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SELF-EFFICACY, LEARNING STYLES, AND LEARNING DISCIPLINE AS PREDICTORS OF MATHEMATICS ACHIEVEMENT AMONG VOCATIONAL SCHOOL STUDENTS

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ABSTRACT

This study aims to analyze the influence of self-efficacy, learning styles, and learning discipline on students' mathematics learning outcomes at Muhammadiyah Mlati Vocational School, Sleman. The research employed a quantitative approach using a survey method. The research instrument was a scale that had been validated through expert judgment and tested for its validity and reliability. Data were collected from 150 respondents and analyzed using SPSS-25 through prerequisite tests (normality, multicollinearity, heteroscedasticity, and linearity) and hypothesis testing using regression analysis. The results of the validity and reliability tests indicated that all instrument items were valid and reliable. The data were normally distributed, free from multicollinearity and heteroscedasticity, and met the assumption of linearity among variables. Descriptive analysis showed that the average scores for all variables were relatively high, exceeding 75. Regression analysis revealed that self-efficacy, learning styles, and learning discipline had a significant influence on mathematics learning outcomes, both simultaneously and partially. This study highlights the importance of strengthening students' internal factors in supporting academic achievement, particularly in mathematics learning at the vocational high school level. The findings are expected to serve as a reference for teachers in designing learning strategies that consider students' individual characteristics.

***Keywords**: self-efficacy, learning style, learning discipline, mathematics learning outcomes*

Abstrak

Penelitian ini bertujuan untuk menganalisis pengaruh self-efficacy, gaya belajar, dan kedisiplinan belajar terhadap hasil belajar matematika siswa SMK Muhammadiyah Mlati, Sleman. Pendekatan yang digunakan adalah kuantitatif dengan metode survei. Instrumen penelitian berupa skala yang telah divalidasi melalui expert judgement dan diuji validitas serta reliabilitasnya. Data dikumpulkan dari 150 responden dan dianalisis menggunakan SPSS-25 melalui uji prasyarat (normalitas, multikolinearitas, heteroskedastisitas, dan linearitas) serta uji hipotesis regresi. Hasil uji validitas dan reliabilitas menunjukkan bahwa seluruh item instrumen dinyatakan valid dan reliabel. Data berdistribusi normal, bebas dari multikolinearitas dan heteroskedastisitas, serta memenuhi asumsi linearitas antara variabel. Analisis deskriptif menunjukkan nilai rata-rata yang cukup tinggi untuk semua variabel, yaitu di atas 75. Uji regresi menunjukkan bahwa self-efficacy, gaya belajar, dan kedisiplinan belajar secara simultan maupun parsial berpengaruh signifikan terhadap hasil belajar matematika. Penelitian ini menegaskan pentingnya penguatan faktor internal siswa dalam menunjang pencapaian akademik, khususnya dalam pembelajaran matematika di tingkat SMK. Temuan ini diharapkan menjadi acuan bagi guru dalam merancang strategi pembelajaran yang mempertimbangkan karakteristik siswa.

Kata Kunci: self-efficacy, gaya belajar, kedisiplinan belajar, hasil belajar matematika,

1. INTRODUCTION

Mathematics is a fundamental subject that plays a crucial role in developing students' logical, systematic, and critical thinking skills [1]. Mathematical proficiency is essential not only in academic contexts but also in

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everyday life, including decision-making and problem-solving. Within the framework of Indonesia's national curriculum, mathematics is a compulsory subject delivered continuously from elementary through senior secondary levels, including at Vocational Schools. However, in practice, many vocational students continue to struggle with understanding and mastering abstract and complex mathematical concepts. This issue is reflected in the low average scores in mathematics, as seen in school exams, national assessments, and classroom evaluations [2]. These findings highlight challenges in mathematics instruction, which are not solely related to teaching methods but also to individual student factors that influence learning outcomes.

