International Journal of Multicultural and Multireligious Understanding

http://ijmmu.com
editor@ijmmu.com
ISSN 2364-5369
Volume 13, Issue 3
March, 2026
Pages: 251-262

The Influence of Basic Mathematical Ability on Elementary School Students' Motivation and Learning Outcomes

Sari Noviyanti Indriani; Rahayu Condro Murti; Setiawan Edi Wibowo

Primary Education Study Program, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia
Corresponding author: sarinoviyanti.2024@student.uny.ac.id

http://dx.doi.org/10.18415/ijmmu.v13i3.7395

ABSTRACT

This study aims to analyze the influence of basic mathematical ability on students' motivation and learning outcomes in fourth-grade elementary school. Using a quantitative ex post facto design, the research involved 68 purposively selected students. Data were collected through a basic mathematics test, a motivation questionnaire, and a validated mathematics achievement test, with observations conducted within one academic period. Multiple regression analysis was applied to examine direct and indirect effects among variables. The results show that basic mathematical ability significantly predicts both motivation and learning outcomes, with motivation serving as a mediating factor. These findings imply that strengthening fundamental mathematical concepts is essential for improving students' engagement and academic performance.

Keywords: *Basic Mathematical Ability; Learning Motivation; Learning Outcomes; Regression; Elementary School*

INTRODUCTION

Mathematics is a fundamental discipline that supports the development of students' logical and analytical thinking. In the early grades, students are introduced to essential concepts such as number operations, measurement, and fractions, which function as the foundation for more advanced mathematics (Amin & Pd, 2025). However, many elementary students still perceive mathematics as abstract and difficult, leading to anxiety, low confidence, and reduced motivation—factors that significantly hinder learning outcomes (Fitroh et al., 2018). These conditions highlight the need for learning approaches that strengthen students' basic skills and motivation.

National data reinforce this concern. The 2024 ANBK reported that students' numeracy ability remains at a lower–middle level with an average score of 27.22 (Kemendikbud, 2024), indicating a persistent gap between curriculum expectations and actual achievement. Prior studies confirm that basic mathematical skills are essential for higher-level understanding (Alcívar-Castro et al., 2023) and can be improved through digital-based and adaptive learning media (Hamiyet, 2015; Bang, Li, & Flynn, 2023). Observations at SD Muhammadiyah Sapen Yogyakarta also show that many students struggle with basic skills, affecting both comprehension and motivation. Motivation itself is crucial for mathematics

achievement, supported by studies emphasizing intrinsic motivation and perceived competence (A. Amin et al., 2021; Hallarte et al., 2024; Sandman et al., 2025; Deci & Ryan, 2000).

Grounded in Piaget's cognitive development theory (1970) and Bruner's representation model (1966), this study addresses a gap in prior research, which has rarely examined how basic mathematical skills simultaneously influence motivation and learning outcomes in Indonesian elementary schools. Although earlier studies have explored numeracy or motivation individually (Sari, 2021), integrated analyses remain limited. Therefore, this study aims to analyze the influence of basic mathematical skills on learning motivation and outcomes among fourth-grade students and to examine their role as a simultaneous predictor within the framework of the Merdeka Belajar curriculum (Kemendikbudristek, 2021).

LITERATURE REVIEW

Basic Mathematical Ability

Basic mathematical ability serves as the foundational cognitive competence that enables students to understand more complex mathematical concepts. Mastery of basic skills such as number operations, measurement, and fundamental reasoning is essential, as these abilities function as the core structure supporting subsequent learning (Amin & Pd, 2025; Alcívar-Castro et al., 2023). Previous research further confirms that digital-based media and adaptive learning tools can effectively improve these foundational competencies as well as students' overall learning outcomes (Hamiyet, 2015; Bang, Li, & Flynn, 2023). Supporting this view, L. & Akyuni (2024) reported that Indonesian elementary students show varying levels of numeracy mastery, suggesting the need for improved instructional strategies. Based on this theoretical and empirical foundation, the present study proposes the first hypothesis:
H1: Basic mathematical skills significantly influence students' learning outcomes.

