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Structural Equation Modeling Method to Analyze the Influence of Learning Style, Mathematics Resilience and Learning Motivation on Mathematical Problem-Solving Ability

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Abstract

This study aimed to analyze the influence of learning styles, mathematics resilience, and learning motivation on elementary school students' mathematical problem-solving abilities. The research involved 131 students from three elementary schools in Metro and East Lampung, Indonesia and employed Structural Equation Modeling (SEM) for data analysis. The results showed that all three variables significantly affected students' mathematical problem-solving abilities. Learning motivation had the strongest influence (C.R = 1.880, p = 0.034), followed by mathematics resilience (C.R = 1.754, p = 0.045) and learning style (C.R = 1.729, p = 0.040). The three variables collectively contributed 78.3% to the variance in students' mathematical problem-solving abilities, indicating a strong overall effect. These findings suggest that enhancing students' learning motivation, building mathematical resilience, and aligning teaching methods with students' learning styles are effective strategies to improve their mathematical problem-solving performance. The study recommends the implementation of adaptive and inclusive teaching approaches that consider cognitive and psychological factors in elementary mathematics education.

Keywords: *SEM method, learning style, mathematics resilience, learning motivation, problem-solving ability.*

Abstrak

Penelitian ini bertujuan untuk menganalisis pengaruh gaya belajar, ketahanan matematika, dan motivasi belajar terhadap kemampuan pemecahan masalah matematika siswa sekolah dasar. Penelitian ini melibatkan 131 siswa dari tiga sekolah dasar di Metro dan Lampung Timur, Indonesia dan menggunakan Structural Equation Modeling (SEM) untuk analisis data. Hasil penelitian menunjukkan bahwa ketiga variabel tersebut secara signifikan memengaruhi kemampuan pemecahan masalah matematika siswa. Motivasi belajar memiliki pengaruh paling kuat (C.R = 1,880, p = 0,034), diikuti oleh ketahanan matematika (C.R = 1,754, p = 0,045) dan gaya belajar (C.R = 1,729, p = 0,040). Ketiga variabel tersebut secara kolektif memberikan kontribusi sebesar 78,3% terhadap varians kemampuan pemecahan masalah matematika siswa, yang menunjukkan efek keseluruhan yang kuat. Temuan ini menunjukkan bahwa peningkatan motivasi belajar siswa, membangun ketahanan matematika, dan menyelaraskan metode pengajaran dengan gaya belajar siswa merupakan strategi yang efektif untuk meningkatkan kinerja pemecahan masalah matematika mereka. Penelitian ini merekomendasikan penerapan pendekatan pengajaran yang adaptif dan inklusif yang mempertimbangkan faktor kognitif dan psikologis dalam pembelajaran matematika di sekolah dasar.

Kata kunci: *metode SEM, gaya belajar, ketahanan matematika, motivasi belajar, kemampuan memecahkan masalah.*

INTRODUCTION

Mathematics learning at elementary school level has a crucial role in forming a foundation of knowledge and skills that support students' intellectual development. National Council of Teachers of Mathematics (2000) emphasizes that problem solving is one of the five essential mathematical processes. In addition to being an important part of learning mathematics, problem solving also plays a role in the application of mathematics in everyday life. Amalina & Vidákovich (2023) and Harokah, Wibowo, Sudigdo, Yudianto, & Wulansari (2024) underlines that student engagement in solving mathematical problems is a major indicator of the success of mathematics education. Although each source offers a different perspective, both complement each other in emphasizing the importance of research related to problem-solving skills. However, a major challenge arises when students have difficulty in understanding and solving mathematical problems (Yuliani & Cathrin, 2024). This obstacle needs special attention so that the learning strategies applied can improve students' ability to solve problems effectively.

The results of the Trend in International Mathematics and Science Study (TIMSS) show that elementary school students in Indonesia scored an average of 540 in the mathematics test, placing Indonesia in 40th place out of 58 countries (Mullis, Martin, Kennedy, Trong, & Sainsburry, 2020). The TIMSS evaluation also revealed that Indonesian students still face major challenges in solving complex problem-solving problems. In line with these findings, research Garcia et al. (2024); Kwangmuang, Jarutkamolpong, Duangngern, Gessala, & Sarakan (2024); Rojas et al. (2021); Schäfer, Reuter, Leuchter, & Karbach (2024); and Van Hooijdonk, Mainhard, Kroesbergen, & Van Tartwijk (2024) revealed that low problem-solving ability is one of the main obstacles faced by elementary school students. This finding emphasizes the need for more attention in improving mathematical problem-solving skills at the elementary level.