One key internal factor affecting student achievement is self-efficacy, which refers to a student's belief in their ability to complete specific tasks, including those in mathematics [3]. Students with high self-efficacy tend to be more confident in solving mathematical problems, more persistent when facing difficulties, and more resilient in tackling tasks independently. They are less likely to give up and more capable of devising effective problem-solving strategies [4]. Conversely, students with low self-efficacy are more likely to experience anxiety, lack motivation to study, and give up easily when faced with challenges, all of which negatively affect their academic performance. Therefore, it is essential to examine the extent to which self-efficacy contributes to mathematics achievement, so that teachers can provide the necessary support to enhance students' confidence in learning mathematics.

In addition to self-efficacy, students' learning styles also play a significant role in determining the effectiveness of the learning process. Learning style refers to an individual's preferred way of absorbing, processing, and retaining information [5]. Common learning styles include visual (learning by seeing), auditory (learning by hearing), and kinesthetic (learning by doing). Each student has a dominant learning style, and if the teacher's instructional methods do not align with the students' learning preferences, the learning process becomes less effective. This mismatch can lead to boredom, difficulty in understanding materials, and poor information retention [6]. Thus, recognizing and understanding students' learning styles is crucial in order to adapt instructional approaches to meet their needs.

Another important factor that influences students' mathematics achievement is learning discipline. Learning discipline encompasses regularity in completing assignments, effective time management, adherence to school rules, and consistent commitment to the learning process [7]. Students with strong learning discipline are generally more organized, manage their time efficiently, and show a high level of responsibility in academic tasks. In contrast, students who lack discipline often procrastinate, rarely complete assignments, and do not establish effective study habits, all of which contribute to poor academic performance [8],[9]. Therefore, examining the relationship between students' level of discipline and their mathematics achievement is vital for schools and teachers aiming to foster a learning culture that supports academic success.

Based on the discussion above, it can be concluded that self-efficacy, learning styles, and learning discipline are three critical variables that influence mathematics learning outcomes among vocational students. These factors are interrelated and play distinct roles in shaping students' readiness and success in dealing with the challenging learning processes inherent in mathematics. Although these factors are theoretically linked to academic performance, empirical studies are still needed to determine the extent of their contributions to student achievement [10]. Accordingly, this study is designed to quantitatively examine the influence of self-efficacy, learning styles, and learning discipline on mathematics learning outcomes among vocational high school students. The findings are expected to provide a solid foundation for developing more effective and personalized instructional strategies, and to serve as a reference for teachers and schools in designing targeted educational interventions tailored to students' characteristics in the era of modern learning.

2. LITERATURE REVIEW

2.1. Self-Efficacy

Self-efficacy refers to an individual's belief in their ability to complete specific tasks or achieve desired goals [11]. This concept was first introduced by Albert Bandura in his social cognitive theory, which states that self-efficacy plays a crucial role in determining a person's behavior, including in learning contexts [12]. In the field of education, particularly in subjects that require logic and perseverance such as mathematics, self-efficacy becomes a key factor influencing students' mental readiness and attitudes in facing academic challenges [13]. Students with high levels of self-efficacy tend to be more confident in solving problems, more resilient when facing difficulties, and intrinsically motivated to continue learning despite obstacles [14].

Strong self-efficacy can even foster long-term optimism and perseverance, both of which are essential for academic success.

Self-efficacy has a positive and significant correlation with students' academic achievement, especially in mathematics, which is often perceived as a difficult and intimidating subject by many students [15]. Students who believe in their abilities are more likely to employ effective learning strategies, such as managing their study time well, developing structured study plans, and utilizing systematic and creative problem-solving approaches. Moreover, they are more inclined to ask questions, engage in discussions, and seek clarification when facing confusion, making the learning process more active and profound [16]. In contrast, low self-efficacy can lead to anxiety, self-doubt, fear of failure, and avoidance of complex mathematical tasks.

2.2. Learning Styles

Learning style refers to the manner in which individuals receive, process, and retain information during the learning process [17]. Each individual has specific tendencies or preferences in absorbing information, which influences how they comprehend and reflect on subject matter. There are various types of learning styles, such as visual (learning through seeing), auditory (learning through listening), and kinesthetic (learning through doing or moving). These differences in learning styles significantly affect the effectiveness of the learning process, particularly in subjects that require high reasoning and abstract thinking, such as mathematics [18]. In the context of mathematics education at vocational high schools, understanding students' learning styles is crucial because mathematical material demands not only memorization of formulas but also both conceptual and procedural understanding that varies across individuals. Utilizing instructional media and approaches tailored to students' learning styles can make mathematics more enjoyable and easier to comprehend.

