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THE IMPECT OF SELF-REGULATED LEARNING AND LEARNING STYLES ON STUDENTS' MATHEMATICAL LITERACY ABILITIES

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Abstract

Mathematical literacy skills play a crucial role in helping students solve real-life problems. This is because mathematical literacy trains students to solve contextual problem-based tasks. This study aims to examine the influence of Self-Regulated Learning and learning styles on students' mathematical literacy abilities. The research employs a quantitative research method. The population of this study consists of all 8th-grade students of SMP Negeri 2 Sewon. The study utilizes both test and non-test instruments. The test instrument is used to measure students' mathematical literacy abilities, while the non-test instrument, in the form of a questionnaire, is used to assess Self-Regulated Learning and learning styles. The research procedure involves completing the Self-Regulated Learning and learning style questionnaires followed by solving a mathematical literacy test. The study includes 32 items on Self-Regulated Learning, 16 items for each learning style, and 5 questions for the mathematical literacy test. The data from all variables are normally distributed and homogeneous. Further analysis is conducted using multiple regression with three variables. The results of this study reveal a significant influence of Self-Regulated Learning and learning styles on students' mathematical literacy abilities. These findings provide valuable insights for the development of more adaptive and effective teaching strategies, particularly in enhancing students' mathematical literacy skills in school settings. The implications of this study are expected to serve as a reference for designing targeted and relevant learning approaches that address students' needs.

Keywords: Self-Regulated Learning, Learning Styles, Students' Mathematical Literacy Ability

Abstrak

Kemampuan literasi matematika siswa berperan penting dalam membantu siswa memecahkan masalah dalam kehidupan sehari-hari. Hal tersebut disebabkan karena kemampuan literasi matematika melatih siswa untuk menyelesaikan soal-soal yang berbasis masalah kontekstual. Penelitian ini bertujuan untuk mengetahui pengaruh *Self-Regulated Learning* dan gaya belajar terhadap kemampuan literasi matematika siswa. Penelitian ini menggunakan metode penelitian kuantitatif. Populasi dalam penelitian ini adalah seluruh kelas VIII SMP Negeri 2 Sewon. Penelitian ini menggunakan instrumen tes dan non-tes. Instrumen tes digunakan untuk mengukur kemampuan literasi matematika siswa. Instrumen non-tes berupa angket digunakan untuk mengukur *Self-Regulated Learning* dan gaya belajar siswa. Tahapan dalam penelitian ini yaitu pengisian angket *Self-Regulated Learning* dan gaya belajar siswa kemudian mengerjakan soal tes kemampuan literasi matematika siswa. Penelitian Ini terdiri dari 32 butir item *Self-Regulated-Learning*, 16 butir untuk masing-masing gaya belajar, dan 5 soal tes kemampuan literasi matematika. Seluruh data dari masing-masing variabel berdistribusi normal dan homogen. Uji lanjut menggunakan analisis regresi berganda tiga variabel. Hasil penelitian ini mengungkapkan bahwa terdapat pengaruh signifikan antara *Self-Regulated Learning* dan gaya belajar terhadap kemampuan literasi matematika siswa. Temuan ini menawarkan wawasan berharga bagi pengembangan strategi pembelajaran yang lebih adaptif dan efektif, khususnya dalam meningkatkan keterampilan literasi matematika siswa di lingkungan sekolah. Implikasi dari penelitian ini diharapkan dapat menjadi acuan dalam merancang pendekatan pembelajaran yang lebih tepat sasaran dan relevan dengan kebutuhan siswa.