Motivation in Learning Mathematics

Motivation is a psychological factor that determines students' persistence, engagement, and interest in learning mathematics. Prior studies show that motivation plays a significant role in shaping mathematics achievement at various grade levels (A. Amin et al., 2021). Intrinsic motivation is strengthened when students perceive themselves as competent and capable, which aligns with findings by Hallarte et al. (2024) and Sandman et al. (2025). Self-determination theory by Deci and Ryan (2000) reinforces that students' sense of competence is essential for developing intrinsic motivation. In the Indonesian context, Laili (2016) demonstrated that motivation directly contributes to mathematics achievement. These studies indicate that students with higher basic mathematical skills are more confident and motivated when engaging in learning. Thus, the second hypothesis is proposed as follows:
H2: Basic mathematical skills significantly influence students' learning motivation.

Learning Outcomes in Mathematics

Previous empirical findings also highlight the essential role of learning motivation in determining mathematics achievement. Research consistently shows that higher motivation leads to improved learning outcomes, as motivated students tend to exert greater effort and demonstrate more persistence in solving mathematical problems (A. Amin et al., 2021; Laili, 2016).

Guided by this evidence, the third hypothesis is formulated as follows:

H3: Learning motivation significantly influences students' learning outcomes.

Based on the theoretical foundation and previous studies, the conceptual framework of this research illustrates the relationships among the three variables: basic mathematical skills as the independent variable, learning motivation as the mediating variable, and learning outcomes as the dependent variable. The model positions learning motivation as a mediator that links basic mathematical skills to learning outcomes, suggesting both a direct and indirect effect within the elementary school learning context. Based on the independent and dependent variables that were used, the author describes the conceptual framework as follows:

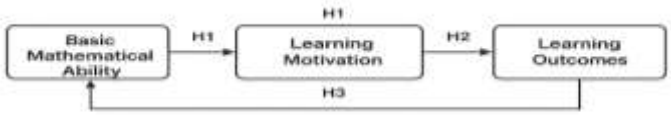

Figure 1. Conceptual Framework

RESEARCH METHOD

This study employed a quantitative approach with an ex post facto causal-comparative design, selected because the researcher did not manipulate the independent variable but examined existing differences in students' basic mathematical abilities and their effects on motivation and learning outcomes. This aligns with Kerlinger's explanation in Sugiyono (2017) that ex post facto research investigates events that have already occurred to identify possible causal factors. The research was conducted at SD Muhammadiyah Sapen Yogyakarta with a population of 82 fourth-grade students during the first semester of the 2025/2026 academic year. A sample of 68 students was determined using the Slovin formula with a 5% margin of error and selected through proportional random sampling to ensure representativeness, following the recommendations of Sugiyono (2017) and Rachmawati (2022). Inclusion and exclusion criteria were applied to ensure that the selected participants matched the research objectives, and all procedures complied with ethical principles of confidentiality, informed consent, and child protection as suggested by Creswell (2018) and Sugiyono (2019).

Data were collected using three instruments: a basic mathematics ability test, a learning motivation questionnaire, and academic documents. The mathematics ability test contained 20 multiple-choice items covering arithmetic, fractions, measurement, and contextual problem-solving, while the motivation questionnaire was based on a Likert scale and measured indicators such as interest, perseverance, self-efficacy, achievement drive, and attitudes toward challenges. Both instruments were tested for validity and reliability in accordance with Setiawan (2020). Secondary data in the form of summative mathematics scores were obtained from school records, consistent with the approach used by Suryani and Sutopo (2021), who noted the importance of documented academic results as objective indicators of learning outcomes. All instruments were administered in a classroom setting under normal conditions and with prior permission from the school, teachers, and parents.