Literature indicates that a mismatch between students' learning styles and the teaching methods used can be one of the causes of poor academic performance [19]. For example, students with a visual learning style will better understand mathematical concepts when provided with visuals such as images, graphs, diagrams, or animations. Meanwhile, auditory learners benefit more when teachers emphasize vocal intonation and provide clear and structured verbal explanations [20]. Kinesthetic learners, on the other hand, grasp material more effectively when actively involved in experiments, simulations, or other physical activities that integrate mathematics with real-life practice. Therefore, teachers are expected to implement diverse and flexible teaching approaches to accommodate the various learning styles present in the classroom.

2.3. Learning Discipline

Learning discipline refers to students' ability to manage their time, adhere to rules, and consistently fulfill academic responsibilities in an orderly and conscious manner [21]. In the context of mathematics learning which is cumulative in nature and requires deep understanding as well as continuous practice discipline is an essential element. Mathematics is not a subject that can be mastered instantly; instead, it demands a consistent and gradual learning process [22]. Thus, students with high levels of discipline are more organized in managing their study schedules, completing assignments on time, and actively and orderly participating in classroom learning. Furthermore, discipline reflects a student's sense of responsibility toward their academic obligations, which indirectly shapes positive learning behaviors in daily activities.

Research conducted by Sithole et al. [23] shows that learning discipline has a significant positive correlation with students' academic achievement, especially in exact sciences like mathematics that demand high levels of perseverance and patience. Disciplined students tend to have greater academic endurance and are better able to maintain focus even when encountering challenges or difficulties in understanding material. Discipline also enhances the development of self-regulation skills, which are important for setting learning priorities and sustaining long-term motivation [24]. Moreover, a learning environment that supports discipline such as clear classroom rules, consistent teacher roles, and fair evaluation systems can further reinforce the development of disciplined character among students.

2.4. Mathematics Learning Outcomes

Mathematics learning outcomes serve as a primary indicator of how well students are able to understand, apply, and evaluate mathematical concepts taught in class [25]. These outcomes are not limited to numerical scores alone, but also reflect students' ability to think logically, critically, and systematically in solving various problems. In practice, learning outcomes are commonly assessed through various evaluations such as formative and summative tests, daily quizzes, midterm and final exams, as well as national assessments

[26]. At the vocational high school level, mathematics learning outcomes are of particular importance as they determine graduation eligibility and influence further academic pathways, especially for students planning to pursue studies in science and technology fields. Success in mathematics also indicates students' readiness to face more advanced academic challenges, whether in higher education or the workforce.

Research Amin et al. [27] suggests that mathematics learning outcomes are not the result of chance, but rather influenced by a complex interaction of internal and external factors. Internal factors include psychological aspects such as self-efficacy, learning styles, discipline, motivation, and interest in the subject. Students who are confident in their abilities, disciplined in their studies, and aware of their preferred learning styles tend to achieve better academic outcomes [28]. External factors include the role of teachers in selecting appropriate teaching strategies, the availability of supportive learning media and resources, and the home learning environment, including parental support.

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3. METHOD

This study uses a quantitative approach. The subjects studied were students of Muhammadiyah Mlati Vocational School, Sleman Regency. The instrument used was a scale to measure variables such as self-efficacy, learning styles, and learning discipline towards mathematics learning outcomes. The instrument has gone through a validation process by professional experts who are competent in their fields (expert judgment), then revised and refined. After that, the instrument was tested and the data obtained was analyzed to test its validity and reliability. The next stage is data collection involving 150 respondents. The data collected was then analyzed using prerequisite tests and hypothesis tests with the help of SPSS-25 software.