Kata Kunci: *Self-Regulated Learning, Learning Styles, Students' Mathematical Literacy Ability*

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1. Pendahuluan

In general, education can be divided into two types: formal and non-formal. Formal education is typically obtained through school learning activities, with mathematics being one of the key subjects taught. Mathematics has two main objectives (Rahmah, 2018). The formal objectives, which focus on developing students' reasoning and personality, and the material objectives, which aim to equip students with the skills to apply mathematical knowledge in real-life problem-solving. According to Harefa et al., (2023 mathematics education enables students to understand concepts, recognize patterns, reason logically, and use mathematics to carry out practical tasks. Rahmah (2018) further emphasized that one function of mathematics education is to enhance skills in calculation, measurement, and applying mathematical principles to everyday life. Thus, literacy in mathematics, referred to as mathematical literacy, is essential for supporting students' problem-solving abilities. Based on data from the Program for International Student Assessment (PISA), which examined students' mathematical literacy skills in various countries, Indonesia ranked sixth in the 2018 PISA assessment, scoring 379. This makes Indonesia one of the countries with low mathematical literacy (Furqon et al., 2021). In fact, Hera & Sari (2015) explained that mathematical literacy in its role in everyday life helps improve problem-solving skills so that everyone, including students, needs to have high mathematical literacy skills. This ability helps individuals analyze and interpret problems in detail, enabling them to find appropriate solutions. Low mathematical literacy skills can be influenced by several factors, including self-regulated learning and learning styles.

Mathematical literacy plays a crucial role in students' ability to solve real-world problems, as it involves understanding and applying mathematical concepts in context. Key indicators of mathematical literacy include the ability to solve contextual problems, reason mathematically, and communicate mathematical ideas effectively. These skills are fundamental for students to become proficient problem-solvers in their daily lives. Self-Regulated Learning (SRL) refers to a student’s ability to control their own learning process. This includes setting learning goals, seeking out resources, managing time effectively, and evaluating their own progress (Abror, 2022). The ability to regulate one’s learning could potentially influence mathematical literacy, as students with strong SRL

skills are more likely to approach mathematical tasks systematically and with greater focus. For instance, students who manage their learning independently are able to complete assignments more efficiently and effectively (Merdiasi et al., 2021). Given the importance of mathematical literacy, it is worth exploring whether SRL is related to students' mathematical literacy abilities. Specifically, it is crucial to examine whether SRL can enhance students' ability to apply mathematical knowledge in practical contexts. This relationship must be rooted in a theoretical framework to provide a solid basis for the quantitative analysis of the influence of SRL on mathematical literacy.

Student success in mathematics, including mathematical literacy, can be influenced by various factors, one of which is the learning style. Learning style refers to how students absorb, process, and organize information during the learning process (Budiarti & Jabar, 2016). Learning style is the way students make sense of and internalize information. (Rostiana Sundayan, 2018). Santi Widyawati (2016) further defines it as the process through which individuals absorb, organize, and understand the information they encounter in their learning journey. However, it is essential to explore whether different learning styles are associated with varying levels of mathematical literacy. While each student has unique learning characteristics, it is necessary to investigate if specific learning styles enhance certain aspects of mathematical literacy. Understanding this connection can provide valuable insights into how teaching strategies might be adapted to improve literacy outcomes for students, particularly in mathematics.

Previous studies have highlighted the persistently low levels of mathematical literacy among students in Indonesia. Muzaki & Masjudin (2019) found that only 19% of eleventh-grade students at SMA N 1 Kediri demonstrated high mathematical literacy skills. Similarly, Andi Zulkardi & Darmawijaya (2018) observed that students' mathematical literacy skills remain suboptimal. However, this research aims to explore aspects that were previously overlooked, particularly the influence of Self-Regulated Learning and learning styles on mathematical literacy. Unlike previous studies, which primarily focused on assessing literacy levels, this study will delve into how individual learning characteristics, such as self-regulation, contribute to improving mathematical literacy outcomes.

At SMP Negeri 2 Sewon, students' mathematical literacy remains relatively low. This observation is reflected in the results of the summative assessment on the topic of System of Linear Equations in Two Variables conducted in class VIII H, where only 25.81% of students scored above the Minimum Mastery Criteria (KKTP). The remaining 74.19%

scored below the KKTP, primarily due to their inability to correctly answer questions related to mathematical literacy. This indicates that many students have not yet mastered mathematical literacy skills, as evidenced by the fact that most students sought help from their peers or the researcher when attempting the assessment questions. Additionally, when asked to explain the steps to solve the problems, most students were unable to provide clear answers. Observations during the researcher's PLP II placement also revealed that only 25% of students were actively engaged in class discussions, with others remaining silent unless prompted by the teacher. However, the aim of this study is not to directly address these literacy gaps but to examine how Self-Regulated Learning (SRL) and learning styles influence students' mathematical literacy abilities.