The results of observations and interviews with teachers at State Islamic Elementary School (MIN) 1 Metro, MIN 1 East Lampung, and MIM Pekalongan East Lampung showed that students had not fully mastered mathematical problem-solving skills. This finding was obtained after teachers observed and evaluated students' abilities in various aspects of problem solving, such as understanding, identifying, planning, guessing, analyzing, trying, interpreting, finding, generalizing, and reviewing a problem given in learning. In fact, teachers have provided various problem-solving exercises routinely to improve students' skills. This is in line with research Wahyuni, Mulyono, & Mawardi (2024), which states that students who practice more often in solving problems tend to get higher scores on problem-solving tests compared to those who get limited practice. However, even though learning efforts have been made, there are still challenges in ensuring the effectiveness of such practice in improving students' problem-solving abilities.

Students' success in solving math problems is influenced by several factors, including learning styles, math resilience, and learning motivation. These three factors are interrelated and play an important role in learning math. Learning styles are individual characteristics that determine how students receive, process, and use information. Each student has different preferences in understanding the material, so understanding their learning styles can help teachers design more effective learning strategies. Negara, Nurlova, & Hidayati (2021) found that students with high intelligence and visual learning styles tend to excel in problem solving, while students with lower intelligence performed better when using auditory or kinesthetic learning styles. These findings confirm that learning approaches tailored to students' learning styles can contribute to improving mathematical problem-solving abilities.

Recent research shows that adapting teaching methods to students' learning styles can improve learning outcomes in mathematics. Joswick, Skultety, & Olsen (2023) emphasized that adapting teaching to learning styles, especially for students with learning difficulties, can help them better understand mathematical concepts. In line with these findings, Cardino & Ortega-Dela Cruz (2020) found that the introduction and application of various learning styles in mathematics teaching increases the effectiveness of learning. In addition, the adjustment between the teacher's teaching style and the student's learning style not only improves conceptual understanding, but also reduces academic anxiety, increases learning motivation, and helps students complete tasks better (Rogowsky, Calhoun, & Tallal, 2020). Furthermore, a study by Fitriya, Sari, & Yudianto (2024) and Mdhlalose & Mlambo (2023) revealed that the integration of technology in learning that is adapted to students' learning styles can increase their involvement and motivation in learning mathematics.

Mathematical resilience reflects students' ability to overcome difficulties, cope with obstacles, and remain motivated in learning mathematics. Understanding the factors that influence mathematical resilience can provide insights into designing learning approaches that support positive mathematical development. Yuniar, Nafiah, & Siregar (2022) explains that mathematical resilience is closely related to problem-solving abilities. Johnston-Wilder et al. (2016) emphasizes that mathematical resilience involves the courage to overcome the fear of failure and the willingness to continue trying despite difficulties. In line with that, Johar, Harnita, Sasaki, & Oktari (2025) revealed that students with high levels of mathematical resilience tend to have better problem-solving abilities. This is supported by research Xenofontos & Mouroutsou (2023), which shows that students with high mathematical resilience are better able to cope with stress during exams and achieve better learning outcomes.

Furthermore, a study by Yeager & Dweck (2020) showed that the application of growth mindset can increase students' mathematical resilience. They found that students who believe that their abilities can develop through effort are more likely to have resilience in facing mathematical challenges. In addition, Boaler (2019) emphasizes that learning approaches that emphasize developing resilience and positive mindsets toward mathematics can help students overcome anxiety and improve their performance in the subject.

Learning motivation is an important factor that determines the extent to which students invest in learning activities, including in solving mathematical problems. In general, motivation is divided into two types, namely intrinsic motivation and extrinsic motivation. Intrinsic motivation comes from within the student, such as curiosity and pleasure in learning, while extrinsic motivation is influenced by external factors, such as rewards or punishments. (Morris, Grehl, Rutter, Mehta, & Westwater, 2022).