The collected data were analyzed through a series of quantitative procedures, beginning with data cleaning, coding, and examination of distribution assumptions. Descriptive statistics were used to summarize students' basic mathematical abilities, learning motivation, and mathematics learning outcomes. Before conducting inferential analysis, the data were tested for normality using the Kolmogorov–Smirnov or Shapiro–Wilk tests, for linearity using ANOVA, and for homogeneity using Levene's test. Inferential statistical techniques were then performed using SPSS 26, with a significance level of $\alpha = 0.05$. Simple linear regression was used to determine the effect of basic mathematical ability on learning motivation, while multiple linear regression was conducted to analyze the effects of basic mathematical ability and learning motivation on learning outcomes. The indirect effect of basic mathematical ability through learning motivation was examined using a bootstrapped mediation procedure, following the recommendation of Hayes (2017), which provides robust estimation for indirect effects in social.

RESEARCH RESULTS AND DISCUSSION

Research Results

This study involved 68 fourth-grade students of SD Muhammadiyah Sapen Yogyakarta, selected through proportional random sampling from 10 learning groups. The research data collected consisted of three variables, namely:

1. Basic Mathematical Ability (X), obtained through an objective test consisting of 20 multiple-choice items covering number concepts, arithmetic operations, fractions, and measurement, with a score range of 0–100.
2. Learning Motivation (Y_1), obtained through a Likert-scale questionnaire (1–4: always, often, sometimes, never) consisting of 30 statements that measured the dimensions of perseverance, curiosity, responsibility, and achievement orientation.
3. Mathematics Learning Outcomes (Y_2), obtained from students' summative assessment scores in mathematics.

Table 1. Descriptive Statistics of Each Variable

Variable	N	Mean	Sd	Minimum	Maximum	General Category
Basic Mathematical Ability (X)	68	47.50	18.048	15	90	Low – High
Learning Motivation (Y_1)	68	71.63	13.191	41	95	Low – High
Mathematics Learning Outcomes (Y_2)	68	69.15	16.183	35	98	Low – High

Based on the data in Table 1, in general, the results show that students' basic mathematical ability has an average score of 47.50 with a standard deviation of 18.048, indicating high variability and a tendency toward the low-to-medium category. This suggests that students' abilities vary widely, and many still require reinforcement of fundamental mathematical concepts. Learning motivation has an average score of 71.63 with a standard deviation of 13.191, indicating a relatively good and generally positive level of motivation, although variations among students still exist. Meanwhile, mathematics learning outcomes have an average score of 69.15 with a standard deviation of 16.183, which reflects an achievement level in the medium-to-high category. However, the distribution is uneven, as some students scored very low while others achieved very high results.

Overall, the findings indicate substantial variation in students' abilities and learning outcomes, while learning motivation tends to be good, making it a valuable asset for improving mathematics achievement. These results show a wide distribution of scores from low to high, implying diverse student characteristics in terms of basic abilities, learning motivation, and mathematics learning outcomes. The data also suggest that although students generally demonstrate good motivation and fairly strong learning outcomes, the notable differences in basic mathematical ability may influence imbalances in achievement within the classroom. Therefore, adaptive instructional approaches are needed to accommodate variations in students' abilities and learning needs.

Before conducting regression analysis, a series of prerequisite tests were carried out to ensure data eligibility, including normality tests, linearity tests, and homogeneity tests. The results of the normality test using the Kolmogorov–Smirnov test for the three variables showed that all data were normally distributed, as indicated by significance values greater than 0.05.

Table 2. Normality Test Results

Variable	Sig. (p)	Description
Basic Mathematical Ability (X)	0.094	Normally distributed data
Learning Motivation (Y_1)	0.200	Normally distributed data
Mathematics Learning Outcomes (Y_2)	0.200	Normally distributed data

Based on the results of the Kolmogorov–Smirnov normality test for the three research variables—basic mathematical ability, learning motivation, and mathematics learning outcomes—it was found that all significance values were above 0.05. This indicates that there is no significant difference between the empirical data distribution and the normal distribution. Therefore, it can be concluded that all three variables are normally distributed. The fulfillment of the normality assumption suggests that the data are appropriate for further analysis in the next stages.