Several students at SMP Negeri 2 Sewon mentioned that they faced difficulties in managing their time and study methods. They expressed that a lack of enthusiasm for learning stemmed from their surrounding environment. Specifically, many students reported that at home, they struggled with deciding what to study and how to manage their time, often being distracted by peers inviting them to play. Moreover, students noted that they were unsure about effective study methods, which contributed to their disengagement. Additionally, most students relied on their friends to complete assignments, often feeling too lazy to do it themselves. These issues highlight the need for students to develop strong self-regulated learning skills and an understanding of their learning styles. By doing so, they can better manage their learning activities, which will, in turn, improve their abilities, including mathematical literacy. Such skills are crucial, as they enable students to solve everyday problems effectively. These assumptions are grounded in previous theories suggesting that self-regulation and learning styles significantly impact student outcomes, particularly in problem-solving and academic achievement. Based on the description, the researcher is conducting a quantitative study aimed at examining the impact of Self-Regulated Learning and learning styles on the mathematical literacy skills of Class VIII students at SMP Negeri 2 Sewon. Specifically, this study seeks to determine how Self-Regulated Learning and different learning styles influence students' abilities in mathematical literacy, focusing on their problem-solving skills and conceptual understanding.

2. Metode Penelitian

This study employed a quantitative research design with a correlational approach to examine the relationships between self-regulated learning, learning styles, and students'

mathematical literacy ability. The research was conducted from November to December 2023 at SMP Negeri 2 Sewon, located in Pandes, Panggungharjo, Sewon, Bantul, Special Region of Yogyakarta, Indonesia. The population of the study consisted of all eighth-grade students enrolled at SMP Negeri 2 Sewon during the 2023 academic year. A random sampling technique was applied to select the research sample, resulting in the inclusion of students from classes VIII A, VIII E, VIII F, VIII G, and VIII H, with a total of 142 participants. The variables examined in this study comprised independent and dependent variables. Self-regulated learning and learning styles (visual, auditory, and kinaesthetic) were treated as independent variables, while mathematical literacy ability served as the dependent variable. Data were collected using questionnaires and tests. The questionnaires were administered to measure students' levels of self-regulated learning and their dominant learning style tendencies, whereas a mathematical literacy test was used to assess students' mathematical literacy ability. Prior to data collection, all research instruments underwent a rigorous validation process. The questionnaires and test instruments were first reviewed by expert validators to ensure content validity. Subsequently, a pilot study was conducted to evaluate item validity, reliability, discrimination indices, and difficulty levels, particularly for the mathematical literacy test. Only items that met the established criteria for validity and reliability were retained and used in the main data collection process. Data analysis was carried out using parametric statistical techniques. Preliminary analyses included tests of normality and homogeneity to ensure that the assumptions required for parametric testing were satisfied. Following these prerequisite tests, multiple regression analysis involving three variables was conducted to examine both the individual and combined effects of self-regulated learning and learning styles on students' mathematical literacy ability. Additional analyses were performed by grouping students according to their dominant learning style tendencies in order to obtain a more detailed understanding of the relationships among the variables under investigation.

3. Hasil dan Pembahasan

3.1 Description of Research Data

The data for this study were taken from classes VIII A, VIII B, VIII E, VIII F, VIII G, and VIII H with a total of 173 students as respondents. One class was randomly selected as the instrument trial class, and five classes were used as research samples. The instrument trial was conducted in class VIII B. The following is a description of the data from each research variable.

1) Self-Regulated Learning

This Self-Regulated Learning (SRL) questionnaire has an ideal score of 32 – 128, with the lowest ideal value of 25 and the highest ideal value of 100. The results of the Self-Regulated Learning (SRL) questionnaire analyzed with the help of the IBM SPSS 21 for Windows program have empirical data, namely an average of 73.79, a minimum value of 58, a maximum value of 96, and a standard deviation of 7.75.

