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THE INFLUENCE OF INDEPENDENCE AND LEARNING STYLE ON MATH PROBLEM-SOLVING ABILITY

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Abstract: This study aims to analyze the influence of self-regulated learning and learning styles on the mathematical problem-solving abilities of students at SMA Negeri Ilugua, Mamberamo Tengah Regency, Papua Pegunungan Province. A quantitative approach with a survey design was used. The population consisted of all students at SMA Negeri Ilugua, and the sample included 102 students selected through simple random sampling. Data were collected using an essay-based mathematics problem-solving test and questionnaires to measure self-regulated learning and learning styles. The findings show that: (1) self-regulated learning has a significant effect on students' mathematical problem-solving ability, contributing 48.5% to the variance; (2) learning styles significantly influence problem-solving ability, with kinesthetic learners achieving the highest scores, followed by auditory learners, while visual learners had the lowest; (3) simultaneously, self-regulated learning and learning styles have a significant combined effect, contributing 59.9% to the improvement of problem-solving abilities. These results emphasize the importance of promoting self-regulated learning and tailoring instructional strategies to students' learning styles to enhance mathematical problem-solving skills, particularly in remote regions such as Papua. The study suggests that adaptive learning approaches and stronger interventions to develop learner autonomy are essential for improving educational outcomes.
Keywords: Self-Regulated Learning, Learning Styles, Mathematical Problem-Solving, Papua.

1. INTRODUCTION

Mathematical problem-solving skills are a crucial competency that not only supports academic success but also serves as a foundation for decision-making in practical life. As the core of mathematical literacy, this ability encourages learners to apply abstract concepts, think critically, and design innovative solutions. However, various national studies reveal that this ability is still low at various levels of education, ranging from elementary school to college. This low ability not only hinders academic achievement but also has the potential to affect students' readiness to face global challenges. Therefore, the identification of non-cognitive determinant factors, such as self-regulated learning (SRL) and learning styles, is a strategic step to design effective interventions. (Samosir, 2022; Anisah and Sri Lastuti, 2019; Hemalya et al., 2023; Nanda Muliawati and Sutirna, 2022)

Previous studies have proven the role of SRL in improving mathematical problem-solving skills. Learners' ability to set learning goals, monitor progress, and reflect on outcomes is positively

correlated with problem-solving performance. On the other hand, visual, auditory, and kinesthetic learning style preferences also affect the variation in learners' abilities. Visual learners, for example, show excellence in planning and executing solutions, while kinesthetic learners tend to be limited to the problem understanding stage. However, these findings are inconsistent: some studies state the absence of a significant influence of SRL, while others suggest that kinesthetics may excel in certain aspects. In addition, the majority of studies focused on urban areas with adequate access to education, so they are less representative of the conditions of marginalized areas such as Papua (Mukhid, 2008; Rohani et al., 2022; Syarifah et al., 2023; Hijriani et al., 2024; Rahayuningsih et al., 2021; Rahmatika et al., 2022).

Papua, as a region with higher education disparities, is a critical context that is often overlooked. Research at Ilugua State High School, Central Mamberamo Regency, confirmed the low mathematical problem-solving ability of students, supported by infrastructure gaps and lack of innovative pedagogical literacy. Unfortunately, there has been no research that integrates SRL analysis and learning styles in these remote areas. In fact, the interaction between the two factors may be the key to understanding the variation in learners' abilities in the context of limited resources. Based on the description above, the researcher is interested in conducting a study entitled "The Influence of Learning Independence and Learning Style on the Mathematical Problem-Solving Ability of Ilugua State High School Students". The formulation of the problem in this study is: 1) Is there an influence of learning independence on the mathematical problem-solving ability of students of Ilugua State High School?; 2) Is there an influence of learning style on the mathematical problem-solving ability of students in the Illusua State class?; 3) Does learning independence and learning style together affect the mathematical problem-solving ability of students of Ilugua State High School? (Situmorang et al., 2023).

2. RESEARCH METHOD

This study uses a quantitative approach with a survey design to systematically collect primary data at SMA Negeri 1 Ilugua, Central Mamberamo Regency, Mountainous Papua. The survey design was chosen to measure the relationship between self-regulated learning, learning styles (visual, auditory, kinesthetic), and mathematical problem-solving skills, as well as generalize the findings to the student population in the interior of Papua. The location of the research was determined purposively based on the low mathematical literacy of students in the area (Majdina et al., 2024; Situmorang et al., 2023).

Data collection was carried out in stages: instrument trials on April 8-11, 2025 at SMA Narwastu Inenu Alom (30 respondents) and main data collection on April 23, 2025 after instrument validation was completed. The research population consisted of all students of Ilugua State High School (N=120), with a sample of 92 students selected using simple random sampling based on the Slovin formula (5% error rate) (Majdina et al., 2024). The sample included students in grades X (35), XI (39), and XII (28) to ensure representation. (Audhiha et al., 2022)

The research variables included learning independence as an independent variable (28 indicators including planning, monitoring, self-evaluation), learning style (visual, auditory, kinesthetic), and mathematical problem-solving ability as bound variables (4 indicators: problem understanding, planning, execution, evaluation). The research instruments include a learning independence questionnaire (5-point Likert scale), a learning style questionnaire (VARK questionnaire), and a problem-solving ability description test (maximum score of 40) (Mukhid, 2008; Hijriani et al., 2024; Samosir, 2022; Adisti Yuliastrin et al., 2023; Audhiha et al., 2022).

