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The Effect of Mathematics Learning Interest and Social Skill on Algebraic Reasoning

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ABSTRACT

Algebraic reasoning plays a role in mathematical thinking. Understanding factor affective of algebraic reasoning is essential for improving mathematics education. This study aims to examine the effect of learning interest and social skills on students' algebraic reasoning. We conducted a quantitative study using a correlational design, employing questionnaires and a test as data collection methods. We selected 202 students from the Islamic state of junior high school in Mataram as a research sample using a simple random technique. The study used an algebraic reasoning test, a learning interest questionnaire, and a social skills questionnaire as research instruments. The data was analyzed using descriptive data and inferential analysis. Descriptive data consist of categorical descriptive and statistical descriptive. Inferential analysis used a multiple regression including prerequisite tests (normality, linearity, multicollinearity and heteroscedasticity) and hypothetical tests using t-test for partial and F-test for simultaneous. The result showed that learning interest has no effect on students algebraic reasoning (t-test =0,055, sig. = 0,957 > 0,05). Meanwhile, the social skills have an effect on students algebraic reasoning (t-test =2,943, sig. = 0,004 < 0,05). In addition, learning interest and social skill simultaneously have an effect on algebraic reasoning (F-test = 4,345, sig. = 0,014 < 0,05). The result also confirmed that learning interest and social skills have a 4,2% of contribution to increasing students algebraic reasoning. To improve the students learning interest and social skill, teacher should be encouraged in designing interactive learning and collaborative learning approaches, such as group discussions, peer tutoring, and cooperative problem-solving.

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A. INTRODUCTION

One of the mathematics school goals is to provide the students in using the reasoning related to problems in daily life (BSKAP, 2024; NCTM, 2000). Students' mathematics learning achievement depends on the level of reasoning possessed by the students (Erviana, 2019). Students with excellent reasoning will be able to solve mathematics problems related to their daily lives (Syawahid, 2022). Therefore, the development of reasoning in every mathematics lesson needs to be improved.

Reasoning is manipulating and analyzing processes of objects, representations, diagrams, symbols, or diagrams to make the conclusion based on assumptions (Battista, 2016). Mathematics reasoning refers to the essential to understand mathematics by developing ideas, phenomena, justifying results, and using mathematical conjecture (NCTM, 2000). Reasoning is

related to the process of using patterns of relationships in analyzing situations to develop and investigate presumptions (BSKAP, 2022).

The facts about the importance of reasoning development are not as expected. The program for international students' assessment **(**PISA) 2023 study reported that the average mathematics score of Indonesian students was 366, lower than the average score of PISA participants (OECD, 2023a; Prinantyo, 2023). One part of mathematics assessed by PISA pertained to reasoning, namely the capacity to employ mathematical concepts, tools, and logic to formulate and devise solutions for real-world issues and situations (OECD, 2023b, 2023c).

One of the mathematics contents taught in schools after numbers is algebra. Algebra plays a role in developing mathematics education in high education and employment (NCTM, 2000). It means that a strong foundation in algebra helps students succeed in advanced studies and prepares them for careers that require logical thinking, problem-solving, and quantitative reasoning. Algebra can also be a prerequisite for advanced mathematics (Levin & Walkoe, 2022). Understanding algebra is necessary for students to progress in subjects such as calculus, linear algebra, and advanced statistics. Without a solid grasp of algebraic concepts, students may struggle with more complex mathematical ideas later in their education. The basic competence in algebra includes understanding the pattern, relationship, and function concept (BSKAP, 2022). These competencies provide the students to have an algebraic reasoning ability.

Algebraic reasoning involved the generalizing process of mathematical ideas and expressing them in mathematical expression (Blanton & Kaput, 2005). It allows the students to identify patterns and structures that apply to a wide range of problems. According to Carraher & Schliemann (2007), algebraic reasoning emphasizes the ability to observe the quantity in context and express the relationship by table, graph, symbol, and mathematical expression. It emphasizes that algebraic reasoning highlights the multiple representation. Students with high algebraic reasoning have excellent mathematics achievement (Kalayci et al., 2023). Algebraic reasoning has a relation with enhancing mathematics achievement (Ünal et al., 2023a). It means that algebraic reasoning is a factor in academic success in mathematics learning.