Rahmah, Aniswita, & Fitri (2020) explained that students with intrinsic motivation tend to be more persistent in facing challenges and show higher engagement in mathematics learning, especially in problem solving. In addition, students with high levels of motivation are better able to solve complex mathematical problems. This is in line with the findings Ryan & Deci (2020) and Schunk & Greene (2018), which shows that intrinsic motivation is positively correlated with problem-solving ability, so that students who have the motivation to learn from within themselves tend to perform better in problem-solving tests.

Support from teachers and a positive learning environment play an important role in increasing students' intrinsic motivation. Students who feel supported and valued by their teachers tend to show higher engagement and are more motivated in learning mathematics (Elliot & Sommet, 2023). In addition, studies by Jang, Kim, & Reeve (2016) revealed that learning approaches that provide autonomy to students can increase their intrinsic motivation while strengthening engagement in the learning process. Empirical research shows that a combination of appropriate learning styles, strong mathematical resilience, and high learning motivation can significantly improve students' mathematical problem-solving abilities. For example, research El-Sabagh (2021) shows that students with visual learning styles excel at understanding and solving mathematical problems through the use of diagrams and visualizations, while students with kinesthetic learning styles are more successful when they can interact directly with the material through physical manipulation or movement-based activities.

In addition, previous studies have shown that learning styles, mathematical resilience, and learning motivation each play a role in influencing students' academic achievement (Johnston-Wilder et al., 2016; Joswick et al., 2023; Khumalo, Van Staden, & Graham, 2022; Lee & Johnston-Wilder, 2010). However, most of these studies examined these factors separately or focused on students at higher educational levels, such as junior or senior high school. Comprehensive studies that simultaneously investigate these three factors—especially at the elementary school level—remain limited. Furthermore, few studies in the Indonesian context have utilized Structural Equation Modeling (SEM) to analyze how learning styles, resilience, and motivation jointly influence students' mathematical problem-solving abilities.

This study addresses that gap by exploring the combined effects of learning styles, mathematics resilience, and learning motivation on elementary students' problem-solving skills using SEM. A deep understanding of how these factors interact is expected to serve as a foundation for designing adaptive and inclusive learning strategies that support students' success in mathematics. Therefore, this research provides both theoretical and practical contributions to mathematics education by offering empirical evidence from an underexplored context.

METHODS

This research was conducted in three Islamic elementary school locations, namely MIN 1 East Lampung, MI Muhammadiyah Pekalongan, and MIN 2 Kota Metro. The number of samples in this study was 131 students. Each location held two meetings: the first meeting to explain the activity plan and implementation of the mathematics test, while the second meeting was for data collection through questionnaires distributed to students. This type of research is quantitative, which is systematic and structured, with results in the form of numbers to be analyzed statistically. The research procedures include: 1) Determining the elementary school that will be the object of research, then conducting a prasurvey. 2) Compiling a questionnaire that will be used in the study, on the variables of learning motivation (X1), learning style (X2), and resilience (X3) each consisting of 20 questions, while the math test score variable (Y) consists of 4 questions. 3) Questions on the Y variable are validated by teachers at each school to ensure compliance with the material that has been taught in class. 4) The data collection stage is by distributing questionnaires to students in the three elementary schools totaling 131 students. 5) Data Analysis Stage: Analyzing the data that has been obtained to draw conclusions related to the formulation of the problem (Ali, Hariyati, Pratiwi, & Afifah, 2022). Validity and reliability tests are carried out on each X variable. If there are invalid question items, they will be removed. The final stage is a goodness-of-fit test, a correlation test of the X variables, a partial test, a simultaneous test, and a correlation value to ensure that the final results obtained are good.

Data analysis using the Structural Equation Modeling (SEM) method. SEM is an analysis method that combines regression analysis, factor analysis, and path analysis simultaneously (Putlely, Lesnussa, Wattimena, & Matdoan, 2021). This method is used to test the validity of the model and the suitability between the model and the data (Mulyadi, Wibisono, & Herli, 2021). The advantages of SEM include its ability to detect errors in research that are repetitive in nature and to analyze the relationships between variables more comprehensively (Junaidi, 2021). In general, SEM is used to measure the value of latent variable indicators and analyze the relationship between variables and measurement errors directly (Robi, Kusnandar, & Sulistianingsih, 2017).

The use of the SEM method has several prerequisite tests that will be carried out, including validity tests and reliability tests which are mandatory. The next stage to measure whether the analysis results are good enough or not, the Chi-square test value, CMIN / DF, Goodness of fit infection (GFI), Adjusted goodness-of-fit (AGFI), Tucker-Lewis index (TLI), CFI, and Root mean square error of approximation (RMSEA) are used with the model goodness criteria listed in the table 1 (Waluyo & W, 2020).