2) Learning Style

The three learning styles examined in this study—visual, auditory, and kinesthetic—are each assessed using a questionnaire consisting of 16 items. Each questionnaire has an ideal score range of 6 to 64. In this study, the learning style tendencies of respondents were determined by identifying the highest score obtained across the three learning style questionnaires. The final score for each student was based on their highest learning style score, which represents the most dominant learning style. The respondents were then grouped according to these dominant learning style tendencies. Table 1 below shows the distribution of learning style tendencies among the 142 respondents.

Table 1 Description of Learning Style Variables

Learning Style Tendencies	Number of Respondents	Percentage (%)
Visual Learning Style	64	45
Auditory Learning Style	34	24
Kinesthetic Learning Style	44	31

3) Mathematical Literacy Ability

The average score of the mathematical literacy ability test of class VIII students of SMP Negeri 2 Sewon in this study was 50.51 with the lowest score of 0, the highest score of 100, and a standard deviation of 24.20.

3.2 Research Data Analysis

1) Validity Test

The validity test results for the Self-Regulated Learning (SRL) questionnaire, which included 7 indicators and 35 statement items, revealed that 32 items were valid. For the learning style questionnaires, the validity test for the visual learning style, which comprised 5 indicators and 20 items, identified 16 valid items. Similarly, the auditory learning style questionnaire, consisting of 5 indicators and 20 items, also showed 16 valid items. For the kinesthetic learning style questionnaire, which included 3 indicators and 20 statement items, 16 valid items were found. These findings demonstrate that the majority

of items in each learning style questionnaire were valid, ensuring the reliability of the data for further analysis. Lastly, the validity test for the mathematical literacy ability test, which included 6 indicators and 5 items, also confirmed that all items were valid.

2) Reliability Test

The reliability test results for the instruments used in this study showed varying levels of reliability across different questionnaires and tests. For the Self-Regulated Learning (SRL) questionnaire, which included 32 items, the Cronbach's alpha value was 0.955, indicating excellent reliability ($0.90 \leq \alpha \leq 1.00$). For the learning style questionnaires, the visual learning style, with 16 items, achieved a Cronbach's alpha of 0.550 ($0.40 \leq \alpha \leq 0.70$), which indicates acceptable reliability. The auditory learning style questionnaire, with 16 items, also had a Cronbach's alpha value of 0.690, which is within the acceptable range ($0.40 \leq \alpha \leq 0.70$). Similarly, the kinesthetic learning style questionnaire, consisting of 16 items, showed a Cronbach's alpha of 0.697, again in the acceptable range. Finally, the mathematical literacy ability test, which included 5 items, had a Cronbach's alpha of 0.740 ($0.70 \leq \alpha \leq 0.90$), indicating good reliability. These results suggest that the instruments used in the study were reliable and appropriate for measuring the variables under investigation.

3) Results of the Differential Power Test and Difficulty Index of the Mathematical Literacy Test Instrument

The results of the Differential Power Test and Difficulty Index Test for the mathematical literacy ability test items indicated varying levels of effectiveness in differentiating student performance. In the Differential Power Test, items 1 and 2 were classified as "Well Enough," with Cronbach's alpha values of 0.346 and 0.368, respectively. Items 3 and 4, with higher indices of 0.851 and 0.779, were categorized as "Very Good," while item 5, with a value of 0.566, was categorized as "Good." These results suggest that items with a Differential Power between 0.30 and 0.40 are deemed acceptable for inclusion in the analysis, as they still provide some discriminatory power to distinguish between high and low-performing students.