Blanton & Kaput (2005) characterized algebraic reasoning as arithmetics generalization, functional thinking, and generalizations and justification. NCTM (2016) mentioned five indicators for algebraic reasoning: (a) meaningful use of symbols by selecting variables and constructing expressions and equations in context; (b) connecting algebra with geometry and using connections to solve problems; (c) linking expressions and functions; (d) manipulative consciousness; (e) reasoned solving: view the solution steps as a logical understanding of the relationship; can find patterns, recognize patterns, and generalize. Lepak et al. (2018) compiled the framework for strategies in algebraic reasoning as C1: reading and interpreting text, and making sense of the storyline (context) in problem statements; C2: identifying salient quantities and the relationships between them; C3: using algebraic representations of relationships between quantities; C4: executing calculations and procedures with precision and checking plausibility of results; and C5: providing convincing explanations that give further insight into the depth of students' algebraic thinking.

Indonesian students have obstacles in algebraic reasoning. Andini & Suryadi (2017) revealed that the main obstacle is the student's difficulty in understanding the problem of generalizing the pattern. According to Permatasari et al. (2021), students in 7th grade

experienced the obstacles in understanding the problem and turning it into the mathematics' form. They also unable to generalize the n^{th} term. Students in 8th grade have obstacles in extending action both when expanding the range of applicability and removing particular information from the task (Syawahid & Afifurrahman, 2024). Students in 9th grade have obstacles in algorithmic knowledge, strategy knowledge, and schematic knowledge.

Studies of factor algebraic reasoning have been conducted. Tikkun (2018) constructed 5 factors of algebraic reasoning consist of task time, task work analysis, efficiency rating scale, cognitive load, and working memory. Ünal et al., (2023) found that algebraic reasoning is influenced by visual and symbolic representation. Somasundram (2021) emphasized four cognitive factors of algebraic reasoning consisting of number sense, operation sense, symbol sense, and pattern sense.

Several studies of student algebraic reasoning factors are mostly related to cognitive factors. There are a few studies that relate algebraic reasoning and affective factor. One of the affective aspects that affect mathematics learning achievement is learning interest. Learning interest is a psychological condition that occurs during interaction between students and certain topics or activities, including the process of forming willingness, attention, concentration, and positive feelings towards these topics or activities (Emefa et al., 2020). Learning interest indicates a sense of preference, a sense of student interest in learning activities, which is shown through enthusiasm, participation, and activeness in learning and realizing the importance of these activities to obtain a change in students both in the form of knowledge and other aspects, including attitudes (Sholihah & Listanti, 2022).

Dores et al. (2023) exposed that there is a relationship between learning interest and mathematics reasoning. According to Pratiwi & Mashuri (2020), students with high learning interests tend to be able to fulfill generalization, transformational, and global meta-level activities in algebraic reasoning. Kusuma et al. (2020) revealed that there is an association between learning interest and mathematics creative reasoning by declaring that students with high learning interest will have high mathematics creative reasoning. In general, interest in learning has a positive influence on mathematics learning achievement, including algebraic reasoning (Salifu & Bakari, 2022; Wong & Wong, 2019).

Apart from learning interest, social skills are also one of the factors that influence mathematics achievement, including in reasoning. Social skills are competencies to be able to regulate feelings and thoughts that can be observed in the form of actions or actions that do not harm others and oneself (Sumani et al., 2022). Social skills refer to adaptive behaviors consisting of the skills of initiating and maintaining social relationships, contributing to the development of positive peer relationships, considering the wishes of others in the social circle, and coping with problems that may arise (Polat et al., 2022).

Feser et al. (2023) found that there is a relationship between social skills and mathematics achievement. Students with high social skills have a high mathematics achievement (Caemmerer & Hajovsky, 2022). Social skills play a role in improving algebraic reasoning (function performance) (Christ et al., 2017). Social skills also have an indirect impact on mathematics literacy ability, including those related to algebra (Busnawir et al., 2023). According to Khoirunikmah et al. (2023), social skills have a positive and significant influence

on learning outcomes, with 14,8% of the contribution. In general, social skills play a role in mathematics achievement, including in algebraic reasoning.