Table 1. Goodness Of Fit Test

Goodness of fit	Cut off value
Chi-square	the smaller the better
P-value	≥ 0,05
CMIN/DF	≤ 2,00
RMSEA	≤ 0,08
GFI	≥ 0,90
AGFI	≥ 0,90
TLI	≥ 0,95
CFI	≥ 0,95

The analysis was conducted using AMOS software version 25, which facilitates linear model analysis and factor analysis. The analysis process includes converting questionnaire answers into numerical data, correcting test results, forming models, testing hypotheses, and writing the final model.

RESULTS AND DISCUSSION

This study was designed to answer several problem formulations that have been explained previously, which aim to find out several things related to students' mathematical problem-solving abilities. First, this study wants to find out whether learning styles affect students' mathematical problem-solving abilities. Second, this study also aims to identify whether mathematics resilience affects students' mathematical problem-solving abilities. Furthermore, this study focuses on whether students' learning motivation has an influence on their ability to solve mathematical problems. Finally, this study will analyze whether learning styles, mathematics resilience, and learning motivation can jointly affect students' mathematical problem-solving abilities.

Prerequisite Analysis Test

Validity Test

To test the validity of all variables in this study, the researcher used Confirmatory Factor Analysis (CFA) to evaluate the Standard Factor Loading (SLF) output value of each question item against its variables, such as Student Learning Motivation, Student Learning Style, Student Resilience, and Mathematics Test Scores that have been given. CFA is a statistical technique used to test a previously designed factor model, to ensure how well the measured variables can represent the construct or latent variable to be measured. In CFA analysis, the researcher measured the Standardized Loading Factor (SLF) for each measurement variable. SLF describes the extent to which a measurement variable can be considered valid in measuring the desired latent variable. The higher the SLF value, the stronger the relationship between the measurement variable and the latent variable (Joo, So, & Kim, 2018; Mann, 2013). Each structure is tested separately for effectiveness testing. If the SLF value ≥ 0.5, then the measuring instrument item is considered valid (Hair, Black, Babin, & Anderson, 2019). The following are the results of the validity test for each variable studied.

Validity test of the learning motivation variable

The results of the validation of the learning motivation test are presented in Table 2.

Table 2. Results of learning motivation validity test

Variable	Item	SLF	Decision
Motivation	X1.1	0,987	Valid
	X1.2	0,997	Valid
	X1.3	0,559	Valid
	X1.4	0,691	Valid
	X1.6	0,681	Valid
	X1.7	0,798	Valid
	X1.8	0,861	Valid
	X1.9	0,686	Valid
	X1.10	0,736	Valid
	X1.11	0,746	Valid
	X1.12	0,883	Valid
	X1.15	0,515	Valid
	X1.16	0,521	Valid

Based on the results of the validity test above, a question item is declared valid if it has an SLF value of more than 0.5. In Table 2 above, testing was carried out for the learning motivation variable. By using the SLF value generated for each question item, the results obtained show that all question items used to measure the learning motivation variable are declared valid. This shows that these items can well represent the student learning motivation variable according to the construct referred to in this study.

Validity test of Learning Style variables

The results of the validation of the learning style test are presented in Table 3.

Table 3. Learning style validity test results

Variable	Item	SLF	Decision
Learning Styles	X2.1	0,726	Valid
	X2.2	0,637	Valid
	X2.3	0,533	Valid
	X2.4	0,708	Valid
	X2.5	0,563	Valid
	X2.6	0,585	Valid
	X2.7	0,631	Valid
	X2.8	0,519	Valid
	X2.11	0,571	Valid
	X2.12	0,624	Valid
	X2.15	0,633	Valid
	X2.18	0,698	Valid

Based on the results of the validity test above, a question item is declared valid if it has an SLF value of more than 0.5. In Table 3 above, testing was carried out for the learning style variable. By using the SLF value generated for each question item, the results obtained were that all question items used to measure the learning style variable were declared valid. This shows that each question item can well describe the construct of students' learning styles in this study.

Validity test of resilience variables

The results of the validation of the resilience test are presented in Table 4.