Regarding the Difficulty Index Test, items 1 and 2 were classified as "Easy" with difficulty indices of 0.898 and 0.871, respectively. Items 3 and 4 were categorized as "Medium" with indices of 0.474 and 0.354, while item 5, with

a difficulty index of 0.125, was classified as "Difficult." The inclusion of all three difficulty levels—Easy, Medium, and Difficult—enhances the diversity of the test instrument, allowing it to effectively assess students across a range of mathematical literacy abilities. Items in the "Easy" category assess basic mathematical skills, while "Medium" items evaluate intermediate problem-solving capabilities, and "Difficult" items challenge students to demonstrate higher-order reasoning and advanced problem-solving skills. By incorporating items from all three difficulty categories, the instrument provides a more comprehensive evaluation of students' mathematical literacy, ensuring its validity across different levels of student performance.

3.3 Prerequisite Test

1) Normality Test

The Normality Test for the Self-Regulated Learning (SRL) Questionnaire indicated that the data from all five classes followed a normal distribution. The Kolmogorov-Smirnov test yielded Asymp. Sig. values greater than 0.05 for all classes. The normality of each individual class was tested to ensure that each class met the assumptions required for further statistical analysis, particularly for the regression model. Although combining the classes into a single dataset would have been an option, testing normality individually for each class assures that the regression model remains valid across all groups. Therefore, regression analysis will be conducted on the combined dataset, encompassing all five classes, as per the methodology.

a) Normality Test of Learning Style Questionnaire

The results of the Normality Test for the Self-Regulated Learning (SRL), Visual Learning Style, Auditory Learning Style, and Kinesthetic Learning Style questionnaires revealed that all variables followed a normal distribution. The Kolmogorov-Smirnov test indicated that the Asymp. Sig. values for the SRL variable in classes VIII A, VIII E, VIII F, VIII G, and VIII H were 0.204, 0.722, 0.836, 0.901, and 0.641, respectively, all exceeding the threshold of 0.05, indicating normality across all classes. Similarly, for the visual learning style, the Asymp. Sig. values were 0.977, 0.974, 0.480, 0.501, and 0.933; for auditory learning style, they were 0.554, 0.647, 0.658, 0.614, and 0.321; and for kinesthetic learning style, they were 0.101, 0.932, 0.650, 0.379, and 0.657, respectively—all values

above 0.05, confirming that each learning style variable came from a normally distributed population. Given these results, normality was confirmed for each class, and the dataset was deemed appropriate for regression analysis. The regression was conducted on the combined data from all classes, ensuring the model's validity across all student groups. Testing normality individually for each class, while not strictly necessary when combining the data, enhances the confidence that the regression analysis is valid for the overall sample.

b) Normality Test of Mathematical Literacy Ability Test Questions

The results of the Normality Test for the Mathematical Literacy Ability test, conducted across all classes revealed that the data followed a normal distribution. The Kolmogorov-Smirnov test yielded Asymp. Sig. values of 0.245, 0.832, 0.177, 0.329, and 0.720 for the respective classes, all of which were above the 0.05 threshold. This confirms that the data from the mathematical literacy ability test items were normally distributed. Given these results, the researchers can conclude that the mathematical literacy ability variable comes from a normally distributed population, and thus, the data are suitable for further statistical analysis. Normality was tested for each class individually to ensure the distribution characteristics were consistent across all groups, as regression analysis is typically sensitive to data distribution. Although combining the data could have been an alternative approach, testing normality for each class individually provides additional confidence that the regression analysis is valid for the full sample.

3.4 Multiple Regression Analysis

1) Visual Learning Style Group

a) Determining the Regression Line Equation

The regression analysis results revealed that the constant/intercept value is 45.412, with the slope coefficient for Self-Regulated Learning at 0.506 (with a significance value of 0.566) and for Visual Learning Style at 1.066 (with a significance value of 0.867). Thus, the regression equation can be expressed as: $\hat{Y} = 45.412 + 0.506X_1 + 1.066X_2$. The interpretation of this equation is as follows: when both Self-Regulated Learning and Visual Learning Style are close to zero, the students' mathematical literacy test

score remains at 45.412, meaning that, at low levels of these variables, students' literacy scores do not improve. If Self-Regulated Learning increases by one unit, while Visual Learning Style remains constant, students' mathematical literacy will increase by 0.506 units. Similarly, if Visual Learning Style increases by one unit, while Self-Regulated Learning remains constant, students' mathematical literacy will increase by 1.066 units. The results from the ANOVA regression analysis indicated an F-value of 0.297 with a significance value of 0.744. Since the significance value exceeds 0.05, it can be concluded that the regression coefficients are not statistically significant, implying that the model does not adequately explain the variance in students' mathematical literacy scores.