The validity of the content of the instrument was verified through expert judgment by three experts in mathematics education with revisions to ambiguous items. The validity of the construct was tested using Exploratory Factor Analysis (EFA) and Pearson Correlations, with a KMO result of ≥ 0.606 and a significance of $p<0.05$ for all variables. Reliability was measured using Alpha Cronbach, with very high ($\alpha=0.974$ for problem-solving tests, $\alpha=0.837$ for learning independence) and high ($\alpha=0.703$ for learning styles), and supported by a low Standard Error of Measurement (SEM) (1.98–4.25) (Muslihin et al., 2022; Retnawati, 2016; Gall et al., 2003; Scott, 2014).

Data analysis includes descriptive statistics (mean, standard deviation, quantitative-qualitative conversion) (Akbar, 2013; Widoyoko, 2009) and inferential. Classical assumption tests (normality, multicollinearity, homocedasticity) are performed before regression analysis. Simple linear regression is used to test the influence of learning independence, while the Kruskal-Wallis test is used to test for differences in problem-solving ability between groups of learning styles (due to violations of assumptions of normality). Multiple linear regression is used to test the simultaneous influence of independent variables. All analyses were conducted using IBM SPSS Statistics 20 with a significance level of $\alpha=0.05$. (Alwy Yusuf et al., 2024; Pituch and Stevens, 2016; Herrhyanto and Gantini, 2021; Sholihah et al., 2023).

This research ensures methodological rigor through instrument validation, representative samples, and statistical analysis in accordance with the data characteristics. The combination of parametric and nonparametric tests strengthens the validity of the findings in the context of

educational limitations in Papua (Situmorang et al., 2023).

3. RESULTS AND DISCUSSION

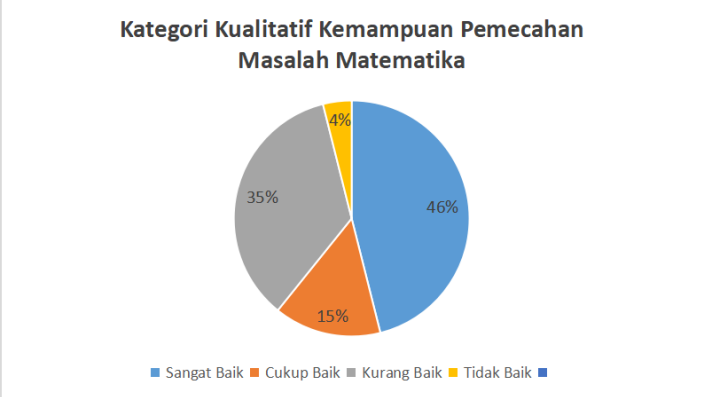
The data on mathematical problem-solving ability was obtained from the description test instrument with a minimum score of 0 and a maximum of 40.

Table 1. Description of Math Problem-Solving Skills

Parameters	Maasalah Solving Ability
Minimum	19
Maximum	40
Average	32.42
Median	33
Mood	40
Std. Deviation	6.828

Based on table 1. The results of the descriptive analysis of students' mathematical problem-solving ability showed a score range between 19 (minimum) to 40 (maximum), with an average of 32.42 and a median of 33, indicating a relatively symmetrical distribution of data around the middle grade. A mode value of 40 indicates that the highest score is the most frequent value, although there is moderate variability (standard deviation = 6.828) which reflects significant differences between learners. The combination of the near-median average and the maximum score mode suggests that some students are achieving optimal ability, while others still face challenges in solving math problems thoroughly.

In addition to explaining the size of data concentration, the researcher also converted data on students' mathematical problem-solving abilities into several categories along with the frequency of students in each category. The conversion data is presented in Figure 1. next.



Picture 1. Qualitative Category Mathematical Problem-Solving Skills

Based on the results of the analysis, the mathematical problem-solving ability of Ilugua State