Table 4. Resilience Validity Test Results

Variable	Item	SLF	Decision
Resilience	X3.1	0,672	Valid
	X3.2	0,714	Valid
	X3.4	0,554	Valid
	X3.6	0,746	Valid
	X3.8	0,825	Valid
	X3.10	0,837	Valid
	X3.13	0,503	Valid
	X3.14	0,844	Valid
	X3.16	0,858	Valid
	X3.17	0,735	Valid
	X3.18	0,577	Valid
	X3.20	0,786	Valid

Based on the results of the validity test above, a question item is declared valid if it has an SLF value of more than 0.5. In Table 4 above, testing was carried out for the resilience variable. Based on the SLF value produced for each question item, the results showed that all question items used to measure the resilience variable were declared valid. This shows that each question item can accurately describe the construct of student resilience in this study.

Reliability Test

The next step in this study is to measure the reliability value of the variables, namely the extent to which the measurement model can be relied on and consistently measures the desired latent construct. Reliability is measured by calculating Construct Reliability (CR) and Average Variance Extracted (AVE). CR measures the reliability and internal consistency of the measured variables that represent latent items. In order for construct reliability to be met, the CR value must be greater than 0.7. Meanwhile, AVE measures the average percentage of variation explained by items in a variable, with the condition that AVE must be more than 0.5 (Hair et al., 2019). However, if the AVE value is less than 0.5, the results are still acceptable as long as the resulting CR value is greater than 0.7. The results of the reliability test are presented in Table 5.

Table 5. Reliability Test Results

Variable	CR	AVE	Decision
Motivation	0,94421	0,575784	Reliable
Learning Styles	0,88242	0,48735	Reliable
Resilience	0,93036	0,53321	Reliable

Based on Table 5 above, it can be seen that all variables used have a CR value of more than 0.7, which indicates good reliability. Likewise, the AVE value for each variable exceeds 0.5, which means that the variation explained by the items in each variable is also quite high. Thus, it can be concluded that the three variables in this study meet the reliability requirements.

Structural Model Testing

After conducting a measurement model test to test validity and reliability, the next step is to test the suitability of the overall research model through a goodness of fit test. This test aims to assess whether the SEM model built is in accordance with the observed sample data. The model suitability test is carried out to ensure the validity of the research model used (Hair et al., 2019). In testing the structural model estimation, the goodness of fit test aims to assess how well the proposed structural model fits the observed data. The main purpose of the goodness of fit test is to measure the extent to which the proposed model fits the covariance or correlation pattern between the observed variables. The structural model describes the relationship between the independent latent variables and the dependent latent variables (Mueller & Hancock, 2018; Smith & Cribbie, 2013). The results of the structural test can be seen in Figure 1.