b) Linearity Test of Regression Line

The analysis of the deviation from linearity for the regression line of the Mathematical Literacy Ability Test (MLAT) and Self-Regulated Learning (SRL) yielded an F value of 0.803 with a significance value of 0.704. Since the significance value exceeds the 0.05 threshold, it can be concluded that the regression line is linear. Similarly, the deviation from linearity analysis for the Mathematical Literacy Ability and Visual Learning Style (VLS) regression line resulted in an F value of 0.799 and a significance value of 0.641, which is also greater than 0.05, confirming that the regression line is linear in this case as well.

c) Correlation Significance Test

The partial correlation analysis between Self-Regulated Learning (X_1) and Mathematical Literacy Ability (Y), controlled for Visual Learning Style (X_2), revealed a correlation of 0.074 with a significance value of 0.566. Since the significance value exceeds 0.05, the null hypothesis (H_0) is accepted, and the alternative hypothesis (H_1) is rejected. Therefore, it can be concluded that the partial correlation between Self-Regulated Learning and students' mathematical literacy abilities, when controlled by visual learning styles, is not significant. Similarly, the partial correlation analysis between Visual Learning Style (X_2) and Mathematical Literacy Ability (Y), controlled for Self-Regulated Learning (X_1), yielded a correlation of 0.022 with a significance value of 0.867. As the significance value is

greater than 0.05, H_0 is accepted, and H_1 is rejected. Thus, the researcher concludes that the partial correlation between visual learning styles and students' mathematical literacy abilities, controlled by Self-Regulated Learning, is also not significant.

2) Auditory Learning Style Group

a) Determining the Regression Line Equation

The regression analysis showed that the constant (intercept) value is 61.691, while the regression coefficient for Self-Regulated Learning (X_1) is 0.761 with a significance value of 0.047, and for Auditory Learning Style (X_2) is -1.089 with a significance value of 0.558. Based on these values, the regression equation can be written as: $\hat{Y} = 61.691 + 0.761X_1 + 1.837X_2$. This equation implies that if both Self-Regulated Learning (X_1) and Auditory Learning Style (X_2) are close to zero, the predicted mathematical literacy score ($\hat{Y}$) will be 61.691. This suggests that when both Self-Regulated Learning and Auditory Learning Style are low, students' mathematical literacy will remain at the baseline value. Furthermore, for every one-unit increase in Self-Regulated Learning; while keeping Auditory Learning Style constant, students' mathematical literacy score is predicted to increase by 0.761 units. In contrast, for every one-unit increase in Auditory Learning Style, with Self-Regulated Learning held constant, the mathematical literacy score is expected to rise by 1.837 units. In the ANOVA test for the regression model, the F value is 2.584 with a significance value of 0.092. Since the significance value is greater than 0.05, we accept the null hypothesis and reject the alternative hypothesis. This result indicates that the regression model is not statistically significant, leading the researcher to conclude that the regression coefficients are not significant.

b) Linearity Test of Regression Line

The linearity test of the regression model was conducted to examine whether the relationship between the variables met the assumption of linearity. The results indicate that the analysis of the deviation from linearity between mathematical literacy ability and self-regulated learning produced an F value of 0.414 with a significance level of 0.961. Given that the significance value exceeded the criterion of 0.05, the null hypothesis

was accepted and the alternative hypothesis was rejected, indicating that the relationship between these variables can be considered linear. Similarly, the deviation from linearity analysis for the relationship between mathematical literacy ability and auditory learning style yielded an F value of 0.830 with a significance level of 0.596. Since this value was also greater than 0.05, the null hypothesis was accepted and the alternative hypothesis was rejected. These findings confirm that the regression models used in this study satisfy the assumption of linearity and are therefore appropriate for subsequent inferential analysis.