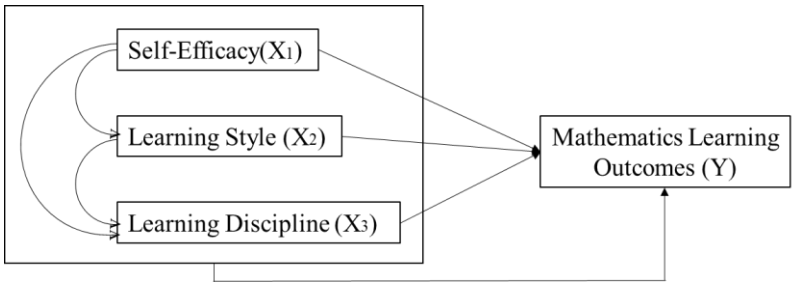

Figure 1. Research Paradigm

The first hypothesis is tested simultaneously, while the second to fourth hypotheses are tested separately (partially). The main understanding in this study is that testing the effect of each independent variable on the dependent variable is usually done using the t-test. Meanwhile, simultaneous testing refers to the analysis of the combined effect of all independent variables on the dependent variable, which is generally done by regression analysis. The conceptual framework describes the relationship and influence of independent variables on the dependent variable. In research involving two or more variables, a literature review becomes important as a supporting theoretical basis. This conceptual framework theoretically links the research variables, namely the independent and dependent variables. In this study, there are four variables, with three as independent variables and one as the dependent variable.

4. RESULTS AND DISCUSSION

4.1. Instrument Testing Results and Descriptive Analysis of Each Variable

Before conducting the research, an instrument test was first conducted which included self-efficacy, learning style, and learning discipline towards mathematics learning outcomes. After the instrument was constructed and validated by experts, the validity and reliability tests were conducted. The results of the instrument testing are presented in the following table.

Table 1. Instrument test results

No	X_1		X_2		X_3		Y	
	t_{count}	Sig.	t_{count}	Sig.	t_{count}	Sig.	t_{count}	Sig.
1	0.314	0.537	0.554	0.435	0.333	0.434	0.398	0.518
2	0.465		0.435		0.659		0.654	
3	0.432		0.453		0.498		0.576	
4	0.335		0.321		0.309		0.743	
5	0.554		0.298		0.249		0.364	

6	0.576	0.543	0.456	0.435
7	0.643	0.333	0.386	0.568
8	0.364	0.659	0.479	0.333
9	0.435	0.288	0.543	0.659
10	0.568	0.496	0.309	0.288

Based on the results of the instrument test analysis that have been described above, it can be seen that the t_{count} value for all items in each variable is greater than the t_{table} value (1.976) and the Cronbach's Alpha significance value exceeds 0.05. Thus, it can be concluded that the research instrument used in this study is valid and reliable to measure the intended variables. After that, a descriptive analysis was carried out to provide an overview of the data used in the study. This analysis aims to display the amount of data collected along with a summary of the total score, average (mean), maximum value, and minimum value for each research variable. The results of the descriptive analysis of the collected research data are presented clearly in the following table.

Table 2. Description of each variable

Value	X_1	X_2	X_3	Y
Minimum	60.00	55.00	40.00	60.00
Maximum	97.50	100	97.50	100
Mean	79.23	81.57	79.53	82,27
Total Score	11,885	12,235	11,930	12,340

The statistical data show that variable X_1 has a minimum value of 60.00 and a maximum of 97.50, with an average of 79.23, while variable X_2 ranges from 55.00 to 100 with an average of 81.57. For variable X_3, the lowest value recorded is 40.00 and the highest reaches 97.50, with an average of 79.53. Variable Y shows a minimum value of 60.00 and a maximum of 100, with the highest average among the variables, at 82.27. The total scores obtained for each variable are 11,885 for X_1, 12,235 for X_2, 11,930 for X_3, and 12,340 for variable Y, which reflect a fairly wide range and performance distribution with an average score tendency above 75, indicating a relatively good level of achievement in these variables.