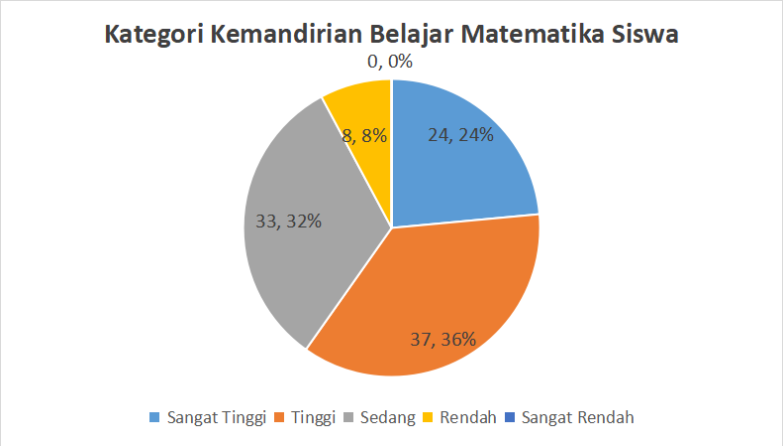
High School students showed significant variations. As many as 46% were in the Very Good category, indicating that most learners were able to understand problems, plan solutions, execute strategies, and evaluate results effectively. However, 36% are still classified as Poor, which reflects difficulties in compiling a settlement plan or conducting systematic re-checks. Meanwhile, 15% of students were in the Quite Good category, showing partial ability in the problem-solving stage, and 4% were in the Not Good category, with fundamental limitations in understanding or carrying out the resolution procedures. This data confirms that although the majority of students have adequate competence, there are still 33.3% of students (Less Good and Not Good) who require specific difficulty-based learning interventions, especially in the aspect of planning and evaluating solutions. These findings reinforce the urgency of a more differential pedagogical approach to reach the diversity of learners' learning needs.

Learning independence data (Table 2) was obtained from a questionnaire instrument with a total of 28 statements. The minimum score that each student can get is 28 and the maximum score is 140.

Table 2. Description of Students' Mathematics Learning Independence

Parameters	Learning Independence
Minimum	60
Maximum	140
Average	101.57
Median	103
Mood	90
Std. Deviation	18.87

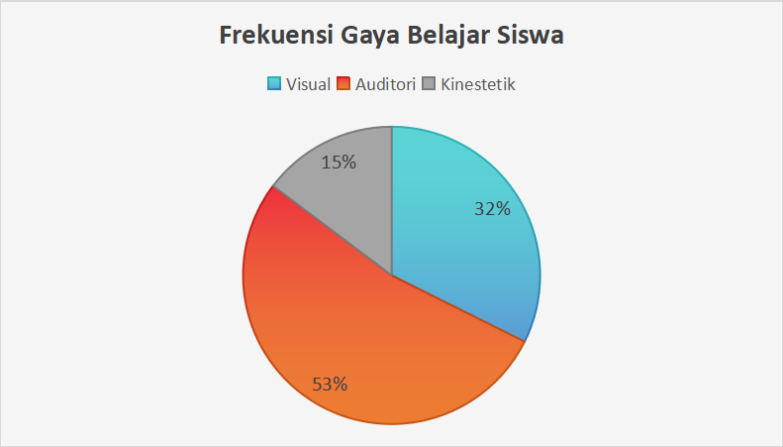
Student learning independence data (Table 2) showed an average score of 101.57 with a median of 103, indicating a relatively symmetrical distribution around the middle grade. The lower than the average and median mode of 90 indicates that there is a group of students who tend to have a lower level of learning independence. The fairly wide range of scores (60–140) and the standard deviation of 18.87 reflect significant variability in students' ability to manage their learning process. Most of the data is concentrated around the mean (based on median and mean proximity), but the existence of a minimum score of 60 indicates that there are learners who still face challenges in terms of planning, monitoring, or self-evaluation. Overall, although some students showed good learning independence (maximum score of 140), interventions are still needed to improve consistency and reduce disparities between groups. In addition, learning independence data is also grouped into several categories as shown in Figure 2. next.



Picture 2. Category of Student Mathematics Learning Independence

The distribution of students' learning independence scores (Figure 2) shows that the majority of respondents are in the high (37 students; 30.8%) and medium (33 students; 27.5%) categories, with a small percentage in the very high (24 students; 20%) and low (8 students; 6.7%) categories. None of the students were in the very low category, indicating that the level of learning independence in general was at moderate to good levels. The dominance of the high and medium categories (total 70 students; 58.3%) reflects the ability of students to manage the learning process independently, although there are still minority groups (6.7%) who need intervention to increase independence. Overall, these data illustrate that most learners have developed self-regulation skills in learning, with room for improvement in the low-performing group.

The type of student learning style data in this study is nominal data. This means that visual, auditory, and kinesthetic learning styles do not have certain intervals or hierarchical sequences. The following is presented data on the frequency of learning styles (Figure 3) at Ilugua State High School.



Picture 3. Frequency of Learners' Learning Styles

Based on Figure 3. It was obtained that the majority of students (54 respondents or 52.94%) identified themselves as auditory learners, showing the dominance of preference for hearing-based learning methods such as oral discussions or explanations. A total of 33 students (32.35%) were classified as visual learners, who relied on visualizations such as graphs or diagrams to understand the material. Meanwhile, only 15 students (14.71%) were included in the kinesthetic category, indicating that physical activity or hands-on practice was less of the main choice in their learning process. This distribution corroborates that the auditory approach is the most common learning style in the study population, followed by visual, while kinesthetic occupies the smallest proportion. These findings reflect the need to adapt teaching strategies that focus on verbal explanations and discussions, without neglecting the integration of visual elements to accommodate the diversity of learners' learning styles.