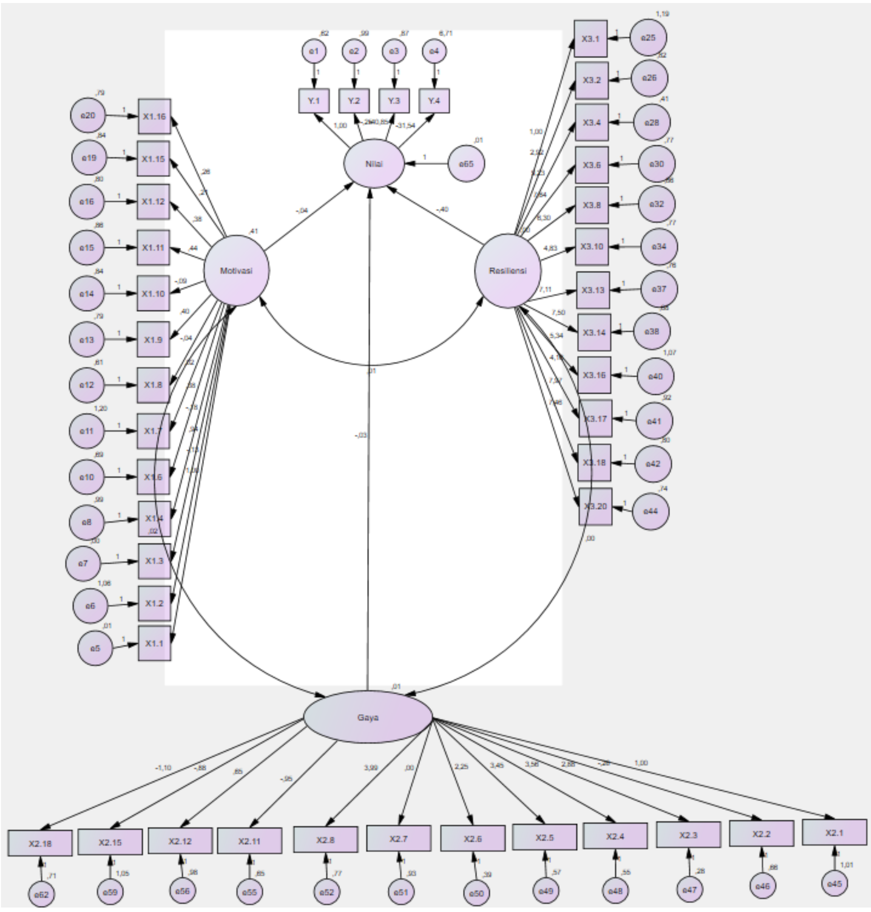

Figure 1. Early Model

The results of the model goodness of fit test are presented in Table 6.

Table 6. Model Goodness of Fit Test

Good of Fit Index	Cut of Value	Results	Evaluation
Chi Square	DF	114,461	Poor
GFI	≥ 0.90	0,942	Good Fit
CMIN/DF	≤ 2.00	1,280	Good Fit
AGFI	≥ 0.90	0,910	Marginal Fit
CFI	≥ 0.95	0,957	Marginal Fit
RMSEA	≤ 0.08	0,077	Marginal Fit
TLI	≥ 0.95	0,970	Good Fit

The results of the model fit test in Table 6 show that several criteria fall into the Good Fit category, namely GFI, CMIN/DF, and TLI. Meanwhile, the AGFI, CFI, and RMSEA criteria fall into the Marginal Fit category. The results of the chi-square test indicate a Poor Fit decision, because the value obtained is still greater than 0. However, the model fit test does not have to meet all Goodness of Fit criteria. The use of 4 to 5 Goodness of Fit criteria is sufficient to assess the suitability of a model. Furthermore, the model improvement stage is carried out if it is still necessary, as well as hypothesis testing for each variable used.

SEM Method Hypothesis Testing

Correlation Test

Table 7. Correlation Test Value Between Independent Variables

			Estimate	S.E.	C.R.	P	Label
Motivation	<-->	Style	,023	,028	,842	,090	par_40
Learning Styles	<-->	Style	,001	,002	,374	,109	par_41
Resilience	<-->	Resilience	,007	,014	,485	,280	par_42

Table 7 shows the results of the correlation test between independent variables used in the study. In the SEM method, if the number of independent variables is more than one, then a correlation test between independent variables needs to be carried out. The requirement that must be considered in the correlation test is the absence of a significant correlation between independent variables (Ginting & Usiono, 2024; Junaidi, 2021). The results of the correlation test show the following: (1) For the variables Learning Style and Motivation, the p-value is 0.090, which is greater than 0.05, so it can be concluded that these two variables are not correlated with each other. (2) For the variables Learning Style and Resilience, the p-value is 0.109, which is also greater than 0.05, which means that the two are not correlated with each other. (3) For the variables Motivation and Resilience, the estimate value is 0.280, which is greater than 0.05, indicating that these two variables do not have a significant correlation.

Partial and Simultaneous Tests

Partial tests are conducted using the Critical Ratio (CR) value or p-value of each independent variable. According to Junaidi (2021), The C.R. value is similar to the t-count value obtained in the analysis, which is then compared to the t-table value. If the C.R. value is greater than 1.657 or the p-value is less than 0.05, then it can be concluded that there is a significant influence between the independent variable and the dependent variable in the study. The results of the simultaneous test can be seen in Table 8 below:

Table 8. Partial Test Value

			Estimate	S.E.	C.R.	P	Label
Problem Solving Skills	<---	Motivation	,064	,034	1,880	,034	par_38
Problem Solving Skills	<---	Resilience	1,544	,880	1,754	,045	par_39
Problem Solving Skills	<---	Learning Styles	,180	,104	1,729	,040	par_43

Based on Table 8, the C.R. value is 1.880 which is greater than the t-count value, and the p-value is 0.034 which is smaller than 0.05. This shows that the motivation variable has a significant influence on mathematical problem solving ability. This result is in line with research conducted by Fatimah, Nurhidayah, Ahmad, Febryanti, & P. (2019), who also found that motivation significantly influences mathematical problem solving ability.