In multiple linear regression analysis, the data must exhibit linear relationships. Therefore, linearity testing was conducted to examine the linear relationship between basic mathematical ability and learning motivation, as well as between basic mathematical ability and mathematics learning outcomes. The results of the linearity test using SPSS show that the relationship between basic mathematical ability and learning motivation is linear. This is indicated by the significance value in the Linearity test of 0.000 (< 0.05), meaning that there is a significant linear relationship between the two variables. The linearity test between basic mathematical ability and mathematics learning outcomes also demonstrates that both variables have a linear relationship and meet the linearity assumption. This is shown by the significance value in the Linearity test of 0.000 (< 0.05), indicating a significant linear relationship between the two variables.

Moreover, the significance values in the Deviation from Linearity test—0.788 and 0.827 (> 0.05)—indicate that there is no significant deviation from the linear pattern. Thus, it can be confirmed that the relationship between basic mathematical ability and mathematics learning outcomes follows a stable linear pattern. This condition ensures that the data are suitable for further analysis using parametric statistical techniques that require the linearity assumption to be met.

Overall, the results of the linearity tests for basic mathematical ability, learning motivation, and mathematics learning outcomes show that all variable pairs follow a linear relationship pattern. This is demonstrated by significance values in the Linearity test that are below 0.05, indicating significant linear relationships between the variables. Additionally, the significance values in the Deviation from Linearity test, which are above 0.05, indicate that there is no significant deviation from the linear pattern. Therefore, it can be concluded that the relationships among the variables in this study follow a consistent and stable linear pattern. The fulfillment of the linearity assumption further strengthens the feasibility of conducting advanced parametric statistical analyses such as linear regression or path analysis.

Thus, an increase in basic mathematical ability is followed by a proportional increase in both learning motivation and learning outcomes. Conceptually, students who possess strong basic mathematical skills tend to feel more confident and have stronger intrinsic motivation when learning mathematics. This supports Bandura's (1997) Self-Efficacy Theory, which states that individuals' perceptions of their own abilities directly influence their level of motivation and academic performance. The confirmed linearity further reinforces that the use of regression analysis in this study is statistically and theoretically appropriate.

These findings are also consistent with Santrock's (2018) view, which asserts that students' perceptions of their academic competence influence their learning motivation. The higher a student's sense of capability in a particular subject, the greater their effort and persistence in learning. Therefore, the linear relationship found in this study provides a strong foundation for the regression analysis conducted in the subsequent stage.

The next prerequisite test is the homogeneity test, which is conducted to determine whether the data from various groups of students have equal variances. Homogeneity of variance is one of the fundamental assumptions in regression analysis; if this assumption is not met, the results may become biased. Based on Levene's Test, the significance values obtained were 0.065 for learning motivation and

0.621 for mathematics learning outcomes. These significance values are greater than 0.05, indicating that the variances across groups are homogeneous or equal.

This equality of variances indicates that there are no substantial differences in data dispersion among student groups in terms of basic mathematical ability, learning motivation, or mathematics learning outcomes. Thus, the data meet the homogeneity assumption required for conducting simple and multiple regression analyses. This homogeneity strengthens the confidence that the subsequent analysis results can be interpreted accurately and reliably.

Based on the results of the three prerequisite tests, it can be concluded that all basic assumptions of regression analysis are fulfilled. The research data are normally distributed, the relationships among variables are linear, and the variances across groups are homogeneous. Therefore, the data are appropriate for further analysis using simple and multiple regression techniques to examine the influence of basic mathematical ability on students' motivation and learning outcomes.

The next step in the data analysis is regression analysis, which is used to examine the effect of basic mathematical ability on learning motivation, as well as the effect of basic mathematical ability and learning motivation on the mathematics learning outcomes of fourth-grade students at SD Muhammadiyah Sapen Yogyakarta. The analysis was carried out in two stages—simple regression and multiple regression—to determine the direct and indirect effects among the variables. The results of the simple regression analysis indicate that basic mathematical ability has a significant influence on students' learning motivation.