Next, we will test the hypothesis to answer the first, second, and third questions. This study analyzed data inferentially using linear regression statistical tests (simple and multiple) and non-parametric Kruskal-Wallis tests. A simple linear regression test to test the influence of learning independence on mathematical problem-solving ability (hereinafter called model 1). The Kruskal-Wallis test to test the influence of learning style (visual, auditory, kinesthetic) on mathematical problem-solving skills (hereinafter referred to as model 2). Multiple linear regression test to test the influence of learning independence and learning style (visual, auditory, kinesthetic) together (simultaneous) on mathematical problem-solving ability (hereinafter referred to as model 3). The following are the results of the residual normality distribution test of the three regression models in question.

Table 3. Residual Normality Distribution Test Results

Data	Kolmogorov-Smirnov			Sapphiro-Wilk		
	Statistics	Df	Sig.	Statistics	Df	Sig.
Residual Model 1	0.080	102	0.112	0.985	102	0.299
Residual Model 2	0.161	102	0.000	0.918	102	0.000
Residual Model 3	0.085	102	0.64	0.978	102	0.082

Based on Table 3. The Kolmogorov-Smirnov (KS) and Saphiro-Wilk (SW) tests confirmed the residual Regression Model 1 with normal distribution (p-values KS=0.112 and SW=0.299; KS=0.080 and SW=0.985 statistics), so the regression analysis results were valid. In contrast, the residual Regression Model 2 deviated significantly from normal (p-values KS and SW=0.000; statistical KS=0.161; SW=0.918), so that the analysis was extended with the non-parametric

Kruskal-Wallis and Mann-Whitney tests. In Regression Model 3, although the p-value SW was marginal (0.082), the KS (0.085) and SW (0.978) statistics showed that the residual tended to be close to normal. (Herrhyanto & Gantini, 2021)

To answer the first research question, namely whether learning independence affects mathematical problem-solving ability, a simple linear regression test was carried out. After conducting the classical assumption test, a model feasibility test is carried out. Model feasibility test first using the F test or reliability test. The following are the results of the F test presented in Table 4. Anova Test F.

Table 4. F Test Results of Model 1 Linear Regression

Type	F	Sig.
Regression	96,058	0,000

Table 4. indicates a significance value of 0.000 (< 0.005), so H_0 is subtracted. This proves that linear regression models are valid for explaining the relationship between learning independence and students' problem-solving abilities. Furthermore, model 1 was tested with simple linear regression to obtain the regression coefficient. The following are the results of the regression test (Table 5).

Table 5. Regression Coefficient of Learning Independence to Mathematical Problem-Solving Ability

Variable	**Regression Coefficients**	**t**	**Sig.**
Constant	32,422	66,815	0,000
SRL	0,253	9,801	0,000

Linear regression analysis (Table 5) showed a positive and significant influence of Self-Regulated Learning (SRL) on mathematical problem-solving ability. Based on the Math Problem Solving equation = 32.422 + 0.253(SRL), each increase of 1 unit of SRL score increases the mathematics score by 0.253 units. This relationship was statistically significant (p = 0.000; t-count = 9.801), confirming that SRL significantly affected math achievement. With a determination coefficient of 0.485, which means that the proportion of the influence of learning independence on the variable of students' mathematical problem-solving ability is 48.5%.

Next, we use the Kruskal-Wallis test to test the second research question. The second research question is whether learning style has a significant impact on mathematical problem-solving skills. We use the Kruskal-Wallis test because the assumption of the residual normality distribution of model 2 (the influence of learning style on mathematical problem-solving ability) is not fulfilled as shown in Table 6. Here are the results of the Kruskal-Wallis test.

Table 6. Kruskall-Wallis Test Results

	Learning Style	N	Mean Rank	Chi-Square	Df	Asymp. Sig.
Problem Solving	Visual	33	20.82	54.652	2	0.000
	Auditory	54	65.07			
	Kinesthetic	15	70.13			
	Total	102				

Based on Table 6. presented in a table, the average rank of students' mathematical problem-solving ability based on learning style is identified. The kinesthetic learning style group (15 students) recorded the highest mean rank, indicating the best problem-solving performance. On the other hand, the auditory learning style group (54 students) ranked second, while the visual learning style group (33 students) had the lowest mean rank. These results are consistent with the principle that the higher the mean rank value, the superior the group's problem-solving ability. Thus, it can be concluded that sequentially, the kinesthetic, auditory, and visual groups represent the level of mathematical problem-solving ability from highest to lowest. Based on the table above, significant differences in math problem-solving ability scores were identified between groups of learning styles (visual, auditory, and kinesthetic). The kinesthetic and auditory groups consistently showed superior performance with significantly higher scores than the visual group. However, a direct comparison between the auditory and kinesthetic groups has not been definitively determined through the Kruskal-Wallis test. Therefore, a post-hoc Mann-Whitney test was performed with the application of Bonferroni correction, in which the significance level () was adjusted to (from the initial α). This procedure is necessary to test the significance of differences between group pairs specifically and to control for the rate of type I errors (Table 7).$\propto\propto= \frac{0,05}{3} = 0,01670,05$