Based on the explanations above, this study aims to examine the effect of learning interest and social skills on students' algebraic reasoning. The hypothesis was constructed to determine the effect of learning interest and social skills on student algebraic reasoning, both partially and simultaneously. The study is expected to be a framework in the study development of the affective factor of mathematics reasoning.

B. METHODS

The study examines the effect of students' learning interests and social skills on their algebraic reasoning. The data was numerically sourced from scores of a learning interest questionnaire, a social skill questionnaire, and an algebraic reasoning test. Therefore, this study employed a quantitative approach with a correlation design. Correlation design not only determines the relationship among the dependent and independent variables but also examines the strength of these relationships (Creswell, 2012). A correlational study quantifies the relationship between two or more quantitative variables by the use of a correlation coefficient (Fraenkel et al., 2012).

This study was conducted at three of Islamic state junior high schools in Mataram with a population of 713 students of 8th grade. The sample size was 202 students, which was selected by simple random sampling. The selection of 8th grade is based on the algebraic material that has been taught from 7th grade. Data were collected using questionnaires and test techniques. The questionnaire technique is intended to obtain data on students' interest in learning and social skills, while the test technique is intended to obtain algebraic reasoning data.

The questionnaires in this study consisted of a learning interest questionnaire and a social skill questionnaire. The learning interest questionnaire adopted from Stevens & Olivárez (2005) consisted of 27 items with 21 positive items and 6 negative items. Indonesia version of learning interest questionnaire was validated with product moment score for 27 items more than 0,381 (r-table), which means that all items have a valid criteria. Furthermore, a Cronbach Alpha score of 0,746 more than 0,6 which means that the questionnaires have a reliable criteria. The learning interest questionnaire involved three factors consisting of emotion, knowledge, and value. The social skill questionnaire was adopted from the social skill improvement system-rating scale (SSIS-RS) developed by Gresham & Elliott (2008) and consisted of 46 items which are divided into 7 domains: communication, cooperation, assertion, responsibility, empathy, engagement, and self-control. Learning interest and social skill questionnaire scored by Likert scale with 5 option scale consist of strongly agree (5), agree (4), less agree (3), disagree (2), and strongly disagree (1). Indonesia version of SSIS-RS was validated with product moment score for 46 items more than 0,176 (r-table), which means that all items have a valid criteria. Furthermore, a Cronbach Alpha score of 0,893 more than 0,6 which means that the questionnaires have a reliable criteria.

The algebraic reasoning test consists of 20 items multiple choice and adapted from Blanton & Kaput (2005), including 8 items of general arithmetic, 8 items of functional thinking, and 4 items of generalization and justification. The algebraic reasoning test was validated using two experts of mathematics education by generating scores of 82,2 and 84,4 based on valid criteria.

In addition, the algebraic reasoning test was pre-tested on 75 students in the state junior high school 2 in Mataram. Based on the pre-tested, retrieved product moment score for 20 item more than 0,227 (r-table), which means that 20 items have a valid criteria. Moreover, retrieved a Cronbach Alpha score of 0,727 more than 0,6 which means that the test have a reliable criteria.

The analyzing data in this study involved the descriptive data and the inferential analyses. The descriptive data consist of categorical descriptive data and descriptive statistic data. The categorical descriptive data in this study used a mean ideal ($M = \frac{1}{2}(maximum\ score + minimumscore)$ and standar deviation ($\frac{1}{6}(maximum\ score - minimum\ score)$ criteria Azwar (2022) for the learning interest and social skill data. While the algebraic reasoning data used the range of 20 for the 100 scale. All data was categorized on a fifth scale consisting of very high, high, medium, low, and very low. Categorical descriptive of learning interest and social skill data was presented in Table 1, and categorical descriptive of algebraic reasoning data was presented in Table 2.