4.2. Prerequisite Analysis Testing

The first step in testing the analysis requirements is to perform a normality test on the data. To perform this test, the Kolmogorov-Smirnov method is used as a statistical tool to assess whether the data distribution follows a normal pattern. This particular test was chosen because, according to Sugiyono (2019), it is appropriate and recommended for use when the sample size exceeds 50 respondents, as in the case of this study. The purpose of the normality test is to determine whether the responses obtained through the questionnaire are normally distributed, which is an important assumption for subsequent parametric statistical analysis (Wahyuni et al., 2024). Ensuring a normal distribution allows for more accurate and reliable interpretation of the results. The results of this normality test, which reflect the characteristics of the data distribution, are presented in the following table.

Table 3. Results of normality test

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		150
Normal Parameters[a,b]	Mean	.0000000
	Std. Deviation	4.47685762
Most Extreme Differences	Absolute	.065
	Positive	.048
	Negative	-.065
Test Statistic		.065
Asymp. Sig. (2-tailed)		.200[c,d]

Based on the table above, in the Kolmogorov-Smirnov column, a significance value of 0.005 is obtained. When compared with the significance level of $\alpha = 0.005$, then H_0 is accepted, which means that the data is normally distributed. Thus, it can be concluded that the values of all variables in this study come from a normally distributed population. Furthermore, a multicollinearity test is carried out to see if there is a perfect

relationship between the independent variables. Multicollinearity is also one of the classical assumption tests to determine whether the regression model used is classified as good. The following are the results of the multicollinearity test.

Table 4. Results of multicollinearity test

Coefficients[a]								
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
Model		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	16.146	4.088		3.847	.000		
	X_1	.384	.147	.278	2.710	.008	.610	1.971
	X_2	.175	.127	.118	1.419	.041	.785	1.281
	X_3	.296	.102	.276	2.847	.004	.618	1.624

a. Dependent Variable: Y

Based on the results of the analysis above, it can be concluded that there is no multicollinearity in the proposed regression model. This is indicated by the tolerance value of variable X_1 of 0.610 > 0.10 and the VIF value of 1.971 < 10 which indicates no multicollinearity. Likewise, variable X_2 has a tolerance value of 0.785 > 0.10 and a VIF value of 1.281 < 10, while variable X_3 has a tolerance value of 0.618 > 0.10 and a VIF value of 1.624 < 10. All of these values indicate that there is no multicollinearity in the regression model used. Furthermore, a heteroscedasticity test was carried out using the Glejser Test technique to determine whether there is a deviation from the classical assumption of homoscedasticity, especially whether there is an unequal variance in the residuals in all observations in the regression model. The results of the heteroscedasticity test can be seen in the following figure.

Table 5. Heteroscedasticity test results

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
Model		B	Std. Error	Beta		
1	(Constant)	2.378E-16	4.088		.000	1.000
	X_1	.000	.147	.000	.000	1.000
	X_2	.000	.127	.000	.000	1.000
	X_3	.000	.102	.000	.000	1.000

a. Dependent Variable: Abs_RES

Based on the results of the analysis above, it can be concluded that there are no symptoms of heteroscedasticity in the regression model used. This is indicated by the significance value of variables X_1, X_2, and X_3 which are all 1,000, greater than 0.05. Furthermore, a linearity test is carried out to determine whether there is a linear relationship between the dependent variable and each independent variable tested. The linear regression model cannot be used if the linearity assumption is not met. The following are the results of the linearity test.

Table 6. Results of linearity test between mathematics learning outcomes and self-efficacy

ANOVA Table							
			Sum of Squares	df	Mean Square	F	Sig.
Y * X_1	Between Groups	(Combined)	1088.279	15	73.212	3.724	.000
		Linearity	570.352	1	570.152	29.000	.000
		Deviation from Linearity	518.027	14	37.716	1.918	.212
	Within Groups		2634.414	134	19.661		
	Total		3712.693	149			

Table 7. Results of linearity test between mathematics learning outcomes and learning style

ANOVA Table						
		Sum of Squares	df	Mean Square	F	Sig.
Y * X_2	(Combined)	527.061	16	33.566	1.397	.152

	Between Groups	Linearity	20.975	1	20.875	.869	.353
		Deviation from Linearity	516.285	15	34.412	1.432	.138
	Within Groups		3195.533	133	24.027		
	Total		3712.693	149			

Table 8. Results of linearity test between mathematics learning outcomes and learning discipline