Table 7. Results of the Mann-Whitney Learning Style Test on Problem-Solving Ability

	Learning Style	N	Mean Rank	Sum of Ranks	Mann-Whitney	Wilcoxon W	Z	Asymp. Sig. (2-tailed)
Problem Solving	Visual	33	20.27	669	108.000	669.000	6.936	0.000
	Auditory	54	58.50	3159				
	Total	87						
Problem Solving	Visual	33	17.55	579	18.000	579.000	5.131	0.000
	Kinesthetic	15	39.80	597				
	Total	48						
Problem Solving	Auditory	54	34.07	1840	355.000	1840.000	0.768	0.443
	Kinesthetic	15	38.33	575				
	Total	69						

Based on a non-parametric statistical test (Table 7) with Bonferroni correction ($\alpha = 0.0167$), significant patterns in mathematical problem-solving ability based on learning style were identified:

1. The auditory group showed significantly superior performance than the visual group ($U = 108.000$, $Z = -6.936$, $p < 0.001$), indicated by a higher mean rank (auditory: 58.50 vs. visual: 20.27).
2. The kinesthetic group also significantly outperformed the visual group ($U = 18{,}000$, $Z = -5.131$, $p < 0.001$), with a marked difference in mean rank (kinesthetic: 39.80 vs. visual: 17.55).
3. Auditory and kinesthetic comparisons showed no significant differences ($U = 355.000$, $Z = -0.768$, $p = 0.443$), although the mean kinesthetic rank (38.33) was numerically higher than that of auditory (34.07).

Overall, the Kruskal-Wallis test confirmed a significant influence of learning style on problem-solving ability ($\chi^2(2) = 54.652$, *p* < 0.001). The highest to lowest ability rankings are: kinesthetic (mean rank = 70.13), auditory (65.07), and visual (20.82).

The final test is a hypothesis test on the prediction of students' mathematical problem-solving ability scores based on students' learning independence and learning style. The results of multiple linear regression tests on the data of learning independence and learning style of students on students' mathematical problem-solving abilities are presented in the following table.

After conducting the classical assumption test, a model feasibility test is carried out. Model feasibility test first using the F test or reliability test. The following are the results of the F test presented in Table 8. Anova Test F.

Table 8. Results of the F Test of Multiple Linear Regression

Type	F	Sig.
Regression	47.949	0.000

In Table 8. indicates a significance value of 0.000 is smaller than the significance level of 0.005. H0 is rejected because of a significance value of 0.000, so the estimated linear regression model is suitable to be used to explain the relationship between problem-solving ability, learning independence and learners' learning style.

The linear regression test (Table 9) in this study involves learning styles which are categorical variables. Therefore, the researcher made visual learning style as a reference variable and other learning styles (auditory and kinesthetic) as dummy variables.

Table 9. Multiple Linear Regression Coefficients of Learning Style and Learning Independence on Mathematical Problem-Solving Ability

Variable	Regression Coefficients	t	Sig.
Constant	29.167	22.412	0.000
Kinesthetic	2.170	0.762	0.448
Auditory	5.546	3.428	0.001
SRL	0.187	3.736	0.000

The linear regression model (Table 9) developed showed a determination coefficient (R^2) of 0.595, indicating that 59.5% variation in students' mathematical problem-solving ability could be explained by the variables of learning style and learning independence. Regarding the comparison of learning styles, the analysis revealed that although the kinesthetic group descriptively had a higher score than the visual group, this difference was not statistically significant ($\beta = 2.170$; $p = 0.448$). In contrast, the auditory group showed significantly superior problem-solving skills compared to the visual group ($\beta = 5.546$; $p = 0.001$).

In addition, learning independence was shown to have a positive and significant effect on problem-solving skills ($\beta = 0.187$; $p < 0.001$). Specifically, for every one-point increase on the learning independence scale, students' math problem-solving ability scores increased by an average of 0.187 points. These findings confirm that in addition to differences between learning style groups, learning independence is a critical predictor that contributes substantively to students' mathematical achievement.

This study revealed that Self-Regulated Learning (SRL) and learning style have a significant effect on students' mathematical problem-solving skills. The kinesthetic learning style has the highest problem-solving ability compared to the auditory and visual learning styles. Students with kinesthetic learning styles have significantly higher problem-solving abilities than those with visual learning styles. In addition, the problem-solving ability of students with kinesthetic learning styles is higher, but not significant to the ability of students with auditory learning styles. Furthermore, learning independence has a significant effect on students' problem-solving abilities.