c) Partial Correlation Significance Test

A partial correlation analysis was conducted to examine the relationship between self-regulated learning and students' mathematical literacy ability while controlling for auditory learning style. The results revealed a partial correlation coefficient of 0.348 with a significance value of 0.047. Since the significance value was below the 0.05 threshold, the null hypothesis was rejected and the alternative hypothesis was accepted, indicating that self-regulated learning is significantly associated with mathematical literacy ability when the effect of auditory learning style is controlled. In contrast, the partial correlation analysis between auditory learning style and students' mathematical literacy ability, after controlling for self-regulated learning, yielded a correlation coefficient of −0.106 with a significance value of 0.558. As this significance value exceeded 0.05, the null hypothesis was accepted and the alternative hypothesis was rejected. These findings suggest that, when the influence of self-regulated learning is accounted for, auditory learning style does not have a statistically significant relationship with students' mathematical literacy ability.

3) Kinesthetic Learning Style Group

a) Determining the Regression Line Equation

The multiple regression analysis yielded a regression equation with a constant value of 44.353, indicating the estimated mathematical literacy score when both self-regulated learning and kinesthetic learning style are at a minimal or zero level. The regression coefficient for self-regulated learning was 0.439 with a significance value of 0.172, suggesting that an increase of one unit in self-regulated learning, while holding kinesthetic

learning style constant, was associated with a modest increase of 0.439 units in students' mathematical literacy, although this effect was not statistically significant. Similarly, the regression coefficient for kinesthetic learning style was 1.072 with a significance value of 0.353, indicating that a one-unit increase in kinesthetic learning style, with self-regulated learning held constant, corresponded to an increase of 1.072 units in mathematical literacy, but this relationship was also not statistically significant. Consequently, the resulting regression model can be expressed as $\hat{Y} = 44.353 + 0.439X_1 + 1.072X_2$. Furthermore, the overall regression model produced an F value of 2.589 with a significance level of 0.087. Since this value exceeded the 0.05 significance threshold, the null hypothesis was accepted and the alternative hypothesis was rejected, indicating that the regression coefficients, when considered simultaneously, did not have a statistically significant effect on students' mathematical literacy ability.

b) Linearity Test of Regression Line

The linearity test of the regression model was conducted to examine whether the relationships among the variables satisfied the assumption of linearity. The results indicated that the deviation from linearity between mathematical literacy ability and self-regulated learning yielded an F value of 1.787 with a significance level of 0.101. As the significance value exceeded the 0.05 threshold, the null hypothesis was accepted and the alternative hypothesis was rejected, suggesting that the relationship between mathematical literacy ability and self-regulated learning can be regarded as linear. Similarly, the analysis of the deviation from linearity between mathematical literacy ability and kinesthetic learning style produced an F value of 0.789 with a significance level of 0.658. Since this value was also greater than 0.05, the null hypothesis was accepted, and the alternative hypothesis was rejected. These findings confirm that the regression relationships involving mathematical literacy ability with both self-regulated learning and kinesthetic learning style meet the linearity assumption, indicating that the regression models are appropriate for further statistical analysis.

c) Partial Correlation Significance Test

A partial correlation analysis was conducted to examine the relationship between self-regulated learning and students' mathematical literacy ability while controlling for the influence of kinaesthetic learning style. The results indicated a partial correlation coefficient of 0.212 with a significance value of 0.172. Since this significance value exceeded the 0.05 threshold, the null hypothesis was accepted and the alternative hypothesis was rejected, suggesting that self-regulated learning does not have a statistically significant relationship with mathematical literacy ability when the effect of kinaesthetic learning style is controlled. Furthermore, the partial correlation analysis between kinaesthetic learning style and students' mathematical literacy ability, after controlling for self-regulated learning, yielded a correlation coefficient of 0.145 with a significance value of 0.353. As this value was also greater than 0.05, the null hypothesis was accepted and the alternative hypothesis was rejected. These findings indicate that neither self-regulated learning nor kinaesthetic learning style demonstrates a significant partial association with students' mathematical literacy ability when the influence of the other variable is taken into account.