ANOVA Table							
			Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Y * X_3	Between Groups	(Combined)	1260.433	16	79.376	4.688	.000
		Linearity	642.693	1	652.583	35.259	.000
		Deviation from Linearity	627.841	15	41.173	2.234	.069
	Within Groups		2262.460	133	18.524		
	Total		3732.693	149			

Based on the results of the analysis, it can be concluded that there is a significant linear relationship between mathematics learning outcomes and the three variables studied. In Table 6, the significance value of the deviation from linearity is 0.212 > 0.05, which indicates a significant linear relationship between mathematics learning outcomes and self-efficacy. In Table 7, the significance value of 0.138 > 0.05 indicates a significant linear relationship between mathematics learning outcomes and learning styles. Meanwhile, in Table 8, the significance value of 0.069 > 0.05 also indicates a significant linear relationship between mathematics learning outcomes and learning discipline.

Hypothesis testing in this study was carried out through multiple regression analysis to determine whether or not there was an influence of two or more independent variables (X) on the dependent variable (Y). This regression analysis was carried out using simultaneous testing (F test), partial testing (t test), and coefficient of determination. Simultaneous significance testing was carried out using the F test, where the ANOVA table shows the significance of the simultaneous influence of the variables self-efficacy, learning styles, and learning discipline on mathematics learning outcomes. The following are the results of the F test.

Table 9. F test results

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	800.630	3	266.883	13.289	.000[b]
	Residual	2922.075	146	20.083		
	Total	3722.683	149			

a. Dependent Variable: Y
b. Predictors: (Constant), X_3, X_2, X_1

The decision taken based on the table above shows that the F test results produce a significance value of 0.000, which is smaller than 0.05. Thus, H_1 is accepted, meaning that the hypothesis is proven. This indicates that the variables of self-efficacy, learning style, and learning discipline together have a significant influence on the mathematics learning outcomes of vocational high school students. After that, a t-test was conducted to test the significance of each regression coefficient individually and to determine the extent to which each independent variable influences the dependent variable, by referring to the t value at a significance level of 0.05. The results of this partial test or t-test are presented in the following table based on analysis.

Table 10. T-Test results

Coefficients[a]						
		Unstandardized Coefficients		**Standardized Coefficients**	**t**	**Sig.**
Model		**B**	**Std. Error**	**Beta**		
1	(Constant)	16.146	4.088		3.847	.000
	X_1	.384	.147	.278	2.710	.008
	X_2	.175	.127	.118	1.419	.041
	X_3	.296	.102	.276	2.847	.004

a. Dependent Variable: Y

Based on Table 9, the hypothesis can be tested partially or one by one, so that the following conclusions can be drawn: (1) The second hypothesis regarding the self-efficacy variable shows a t-test significance value of 0.008 <0.05, so H_1 is accepted and it is concluded that there is a partial influence of self-efficacy on mathematics learning outcomes; (2) The third hypothesis regarding the learning style variable shows a t-test significance value of 0.041 <0.05, so H_2 is accepted and it is concluded that there is a partial influence of learning style on mathematics learning outcomes; and (3) The fourth hypothesis regarding the learning discipline variable shows a t-test significance value of 0.004 <0.05, so H_3 is accepted and it is concluded that there is a partial influence of learning discipline on mathematics learning outcomes.

Furthermore, a determination coefficient test is carried out which shows the magnitude of the influence of the independent variable (X) in explaining changes in the dependent variable (Y). This value is found in the model summary table and is represented by the R-squared value. Based on the results of the analysis using SPSS-25, the following findings were obtained.

Table 11. Coefficient test results

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.463[a]	.214	.198	4.48137

a. Predictors: (Constant), X_3, X_2, X_1

Based on the table above, it shows that the R-Square value is a determination coefficient that has been corrected based on the number and size of samples, so that it can reduce the element of bias if there are additional variables. In this study, the R-Square value of 0.214 shows that the variables of self-efficacy, learning style, and learning discipline together are able to influence the variable of mathematics learning outcomes with a percentage of 21.4%.