Learning independence has a significant effect on math problem-solving skills. This is in line with the results of research conducted by those who stated that learning independence has a very strong effect on mathematical problem-solving skills. The learning independence researched by Ansori is not only in the context of learning mathematics, but also in the context of learning in general. But the problem-solving ability that Ansori researched is the ability to solve mathematical

problems. The results of the study also show that the independence of mathematics learning has a positive effect on students' mathematical problem-solving skills. The sample in Vernelli's research was grade IX students at SMP Negeri 25 Padang. The characteristics of grade IX students (in Vernelli's study) and high school students in grades X, XI, and XII (in this study) have similar characteristics, especially in terms of their learning independence. (Ansori and Herdiman, 2019; Vernelli and Armiati, 2023)

Learning style has a significant influence on math problem-solving skills. This is in line with the results of research conducted by those who show that the learning style of students in East Jakarta affects their ability to solve mathematical problems. The similarity of the research results is also shown in the order of problem-solving abilities based on learning styles in Safira's research results from the highest to the lowest in a row kinesthetic, auditory, and visual learning styles. However, the study has several differences as follows: 1) The study shows that the problem-solving abilities of visual learning students and auditory learning students do not have significant differences; 2) In addition, the problem-solving abilities of auditory learning students and kinesthetic learning students have significant differences. (Safira et al., 2024)

The difference in research results in East Jakarta and Inland Papua related to problem-solving skills based on learning styles is due to geographical and cultural factors. In East Jakarta, schools generally have better access to modern educational facilities, such as visual aids, textbooks, and structured learning methods, which optimally support visual and auditory learning styles. The VAK (Visual-Auditory-Kinesthetic) approach applied at MTs N 32 Jakarta shows that the mathematical problem-solving ability of visual and auditory students is not significantly different because these two styles are easily accommodated through visual media and oral explanations, although kinesthetic students are less facilitated due to the dominance of theory-based methods. In contrast, in Inner Papua, learning relies more on oral communication and direct practice due to the limitations of educational infrastructure, so kinesthetic and auditory learning styles are more accommodated, while visual learners struggle to understand the material without visual media. Cultural factors also play a role, where the structured and competitive learning culture in Jakarta encourages visual and auditory learners to be active in discussions or notes, while in Papua, community-based learning with physical activity is more dominant, supporting kinesthetic and auditory styles but less optimal for visual learners. (Faturahman, 2015; Ridwan, 2017; Ridwan, 2017; Supit et al., 2023).

This study shows that learning independence and learning style simultaneously affect

students' mathematical problem-solving skills. This is in line with the results of research conducted by the University of Wisconsin, which shows that there is a combined influence of learning styles and learning independence on the problem-solving ability of students in class XI MIPA SMA Negeri 1 Majene. The study also wrote that the contribution of learning independence and simultaneous learning styles to students' problem-solving abilities was 18.5% (81.5% was influenced by other factors). Meanwhile, in this study, the contribution of the learning independence model and learning style simultaneously was 59.9% (41.1% was influenced by other factors). However, the results of Sundayana's (2016) research (at Tarogong Kidul State Junior High School, West Java) have different results, namely learning independence is not significantly different from mathematical problem-solving ability when viewed from their learning style. Partially, the study showed that learning style did not have a significant effect on problem-solving skills. The difference between the results of this research and this research can be reviewed from the context of social culture. In Papua, limited access to education and supporting facilities in solving mathematics problems makes learning independence and learning styles important factors that complement each other. Students who should be suitable for visual learning styles, but facilities to provide visualization of mathematical concepts to students are still limited, so these students are required to adjust to the conditions in their environment. Meanwhile, at Tarogong Kidul State Junior High School (West Java), a structured education system with curriculum and technology support reduces dependence on specific learning styles, so that the effect is not partially significant (Alisa et al. 2022; Sunday, 2018).

This research provides important implications for educational practice, especially in the development of mathematics learning strategies that are in accordance with students' learning styles and learning independence. The findings that kinesthetic learning styles have a significant influence on mathematical problem-solving skills suggest that physical activity-based learning and hands-on practice need to be strengthened, especially in areas with cultural and geographical characteristics such as Interior Papua. In addition, learning independence, which has been proven to be significant in influencing problem-solving skills, is the basis for educators to encourage students to be more independent in the learning process, for example by utilizing project-based learning approaches or assignments that require independent exploration. These findings also support the importance of providing educational facilities that can accommodate the needs of visual and auditory learning styles, especially in areas with limited infrastructure access.

The results of this study also strengthen the relevance of educational theories that emphasize

the importance of learning style management and learning independence to optimize student learning outcomes. In the Papuan context, these results provide insight that learning approaches that are appropriate to local cultural and geographical conditions can increase the effectiveness of education, especially in mathematics subjects that are often considered difficult by students. Thus, the implications of this research are not only limited to the academic realm, but also to education policy, especially related to the equitable distribution of the quality of education in various regions of Indonesia.

4. CONCLUSIONS AND SUGGESTIONS

CONCLUSIONS

Students' independence and learning style have a significant effect on their ability to solve mathematical problems, with a contribution of 48.5%.

SUGGESTIONS

It is necessary to pay attention to the independence and learning style of students in improving their mathematical problem-solving skills.