Table 3. Simple Linear Regression Analysis Results

Statistic	Learning Motivation Score
Correlation Coefficient (R)	0.598
Coefficient of Determination (R^2)	0.357
F-value	36.667
Sig. (p)	0.000
Regression Equation	$Y_1 = 50.886 + 0.437X$

Based on the results of the hypothesis testing using simple linear regression analysis, it was found that basic mathematical ability has a significant effect on students' learning motivation ($p < 0.05$). The R^2 value of 0.357 indicates that 35.7% of the variation in learning motivation can be explained by basic mathematical ability. For every 1-point increase in basic mathematical ability, students' learning motivation increases by 0.357 points.

Theoretically, this result is in line with Bandura's (1997) Self-Efficacy Theory, which states that an individual's confidence in their own abilities (perceived competence) can enhance intrinsic motivation in learning. Students with stronger basic mathematical skills tend to feel more confident in facing academic challenges, which in turn increases their motivation to make efforts and achieve optimal learning outcomes. These findings also support Rachmawati (2022), who stated that mastery of basic concepts plays an important role in shaping motivation and persistence in learning mathematics among elementary school students.

The second analysis conducted was multiple linear regression analysis. This analysis was used to determine the extent to which basic mathematical ability and learning motivation jointly influence students' mathematics learning outcomes.

Table 4. Model Summary and Multiple Regression F-Test

Model	R	R^2	F	Sig. (p)
1	**0.862**	**0.742**	**93.578**	**0.000**

Table 5. Multiple Regression Coefficients Table

Variable	Coefficient (B)	t	Sig. (p)	Description
Constant	-1.725	-0.304	0.762	—
Basic Mathematics Ability (X1)	0.233	3.314	0.002	Significant
Learning Motivation (X2)	0.835	8.661	0.000	Significant

Regression Equation: Y2= -1.725 + 0.233X + 0.835X2

The results of the analysis in the table above indicate that basic mathematical ability and learning motivation simultaneously have a significant effect on mathematics learning outcomes ($p < 0.05$). The R^2 value of 0.862 shows that 86.2% of the variation in learning outcomes can be explained by these two variables. The positive direction of the relationship indicates that increases in basic mathematical ability and learning motivation are followed by increases in mathematics learning outcomes.

These findings reinforce the Self-Determination Theory by Deci and Ryan (2000), which emphasizes that intrinsic motivation arises from feelings of competence and autonomy in learning. Students with strong basic mathematical abilities tend to feel more competent, which in turn fosters intrinsic motivation to continue achieving. This result is also consistent with the research of Blume, Dresler, & Moeller (2021), which asserts that foundational numerical ability is a strong predictor of mathematics achievement, as well as Setiawan's (2020) findings that motivation acts as a strengthening factor in the relationship between academic ability and learning achievement at the elementary school level.

In addition to the direct effects, this study also analyzed the indirect effect of basic mathematical ability on learning outcomes through learning motivation. The results of the bootstrapped mediation analysis are presented in the table below:

Table 6. Indirect Effect (Mediation of Learning Motivation)

Path of Influence	Direct Effect	Indirect Effect	Total Effect	Sig. (p)	Description
$X \rightarrow Y_1$	0.437	—	0.437	0.000	Significant
$Y_1 \rightarrow Y_2$	1.025	—	1.025	0.000	Significant
$X \rightarrow Y_2$	0.233	0.448	0.681	0.000	Mediation significant

The results of the bootstrapped mediation analysis show an indirect effect value of 0.448 with $p < 0.05$, indicating that learning motivation significantly mediates the influence of basic mathematical ability on students' learning outcomes. Thus, learning motivation is confirmed to function as a mediating variable in the relationship between basic mathematical ability and mathematics learning outcomes. This

means that strong basic mathematical skills not only have a direct effect on learning outcomes but also enhance students' learning motivation, which in turn contributes to higher academic achievement.