Learning motivation, both intrinsic and extrinsic, has a major influence on students' engagement and persistence in facing mathematical challenges (Ryan & Deci, 2020). Students who have high motivation tend to be more persistent and show better performance in solving mathematical problems (Schreiber & Ashkenazi, 2024). In addition, according to Bolat & Arslan (2024), Strong motivation can increase students' self-confidence in facing complex tasks, including solving mathematical problems.

The test results show that the C.R. value is 1.754 which is greater than the t-count value, and the p-value is 0.045 which is smaller than 0.05. This shows that the resilience variable has a significant influence on mathematical problem solving ability. Research by Attami, Budiyono, & Indriati (2020) also supports this finding, suggesting that mathematical resilience can be used to predict students' ability to solve mathematical problems.

Resilience plays an important role in the problem-solving process. Students with high levels of resilience tend to be better able to overcome obstacles and stay focused on learning goals, which leads to better performance in solving math problems (Chiang, Yeh, & Lee, 2024). According to Eligio (2017), academic resilience allows students to remain persistent and not give up easily when facing challenges in learning mathematics. In addition, Yang & Wang (2022) emphasizes that students' resilience and perseverance in learning are highly correlated with increased academic achievement.

In addition, the C.R. value of 1.729 which is greater than the t-count, and the p-value of 0.040 which is less than 0.05, indicates that the learning style variable also has a significant effect on mathematical problem solving ability. Research conducted by Bhat (2014); Surya, Putri, & Mukhtar (2016); and Szabo, Körtesi, Guncaga, Szabo, & Neag (2020) also shows that students' learning styles have a significant influence on their mathematical problem-solving abilities. Students with visual, aural, read/write, and kinesthetic learning styles show differences in their results in solving mathematical problems.

According to Berger (2019), Students with learning styles that suit the teaching method will find it easier to understand mathematical concepts in depth. Muriyah, Wahyuni, & Saleh (2023) also added that when teaching methods are aligned with students' learning styles (visual, aural, read/write, and kinesthetic), learning effectiveness increases, which ultimately has an impact on improving mathematical problem-solving abilities.

As explained in his book, Junaidi (2021) states that in research that is causal in nature, the expected relationship pattern is that there is no significant correlation between independent variables, but independent variables are expected to have a significant correlation together with the dependent variable. Therefore, a simultaneous test was conducted to determine the influence between independent and dependent variables, with the following results.

Table 9. Simultaneous Test With Problem Solving Ability

	R-Square
Mathematical Problem Solving Ability	,783

Based on the correlation value obtained, it is known that the variables of learning motivation, resilience, and learning style together influence the variable of problem solving ability by 78.3%. According to Sugiyono (2019), The value is included in the strong correlation category, because it is in the range of 0.60 - 0.799. High learning motivation plays an important role in increasing student involvement in the learning process and encouraging them to be more active in finding solutions when facing problems (Almusaed, Almssad, Yitmen, & Homod, 2023). In addition, students with high levels of resilience are better able to deal with academic pressure and respond to it in a more positive way, so they are more resilient in finding solutions to the problems they face (Li, 2017).

In addition to motivation and resilience factors, learning styles also contribute to improving learning effectiveness. Adapting teaching strategies to students' learning styles can help them understand the material better, which ultimately allows them to find alternative solutions when facing math problems (Son, Darhim, & Fatimah, 2020; Szabo et al., 2020). Menurut Almulla & Al-Rahmi (2023), learning approaches that take into account individual characteristics of students can improve conceptual understanding and critical thinking skills, which play an important role in developing problem-solving abilities. Thus, the combination of learning motivation, resilience, and appropriate learning styles can create a conducive learning environment, encourage students to be more independent in solving problems, and improve their analytical thinking skills.

CONCLUSION

Based on the results of the study, it can be concluded that motivation, resilience, and learning styles are key psychological and cognitive factors that significantly shape students' abilities in mathematical problem solving. These variables interact to support students' persistence, adaptability, and engagement in learning, especially when instructional strategies align with their individual needs. The findings underscore the importance of designing inclusive and adaptive learning environments that foster students' intrinsic drive, equip them to face challenges, and accommodate diverse learning preferences, thereby promoting more effective and meaningful mathematics learning experiences.

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