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BIBLIOGRAPHY

Adisti Yuliastrin, Vebrianto, R., Efendi, S., dan Yovita. (2023). Pengembangan Instrumen Untuk Mengukur Keterampilan Kreatif Pada Materi Pencemaran Lingkungan. *Jurnal Ilmiah Pendidikan Citra Bakti*, 10(2), 285–292. https://doi.org/10.38048/jipcb.v10i2.1307

Akbar, S. (2013). *Instrumen Perangkat Pembelajaran*. Remaja Rosdakarya Offset.

Alisa, N., Musli, A. M., dan Aprisal, A. (2022). Pengaruh Gaya Belajar Dan Kemandirian Belajar Terhadap Kemampuan Pemecahan Masalah Matematika Peserta Didik Di Sman 1 Majene. *Jurnal Lebesgue : Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika*, 3(3), 568–575. https://doi.org/10.46306/lb.v3i3.170

Alwy Yusuf, M., Herman, Trisnawati H., Abraham, A., dan Rukmana, H. (2024). Analisis Regresi Linier Sederhana dan Berganda Beserta Penerapannya. *Journal on Education*, 06(02), 13331–13344. https://doi.org/https://doi.org/10.31004/joe.v6i2.5184

Anisah, dan Sri Lastuti. (2019). Identifikasi Kemampuan Pemecahan Masalah Matematika Mahapeserta didik Calon Guru SD di STKIP Taman Peserta didik Bima dan Cara Pengembangannya. *JURNAL PENDIDIKAN MIPA*, 9(2), 101–111.

https://doi.org/10.37630/jpm.v9i2.217

Ansori, Y., dan Herdiman, I. (2019). Pengaruh Kemandirian Belajar terhadap Kemampuan Pemecahan Masalah Matematis Peserta didik SMP. *Journal of Medives : Journal of Mathematics Education IKIP Veteran Semarang*, 3(1), 11. https://doi.org/10.31331/medivesveteran.v3i1.646

Audhiha, M., Vebrianto, R., Habibi, M., Febliza, A., dan Afdal, Z. (2022). Pengembangan Instrumen Kemandirian Belajar untuk Peserta didik Sekolah Dasar. *Madrasah: Jurnal Pendidikan Dan Pembelajaran Dasar*, 14(2), 111–124. https://doi.org/10.18860/mad.v14i2.13187

Faturahman, H. (2015). Faturahman, H. (2015). Peningkatan Kemampuan Pemecahan Masalah Matematika Peserta Didik Dengan Penerapan Pendekatan Visual Auditori Kinestetik (VAK). Fibonacci: *Jurnal Pendidikan Matematika & Matematika*, 1(1), 57–63. https://doi.org/https://doi.org/10.24853/fbc.1.1.57-63

Gall, M. D., Gall, J. P., dan Borg, W. R. (2003). Educational Research: An Introduction (A. E. Burvikovs, Ed.; 7th ed., Vol. 51, Issue 1). Pearson Education, Inc.

Hemalya, F., Yuniati, S., Rahmi, D., dan Kurniati, A. (2023). Meta-Analisis: Kemampuan Pemecahan Masalah Matematis terhadap Modul Ajar Matematika. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, 8(1), 71–81. https://doi.org/10.31004/cendekia.v8i1.2902

Herrhyanto, N., dan Gantini, T. (2021). *Analisis Data dengan Statistika Nonparametrik*. Yrama Widya.

Hijriani, L., Sri Subarinah, Syahrul Azmi, dan Baidowi. (2024). Analisis Kemampuan Pemecahan Masalah Matematika Materi Aritmetika Sosial Ditinjau Dari Gaya Belajar Peserta didik. *Mandalika Mathematics and Educations Journal*, 6(1), 216–229. https://doi.org/10.29303/jm.v6i1.6959

Majdina, N. I., Pratikno, B., dan Tripena, A. (2024). Penentuan Ukuran Sampel Menggunakan Rumus Bernoulli Dan Slovin: Konsep Dan Aplikasinya. *Jurnal Ilmiah Matematika Dan Pendidikan Matematika*, 16(1), 73. https://doi.org/10.20884/1.jmp.2024.16.1.11230

Makbul, M. (2021). *Metode Pengumpulan Data dan Instrumen Penelitian*. https://doi.org/10.31219/osf.io/svu73

Mukhid, A. (2008). Strategi Self-Regulated Learning (Perspektif Teoritik). *Tadris: Jurnal Pendidikan Islam*, 3. https://doi.org/https://doi.org/10.19105/tjpi.v3i2.239

Muslihin, H. Y., Loita, A., dan Nurjanah, D. S. (2022). Instrumen Penelitian Tindakan Kelas untuk Peningkatan Motorik Halus Anak. *Jurnal Paud Agapedia*, 6(1), 99–106. https://doi.org/10.17509/jpa.v6i1.51341

Nanda Muliawati, F., dan Sutirna, S. (2022). Analisis Kemampuan Pemecahan Masalah Matematis Peserta Didik Pada Materi Relasi Dan Fungsi. *PHI: Jurnal Pendidikan Matematika*, 6(1), 32. https://doi.org/10.33087/phi.v6i1.184

Pituch, K. A., dan Stevens, J. P. (2016). *Applied multivariate statistics for the social sciences: Analyses with SAS and IBM's SPSS*. In Routledge.