4.3. Discussion

The instrument testing results in this study indicate that all items in the variables of self-efficacy, learning styles, and learning discipline have t-count values exceeding the t-table values and significance levels that meet the established criteria (> 0.05), indicating that the instruments are valid and reliable. This aligns with the findings of Wahyuni et al. [29] and Siswanto et al. [30], who emphasized that the validity and consistency of instruments are crucial for measuring psychological and behavioral variables in students, particularly in the context of mathematics learning. High instrument validity allows for accurate measurement of psychological variables such as self-efficacy, while reliability ensures that the results can be replicated. This conformity reinforces the assertion that the instruments employed in this research adhere to scientific measurement standards, making the resulting data appropriate for further analysis.

Descriptive analysis shows that the average scores for all research variables exceed 75, specifically self-efficacy (79.23), learning style (81.57), learning discipline (79.53), and mathematics learning outcomes (82.27). These results suggest that, in general, the respondents possess high levels of motivation and discipline as well as fairly strong academic performance in mathematics. This supports Grgic [31] and Zein et al. [32] assertion that high self-efficacy encourages students to persist in overcoming learning challenges, particularly in subjects perceived as difficult, such as mathematics. Similarly, Qurohman [33] and Sumarwati et al. [34] found a positive relationship between learning style and discipline with the mathematics learning outcomes of vocational school students. Therefore, the generally high scores across these variables serve as an initial indicator of a strong relationship between students' internal factors and their academic achievement in mathematics.

The results of the normality, multicollinearity, heteroscedasticity, and linearity tests confirm that the data in this study fulfill the classical assumptions of multiple linear regression. The data are normally distributed, there is no perfect correlation among the independent variables (no multicollinearity), there is no variance distortion of residuals (no heteroscedasticity), and the relationships between the independent and dependent variables are linear. These findings are essential as they ensure that the regression analysis used can provide unbiased and efficient estimates. This result supports the findings of Hadi [35] and Tarso et al. [36], who also

concluded that when classical assumptions are met, the interpretation of regression models in educational contexts becomes stronger and more reliable for data-driven decision-making. Hence, this study demonstrates robustness both conceptually and statistically.

The linearity tests between mathematics learning outcomes and the three independent variables reveal statistically significant relationships. Both self-efficacy and learning discipline demonstrate strong linear relationships, while learning style also indicates a linear trend, albeit with a slightly higher significance value. These findings support Bandura's social learning theory and cognitive approaches, which suggest that self-belief and learning habits directly contribute to academic performance. Additionally, research by Suyarqia et al. [37] and Rosyada et al. [38] noted that visual and kinesthetic learning styles aligned with students' characteristics can enhance the effectiveness of understanding mathematical concepts. The results of this study affirm that instructional models that consider students' affective and cognitive variables are more capable of significantly improving academic performance.

Overall, the findings of this research reinforce numerous previous studies which indicate that self-efficacy, learning style, and learning discipline are critical factors influencing mathematics learning outcomes. For instance, Nidal et al. [39] found that students with higher learning discipline achieved better academic results compared to others, even when initial ability levels were similar. This study is also in line with Yurt [40] and Erlina et al. [41], who highlighted the importance of self-efficacy in fostering students' resilience in learning difficult subjects. Within the context of educational policy in Indonesia, these results imply that educational interventions should include the reinforcement of internal student factors such as motivation, self-confidence, and the development of appropriate learning styles. Therefore, teachers and policymakers must consider a holistic approach that not only focuses on content delivery but also addresses students' mental readiness and learning habits to comprehensively improve academic outcomes.

5. CONCLUSION

Based on the results of the study and discussion, all classical assumptions such as normality, multicollinearity, heteroscedasticity, and linearity are also met. There is a significant linear relationship between the three independent variables on purchasing choices, which shows that self-efficacy, learning styles, and learning discipline on students' mathematics learning outcomes are 21.4%. Given that all independent variables have a linear relationship to learning outcomes, teachers and schools can design learning and coaching strategies that focus on increasing self-efficacy, developing appropriate learning styles, and strengthening learning discipline to improve student achievement in mathematics.

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DAFTAR PUSTAKA

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