Table 1. Learning Interest and Social Skill Data Category

Range Criteria	Learning Interest Range	Social Skill Range	Category
$x \geq M + 1{,}5\ SD$	$x \geq 108$	$x \geq 184$	Very high
$M + 0{,}5\ SD \leq x < M + 1{,}5\ SD$	$90 \leq x < 108$	$153{,}33 \leq x < 184$	High
$M - 0{,}5\ SD \leq x < M + 0{,}5\ SD$	$72 \leq x < 90$	$122{,}66 \leq x < 153{,}33$	Medium High
$M - 1{,}5\ SD \leq x < M - 0{,}5\ SD$	$54 \leq x < 72$	$92 \leq x < 122{,}66$	Low
$M - 1{,}5\ SD \geq x$	$54 \geq x$	$92 \geq x$	Very low

Table 2. Algebraic Reasoning Category

Range Criteria	Category
$81 - 100$	Very high
$61 - 80$	High
$41 - 60$	Medium High
$21 - 40$	Low
$0 - 20$	Very low

Inferential analysis involves prerequisite tests and hypothesis testing. The prerequisite tests consist of the normality test using Kolmogorov-Smirnov (significance criteria 0,05), linearity test using sig. deviation from linearity (significance criteria 0,05), the multicolinearity test using variance inflation factor (VIP) (criteria less than 10), and heteroscedasticity test using Glejser test (significance criteria 0,05) (Hermawan & others, 2019). Hypothesis testing consists of partial hypothesis testing with a t-test. (Significance criteria 0,05) and simultaneous hypothesis testing with the F test (significance criteria 0,05)(Sugiyono, 2019). Furthermore, the regression equation determined to express the relationship between the dependent and independent variables is as follows $Y = a + b_1\ X_1 + b_2\ X_2$. In addition, In addition, the contribution of the independent variable to the dependent variable is determined using *Rsquare*.

C. RESULT AND DISCUSSION

1. Descriptive Data of Algebraic Reasoning, Learning Interest, and Social Skill

Descriptive data in this study consist of category descriptive and statistical descriptive. Category descriptive data of algebraic reasoning, learning interest, and social skill involved the categorical data based on category consist of very high, high, medium, low, and very low. Figure 1 shows the category descriptive data of algebraic reasoning, learning interest, and social skill. It revealed that most students have algebraic reasoning in the medium category, with 88 students (43,56%). In learning interest, most students are in the high and medium category, with 81 students (40,1%). Meanwhile, in social skills, most students in the high category, with 121 students (59,9%). Descriptive statistics data consist of mean, minimum, maximum, variance, and range. Table 3 shows the descriptive statistics data of algebraic reasoning, learning interest, and social skill. Based on Table 3, the data of algebraic reasoning and social skill have a large data distribution from mean value. The mean of learning interest is the least mean from algebraic reasoning and social skill data.

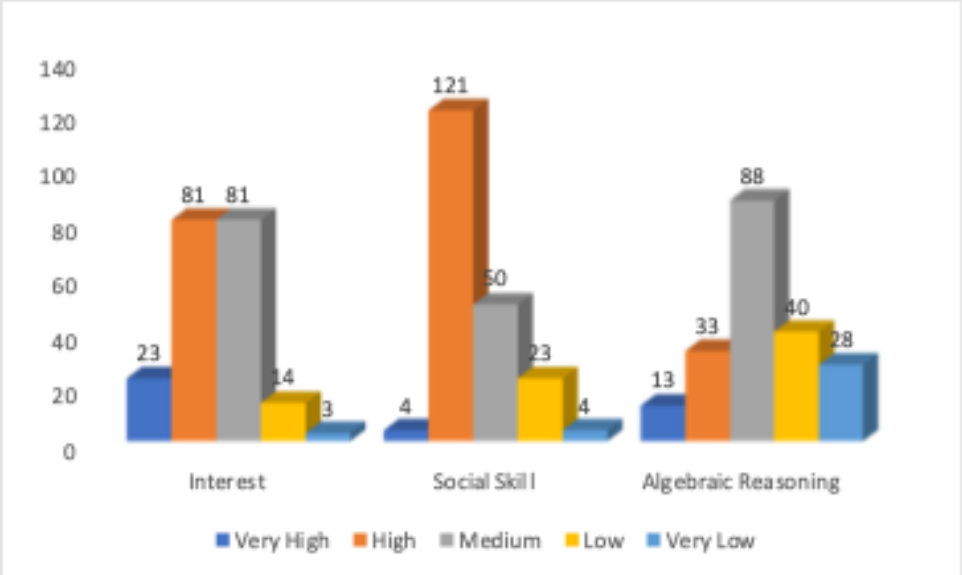

Figure 1. Category Descriptive Data

Table 3. Statistical Descriptive Data

Aspect	Mean	Minimum	Maximum	Variance	Range
Algebraic Reasoning	59,63	25	100	297,74	75
Learning Interest	50,32	25	83,89	68,53	58,89
Social Skill	85,70	43,33	103,89	175,27	60,56