Rahayuningsih, S., Hasbi, M., Mulyati, M., dan Nurhusain, M. (2021). The Effect Of Self-Regulated Learning On Students' Problem-Solving Abilities. *Aksioma: Jurnal Program Studi*

Pendidikan Matematika, 10(2), 927. https://doi.org/10.24127/ajpm.v10i2.3538

Rahmatika, Khairiani, dan Nurul Akmal. (2022). Analisis Kemampuan Pemecahan Masalah Matematika Ditinjau Dari Gaya Belajar Peserta didik. *Ar-Riyadhiyyat: Journal of Mathematics Education*, 3(1), 10–20. https://doi.org/10.47766/arriyadhiyyat.v3i1.497

Retnawati, H. (2016). Analisis Kuantitatif Instrumen Penelitian: (Panduan Peneliti, Mahapeserta didik, dan Psikometrian) (1st ed.). Parama Publishsing.

Ridwan, M. (2017). Profil Kemampuan Penalaran Matematis Peserta Didik Ditinjau Dari Gaya Belajar. *Kalamatika: Jurnal Pendidikan Matematika*, 2(2), 193–206. https://doi.org/10.22236/KALAMATIKA.vol2no2.2017pp193-206

Rohani, D., R, Z., dan Bistari, B. (2022). Kemampuan Pemecahan Masalah Matematika Ditinjau Dari Self-Regulated Learning Peserta Didik Dalam Materi Lingkaran Di SMP. *Jurnal AlphaEuclidEdu*, 3(2), 168. https://doi.org/10.26418/ja.v3i2.52772

Safira, A., Choirunnisah, Octavyanti, I. A., Apriliyani, N. D., dan Wigati, N. A. (2024). Pengaruh Gaya Belajar terhadap Kemampuan Pemecahan Masalah Matematika Peserta didik. *Algoritma: Jurnal Matematika, Ilmu Pengetahuan Alam, Kebumian Dan Angkasa*, 2(4), 249–255. https://doi.org/10.62383/algoritma.v2i4.165

Samosir, E. (2022). Kemampuan Literasi Matematika: Kaitannya dengan Kemampuan Pemecahan Masalah. *Jurnal Riset Pendidikan Matematika Jakarta*, 4(1), 60–72. https://doi.org/10.21009/jrpmj.v4i1.23026

Sholihah, S. M., Aditiya, N. Y., Evani, E. S., dan Maghfiroh, S. (2023). Konsep Uji Asumsi Klasik Pada Regresi Linier Berganda. *Jurnal Riset Akuntansi Soedirman*, 2. https://doi.org/10.32424/1.jras.2023.2.2.10792

Situmorang, P. L., Fatchuroji, A., dan Oktariani, M. (2023). Pelatihan Matematika Dasar Bagi Usia Remaja Asli Papua Sebagai Upaya Meningkatkan Kemampuan Berhitung. *Faedah: Jurnal Hasil Kegiatan Pengabdian Masyarakat Indonesia*, 1(1), 39–46. https://doi.org/10.59024/faedah.v1i1.42

Sugiyono. (2014). Statistik Untuk Penelitian. CV. Alfabeta.

Sundayana, R. (2018). Kaitan antara Gaya Belajar, Kemandirian Belajar, dan Kemampuan Pemecahan Masalah Peserta didik SMP dalam Pelajaran Matematika. *Mosharafa: Jurnal Pendidikan Matematika*, 5(2), 75–84. https://doi.org/10.31980/mosharafa.v5i2.262

Supit, D., Meiske Maythy Lasut, E., Jerry Tumbel, N., Klabat, U., Airmadidi Bawah, J., dan Utara, S. (2023). Gaya Belajar Visual, Auditori, Kinestetik terhadap Hasil Belajar Peserta didik. *Journal on Education*, 05(03), 6994–7003.

Syarifah, R., Permadi, H., Qohar, A., dan Anwar, L. (2023). Kemampuan Pemecahan Masalah Geometri Peserta didik berdasarkan Self-Regulated Learning. *Edumatica: Jurnal Pendidikan Matematika*, 13(03), 258–272. https://doi.org/10.22437/edumatica.v13i03.22185

Vernelli, A. R., dan Armiati. (2023). Pengaruh Efikasi Diri Dan Kemandirian Belajar Peserta Didik SMP terhadap Kemampuan Pemecahan Masalah Matematika Mahasiswa Program Studi Pendidikan Matematika FMIPA UNP. *In Jurnal Edukasi dan Penelitian Matematika*.

Widoyoko, E. P. (2009). *Evaluasi Program Pembelajaran*. Pustaka Pelajar.