3.5 Hypothesis Testing

This study examined three hypotheses concerning the relationships among self-regulated learning, learning styles, and mathematical literacy skills of eighth-grade students at SMP Negeri 2 Sewon. The first hypothesis tested whether self-regulated learning influenced students' mathematical literacy skills. The hypothesis was evaluated using simple regression analysis. The results indicated that the correlation coefficient exceeded the critical value and the calculated t-value was greater than the corresponding t-table value, leading to the rejection of the null hypothesis. This finding demonstrates that self-regulated learning has a significant effect on students' mathematical literacy skills. The coefficient of determination revealed that self-regulated learning accounted for 5.3% of the variance in mathematical literacy skills. The resulting regression equation was $\hat{Y} = -2.643 + 0.720X$, indicating that each one-unit increase in self-regulated learning was associated with an increase of 0.720 units in students' mathematical literacy skills, despite the negative intercept value.

The second hypothesis investigated the influence of individual learning styles—visual, auditory, and kinaesthetic—on students' mathematical literacy skills. For students with a tendency toward visual learning styles, the analysis showed that both the correlation coefficient and the t-value failed to meet the criteria for statistical significance. The coefficient of determination indicated that visual learning style contributed only 0.4% to the variance in mathematical literacy skills. Although the regression coefficient was positive, suggesting a potential increase in literacy skills with higher visual learning tendencies, the effect was not statistically significant, leading to the acceptance of the null hypothesis.

A similar pattern emerged for students with auditory learning style tendencies. The results demonstrated that neither the correlation coefficient nor the t-value reached the required significance level. The coefficient of determination showed that auditory learning style explained only 2.4% of the variance in mathematical literacy skills. Although the regression coefficient indicated a positive relationship, the effect was not statistically significant, and therefore the null hypothesis was accepted, indicating that auditory learning style did not significantly influence students' mathematical literacy skills.

Likewise, the analysis of kinaesthetic learning style revealed that the relationship between kinaesthetic learning tendencies and mathematical literacy skills was not statistically significant. The coefficient of determination showed that kinaesthetic learning style contributed 7% to the variance in students' mathematical literacy skills. Despite a positive regression coefficient suggesting a potential increase in literacy skills with higher kinaesthetic learning tendencies, the statistical tests did not support a significant effect, resulting in the acceptance of the null hypothesis.

The third hypothesis examined the joint influence of self-regulated learning and learning styles on students' mathematical literacy skills. The results indicated that the combined predictors produced a correlation coefficient exceeding the critical value, leading to the rejection of the null hypothesis. The coefficient of determination revealed that self-regulated learning and learning styles together accounted for 5.6% of the variance in mathematical literacy skills. The resulting regression equation was $\hat{Y} = -14.241 + 0.636X_1 + 0.393X_2$, indicating that increases in both self-regulated learning and learning styles were associated with improvements in students' mathematical literacy skills. These findings suggest that, although individual learning styles did not show significant independent effects, their combined contribution with

self-regulated learning plays a meaningful role in shaping students' mathematical literacy abilities.

4. Kesimpulan dan Saran

Based on the results of the data analysis, it can be concluded that self-regulated learning has a measurable influence on the mathematical literacy ability of eighth-grade students at SMP Negeri 2 Sewon, as indicated by a correlation coefficient exceeding the critical value and a coefficient of determination showing that self-regulated learning accounts for 5.3% of the variance in students' mathematical literacy ability. In contrast, the analysis of individual learning styles—visual, auditory, and kinesthetic—revealed correlation coefficients that did not exceed the critical threshold, indicating that none of these learning styles independently exert a significant influence on students' mathematical literacy ability. However, when self-regulated learning and learning styles were considered simultaneously, the combined analysis demonstrated a correlation coefficient greater than the critical value, with a coefficient of determination of 5.6%. This finding suggests that, although learning styles do not significantly affect mathematical literacy ability on their own, their joint contribution alongside self-regulated learning plays a modest but meaningful role in shaping students' mathematical literacy outcomes.

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