These findings align with McClelland's Achievement Motivation Theory (1987), which emphasizes that the drive to succeed (achievement motivation) is influenced by one's perceived competence and prior success experiences.
The results of the regression analyses conducted can be summarized in the table below:

Table 7. Summary of Regression Analysis Results

Relationship Between Variables		R	R^2	Sig. (p)	Description
$X \rightarrow Y_1$		0.661	0.437	0.000	Significant
$X \rightarrow Y_2$		0.681	0.464	0.000	Significant
$Y_1 \rightarrow Y_2$		0.824	0.679	0.000	Significant
$X \rightarrow Y_2$ throughY_1		0.443	—	0.000	Significant mediation

The results of the study indicate that basic mathematical ability is an important factor in enhancing students' motivation and learning outcomes. Students with strong basic skills tend to have higher self-confidence and stronger learning motivation, which ultimately contributes to more optimal learning achievement. These findings align with the Self-Determination Theory (Deci & Ryan, 2000), which emphasizes that intrinsic motivation develops from a sense of competence and autonomy in learning. In addition, the results of this study are consistent with the findings of Blume, Dresler, & Moeller (2021) and Setiawan (2020), which show that basic numerical abilities and intrinsic motivation are strong predictors of mathematics achievement among elementary school students.

DISCUSSION

The results of the study indicate that basic mathematical ability has a significant effect on students' learning motivation. The correlation value of 0.661 ($p < 0.05$) suggests that the higher the students' basic mathematical skills, the stronger their internal drive to learn mathematics. Students who understand fundamental concepts well tend to feel more confident and show greater persistence when facing learning challenges.

This finding supports Bandura's (1997) Self-Efficacy Theory, which states that belief in one's own abilities enhances intrinsic motivation to achieve success. In the context of mathematics learning in elementary school, basic skills such as numerical operations, fractions, and measurement serve as the foundation for developing a sense of academic competence. When students are able to solve basic problems correctly, they become more motivated to tackle more complex material. This study also aligns with Rahmawati (2022), who reported that basic numerical ability is positively related to mathematics learning motivation among elementary students. This highlights that mastery of basic skills is not only a cognitive factor but also a trigger for affective aspects that support the learning process.

Furthermore, the results of the regression analysis show that basic mathematical ability has a significant effect on students' mathematics learning outcomes, with a correlation value of 0.681 ($p < 0.05$). This means that students who have strong mastery of fundamental mathematical concepts tend to achieve better learning outcomes. Basic skills function as the foundation for mastering advanced concepts, so students who are proficient in basic operations—such as addition, subtraction, multiplication, and division—are more likely to understand more complex topics such as geometry, fractions, and simple algebra.

These findings reinforce the views of Kilpatrick, Swafford, and Findell (2001), who state that proficiency in basic skills is a prerequisite for achieving higher-level mathematical competence. The results also align with the study by Blume, Dresler, and Moeller (2021), which found that basic numerical ability is a strong predictor of mathematics achievement in elementary school. Therefore, strengthening basic skills can be considered a preventive step against future mathematics learning difficulties.

Learning motivation also has a significant effect on mathematics learning outcomes ($R = 0.824$; $p < 0.05$). Students with high learning motivation are more likely to demonstrate positive attitudes toward mathematics, actively participate in learning, and show persistence in completing tasks. Motivation serves as a psychological force that drives students to achieve learning goals and sustain their engagement in the learning process.

This finding aligns with Deci and Ryan's (2000) Self-Determination Theory, which emphasizes the importance of intrinsic motivation in learning. Curiosity, interest in challenges, and the need to feel competent are key drivers of academic success. These findings are further supported by Setiawan (2020), who found that intrinsic motivation is positively correlated with learning achievement among elementary students. Thus, mathematics instruction that fosters self-confidence, curiosity, and active engagement will positively impact students' learning outcomes.

