the standard error value, the better the model's ability to predict the value of the dependent variable. Overall, this study shows that mathematical logical intelligence, mathematical connection, and interest in learning jointly and partially have a significant effect on mathematical problem solving ability of elementary school students. Thus, these results illustrate that developing these three aspects can be an effective strategy to improve students' mathematical problem solving skills.

Research by Irawan et al (2016), outlined that the factors that influence mathematical problem solving ability include initial knowledge, appreciation of mathematics, and mathematical logical intelligence. Bethony et al (2024) found that there was a positive and significant influence between mathematical logical intelligence, visual-spatial intelligence, and learning motivation on students' problem solving ability. Zulkarnain and Nurbaiti (2019) found that there is an effect of mathematical logical intelligence on problem solving ability, which means that the higher the mathematical logical intelligence, the higher the problem solving ability. Vice versa, the lower the mathematical logical intelligence, the lower the problem solving ability. Asmal (2020) stated that there was a positive and significant effect of mathematical logical intelligence on the problem solving ability of seventh grade students by 18.75%. In line with this, in this study it was found that there was a significant influence between mathematical logical intelligence on students' mathematical problem

solving ability, which amounted to 29.3% of the total variability of problem solving ability explained by the regression model.

Research by Wawan and Retnawati (2022) on factors affecting students' mathematics learning achievement explained that several factors affecting mathematical problem solving ability are learning motivation, learning anxiety, mathematical connection ability, perceptions of teacher competence, available learning facilities, conducive learning environment, curriculum, use of technology in learning, critical thinking skills, and students' creative thinking skills. Fitri and Hasyim (2018) and Wati, Medika, and Junaidi (2021) in their research found that there is an influence between mathematical connection ability on students' mathematical problem solving ability. In line with this, this study found that there is a significant influence between mathematical connection ability on students' mathematical problem solving ability, which is 50.0% of the total variability of problem solving ability explained by the regression model.

Research conducted by Yuliati (2021) shows that there is a significant influence between interest in learning on the mathematical problem solving ability of class VIII students at the junior high school level. Meanwhile, research conducted by Maulina, Harun, and Sutrisno (2022) stated that interest in learning has a positive and significant effect on mathematical problem solving ability by contributing an effective contribution of 19.7% and a relative contribution of 43.4%. This is in line with the results obtained in this study, namely that there is a significant influence between interest in learning on the mathematical problem solving ability of grade IV students at the elementary school level, which is 21.9% of the total variability in problem solving ability explained by the regression model. Nisrina (2018) and Mawardi (2019) also stated that there is a significant direct influence between interest in learning on mathematical problem solving ability. Students who do not have an interest in learning mathematics will be lazy and reluctant when solving math problems (Agustin and Hartanto, 2018; Nisrina, 2018).

CONCLUSIONS

There is a significant influence of mathematical logical intelligence, mathematical connection ability, and learning interest on students' mathematical problem-solving abilities. Specifically, mathematical logical intelligence has a significant effect on students' ability to solve mathematical problems, as does mathematical connection ability, which enhances their understanding and application of mathematical concepts. Additionally, learning interest plays a crucial role in fostering active engagement and improving problem-solving performance. Furthermore, when considered simultaneously, mathematical logical intelligence, mathematical connection ability, and learning interest collectively have a significant impact on students' mathematical problem-solving abilities, highlighting the importance of these factors in supporting effective mathematics learning.

REFERENCES

Ajija, Shochrul Rohmatul, dkk. (2011). Cara Cerdas Menguasai Eviews. Jakarta: Salemba Empat.

Asmal, M. (2020). Pengaruh kecerdasan logis matematis terhadap kemampuan pemecahan masalah siswa kelas VII SMPN 30 Makassar. Elips: Jurnal Pendidikan Matematika, 1(1), 30-36.

Fitri, L., & Hasyim, M. (2018). Pengaruh kemampuan disposisi matematis, koneksi matematis, dan penalaran matematis terhadap kemampuan pemecahan masalah matematika. JP2M (Jurnal Pendidikan dan Pembelajaran Matematika), 4(1), 47-60.

Bethony, M., Alam, S., & Taufiq, T. (2024). Pengaruh Kecerdasan Logis-Matematis, Kecerdasan Visual-Spasial, Dan Motivasi Belajar Terhadap Kemampuan Pemecahan Masalah Matematika. Pedagogy: Jurnal Pendidikan Matematika, 9(2), 322-337.

Davita, P. W. C., & Pujiastuti, H. (2020). Anallisis Kemampuan Pemecahan Masalah Matematika ditinjau dari Gender. Kreano, Jurnal Matematika Kreatif-Inovatif, 11(1), 110-117.

Irawan, I. P. E., Suharta, I. G. P., & Suparta, I. N. (2016, August). Faktor-faktor yang mempengaruhi kemampuan pemecahan masalah matematika: pengetahuan awal, apresiasi matematika, dan kecerdasan logis matematis. In Prosiding Seminar Nasional MIPA.

Ghozali, I. (2016). Aplikasi Analisis Multivariete Dengan Program IBM SPSS 23. Edisi 8. Semarang: Badan Penerbit Universitas Diponegoro.

Jiah, P., Turmudi, T., & Rahayu, P. (2023). Penerapan Model Pembelajaran Realistic Mathematics Education untuk Meningkatkan Kemampuan Koneksi Matematis Siswa Sekolah Dasar. Jurnal Ilmiah Matematika Realistik, 4(2), 204-211.

Mawardi, A. (2019). Pengaruh Minat dan Kebiasaan Belajar terhadap Kemampuan Pemecahan Masalah Matematika (Survei Pada SMP Swasta di Kabupaten Bekasi). Alfarisi: Jurnal Pendidikan MIPA, 2(2), 171–178.

Maulina, V., Harun, L., & Sutrisno, S. (2022). Pengaruh Minat Belajar dan Resiliensi Matematis Terhadap Kemampuan Pemecahan Masalah Matematis Siswa. Imajiner: Jurnal Matematika Dan Pendidikan Matematika, 4(4), 347-354.

Nisrina, N. (2018). Pengaruh Minat dan Motivasi Belajar terhadap Kemampuan Pemecahan Masalah Matematik. Alfarisi: Jurnal Pendidikan MIPA, 1(3), 294–303.

Wawan., & Retnawati, H. (2022). Empirical Study of Factors Affecting the Students' Mathematics Learning Achievement. International Journal of Instruction, 15(2), 417-434

Wati, M., Medika, G. H., & Junaidi, J. (2021). Pengaruh Kemampuan Koneksi Matematis Terhadap Kemampuan Pemecahan Masalah Matematis Siswa. Math Educa Journal, 5(1), 54-61.

Yuliati, I. (2021). Kemampuan pemecahan masalah matematika ditinjau dari minat belajar peserta didik. Jurnal Cendekia: Jurnal Pendidikan Matematika, 5(2), 1159-1168.

Zulkarnain, I., & Nurbaiti, I. (2019). Pengaruh Kecerdasan Logis Matematis Terhadap Kemampuan Pemecahan Masalah. Diskusi Panel Nasional Pendidikan Matematika, 5(1).