In addition to the direct effect, this study also found an indirect effect of basic mathematical ability on learning outcomes through learning motivation as a mediating variable (indirect effect = 0.443; $p < 0.05$). This indicates that basic mathematical ability not only contributes directly to learning outcomes but also indirectly enhances learning outcomes by strengthening students' motivation. Students with good basic mathematical skills tend to feel more capable and comfortable during learning, which in turn increases their motivation to continue practicing and improving their academic performance.

This mediation mechanism illustrates that cognitive aspects (basic ability) and affective aspects (learning motivation) interact in shaping students' academic performance. This result is consistent with Yuliana (2021), who emphasized that learning motivation strengthens the relationship between prior ability and academic achievement. Therefore, in the context of elementary education, learning motivation serves as an important bridge linking basic mathematical ability with optimal learning outcomes.

CONCLUSION

The results of this study indicate that basic mathematical ability has a significant influence on both learning motivation and learning outcomes of fourth-grade students at SD Muhammadiyah Sapen Yogyakarta. Learning motivation was also found to have a significant effect on learning outcomes, with a stronger contribution compared to the other variables. In addition, the mediation analysis confirmed that learning motivation plays a significant mediating role in the relationship between basic mathematical ability and learning outcomes. These findings emphasize that improving students' basic mathematical skills will have a more optimal impact on learning outcomes when accompanied by high learning motivation. Thus, internal student factors—particularly basic ability and learning motivation—are key determinants of success in learning mathematics. The implications of this study suggest the need for learning strategies that not only strengthen basic mathematical skills but also actively enhance students' motivation through approaches that are engaging, contextual, and aligned with students' learning needs.

REFERENCES

Amin, A., & Pd, N. (2025). *Konsep Dasar Matematika MI/SD* .Lingkar Edukasi Indonesia

Amin, A., Suparman, R., & Wijaya, A. (2021). Hubungan motivasi belajar dan prestasi matematika siswa sekolah dasar. *E-Journal Universitas Pendidikan Ganesha, 9(2)*, 145–153.

Amin, M., Agus Kurniawan, D., Zannah Azzahra, M., & Eka Septi, S. (2021). *3,4,5 Faculty of Teaching and Education*, 5(4), 622–630. https://ejournal.undiksha.ac.id/index.php/IJEE

Astriani, L., & Akyuni, N. I. (2024). Analysis of Numeracy Skills in Grade VI Elementary School Students in Solving Minimum Competency Assessment Questions. *Kalamatika: Jurnal Pendidikan Matematika, 9(1)*, 15–30. https://doi.org/10.22236/kalamatika.vol9no1.2024pp15-30

Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman.

Bang, H. J., Li, L., & Flynn, K. (2023 Efficacy of an Adaptive Game-Based Math Learning App to Support Personalized Learning and Improve Early Elementary School Students' Learning. *Childhood Education Journal, 51(4)*, 717–732. https://doi.org/10.1007/s10643-022-01332-3

Bruner, J. S. (1966). *Toward a theory of instruction*. Harvard University Press.

Creswell, J. W. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.

Deci, E. L., & Ryan, R. M. (2000). The "What" and "Why" of Goal Pursuits: Human Needs and the Self-Determination of Behavior**.** *Psychological Inquiry, 11(4)*, 227–268.

Fitri, Z. A., Susanti, D., & Rahayu, S. W. (2024). Analisis Motivasi Belajar Terhadap Hasil Belajar Matematika. *MAXIMA: Jurnal Pendidikan Matematika*, 2(1). https://doi.org/10.30739/maxima.v2i1.3284

Giofrè, D., Donolato, E., & Mammarella, I. C. (2022). *The differential role of verbal and visuospatial working memory in mathematics and reading* [Preprint]. arXiv. https://doi.org/10.48550/arXiv.2201.00164

Graciani, H., Hanurawan, F., Chusniyah, T., & Rahmawati, H. (2023). The role of self-efficacy in improving student motivation. *KnE Social Sciences, 8(19)*, 14362. https://doi.org/10.18502/kss.v8i19.14362

Hallarte, D. K., et al. (2024). *Modeling self-regulation in learning mathematics through teacher-promoting interaction and parental support among STEM learners: The mediating role of intrinsic motivation., 10.* https://doi.org/10.1016/j.ssaho.2024.101135

Hamiyet, S. (2015). The effects of computer games on basic math skills. *Educational Research and Reviews, 10(22)*, 2846–2853. https://doi.org/10.5897/err2015.2172

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis* (2nd ed.). The Guilford Press.

Karagiannakis, G., Noël, M. P., Baccaglini-Frank, A., & Termine, C. (2024). Mathematical skills classification through primary education. *Discover Education, 3(1).* https://doi.org/10.1007/s44217-024-00267-8

Kemendikbud. (2024). *Laporan ANBK Nasional Tahun 2024: Numerasi Siswa SD di Indonesia*. Kemendikbud.

Kemendikbudristek. (2021). *Kurikulum Merdeka dan Penguatan Literasi-Numerasi*. Kemendikbudristek.

Laili, H. (2016). *Keefektifan Pembelajaran dengan Pendekatan CTL dan PBL Ditinjau dari Motivasi dan Prestasi Belajar Matematika.* PYTHAGORAS: Jurnal Pendidikan Matematika, 11(1), 25–34. https://doi.org/10.21831/pg.v11i1.9679

Linnavalli, T., Jylänki, P., Kainulainen, J., Tervaniemi, M., & Törmänen, M. (2024). *The associations between mathematical skills, cognitive performance, and language background in elementary school children: A two-year follow-up study.* Scandinavian Journal of Educational Research, 69(6), 1304–1318. https://doi.org/10.1080/00313831.2024.2419063

Piaget, J. (1970). *Science of education and the psychology of the child*. Oxford University Press.

Rachmawati, D. (2022). *Strategi sampling proporsional*. Jurnal Penelitian dan Evaluasi Pendidikan, 26(1), 45–58.

Ryan, R. M., & Deci, E. L. (2000). *Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being*. American Psychologist, 55(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68 Ouci+1

Saputri, R. P., Yulastri, A., Ganefri, Giatman, M., Irfan, D., & Effendi, H. (2025). *Impact of Interactive Media Utilization on Enhancing Learning Outcomes: Meta-Analysis.* Jurnal Penelitian Pendidikan IPA, 11(3), 40–49. https://doi.org/10.29303/jppipa.v11i3.10438

Sardiman, A. M. (2018). *Interaksi dan motivasi belajar mengajar*. Raja Grafindo Persada.

Sudjana. (2005). *Metoda statistika*. Tarsito.

Sugiyono. (2017). *Metode penelitian pendidikan*. Alfabeta.

Sugiyono. (2019). *Statistika untuk penelitian*. Alfabeta.

Sugiyono. (2021). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Alfabeta.

Svane, R. P., Willemsen, M. M., Bleses, D., Krøjgaard, P., Verner, M., & Nielsen, H. S. (2023). *A systematic literature review of math interventions across educational settings from early childhood education to high school.* Frontiers in Education, 8, 1229849. https://doi.org/10.3389/feduc.2023.1229849

Uno, H. B. (2011). *Teori motivasi dan pengukurannya*. Bumi Aksara.

Wahyu Oktavianingsih & Pramudiani, P. (2022). *The Effect of Realistic Mathematics Approach on Creative Thinking Ability of Fourth Grade Elementary School Students.* Journal for Lesson and Learning Studies, 5(2), 220–226. https://doi.org/10.23887/jlls.v5i2.49842 E-Journal Undiksha+1

Wasni, N. Z., Putra, E. A., Sembiring, R. E. A., Hendra, Y., & Febriyanti, E. (2024). *The Influence of Emotional Intelligence, Self-Efficacy, and Learning Motivation on Student Achievement.* Edukasi, 18(2), 105–120. https://doi.org/10.15294/edukasi.v18i2.16416