Based on Table 3, the mean of algebraic reasoning was 59,63 with a variance 297,74. It shows that the range of low category and high category was diverse. The mean of algebraic reasoning in this study was higher than the previous study, which revealed that mean of 60 students was 52,83 (Ünal et al., 2023a). The mean was also less than the study by Maulida (2024), which found the mean of students algebraic reasoning was 65,3.

2. Prerequisite Test

a. Normality Test

The normality test aims to evaluate the normal distribution data. In this study, the normality test used the Kolmogorov-Smirnov test for the residual value of the data. The normality test was presented in Table 4.

Table 4. Normality Test

N	Kolmogorov-Smirnov Z	Assimp. Sign (2-tailed)	Prerequisites for normality test	Conclusion
202	1,184	0,121	0,121 > 0,05	Normal Distribution

b. Linearity Test

A linearity test aims to evaluate a liniar relationship between variables. In this study, the linearity test used a significance deviation from liniearity (F-test) with 0,05 criteria. A linearity test was presented in Table 5.

Table 5. Linearity Test

A Grouping Data	F	Deviation from linearity sig.	Prerequisites for linearity test	Conclusion
Learning interest to algebraic reasoning	0,928	0,620	0,620 > 0,05	Linear Pattern
Social skill to algebraic reasoning	1,065	0,374	0,374 > 0,05	Linear Pattern

c. Multicolinearity Test

A multicolinearity test aims to evaluate the correlation between independent variables in a regression model. In this study, a multicolinearity test used Tolerance value and Variance Inflation Factor (VIP) with 0,01 criteria for tolerance and 10 for VIP. It was presented in Table 6.

Table 6. Multicollinearity Test

A Grouping Data	Tolerance	VIP	Prerequisites for Multicollinearity Test	Conclusion
Learning interest to algebraic reasoning	0,998	1,002	0,998 > 0,01 or 1,002 < 10	There is no multicollinearity symptom
Social skill to algebraic reasoning	0,998	1,002	0,998 > 0,01 or 1,002 < 10	There is no multicollinearity symptom

d. Heteroscedasticity Test

The heteroscedasticity test aims to determine the difference of variance and a significance residual in a regression model. The heteroscedasticity test in this study used Glesjer test. It was presented in Table 7.

Table 7. Heteroscedasticity Test

A Grouping Data	t	sig	Prerequisites for heteroscedasticity test	Conclusion
Learning interest to algebraic reasoning	0,008	0,994	0,994 > 0,05	There is no heteroscedasticity symptom
Social skill to algebraic reasoning	0,407	0,684	0,684 > 0,05	There is no heteroscedasticity symptom

3. Hypothetical Test

a. Partial Hypothetical Test

The partial hypothetical test is intended to examine the effect of learning interest and social skill variables on algebraic reasoning separately. The partial hypothetical test in this study used a t-test with significance criteria less than 0,05. It was presented in Table 8.

Table 8. Partial Hipotetical Test

A Grouping Data	t	sig	Prerequisites for Hypothetical Test	Conclusion
Learning interest to algebraic reasoning	0,055	0,957	0,957 > 0,05	There is no effect
Social skill to algebraic reasoning	2,493	0,004	0,004 < 0,05	There is a significance effect

Based on Table 6 above, it appears that learning interest has no effect on algebraic reasoning directly, while social skill has an effect on algebraic reasoning. This result indicated that two independent variables in this study have a different contributing on students' algebraic reasoning. The finding is in line with Hidayati & Munandar (2023) and Ginne et al. (2024) which revealed that learning interests have no influence on the mathematics conceptual understanding. Meanwhile, It corresponds with the previous study that revealed that social skills have an effect on students achievement (Busnawir et al., 2023; Caemmerer & Hajovsky, 2022; Christ et al., 2017; Feser et al., 2023b; Khoirunikmah et al., 2023; Mulyana et al., 2023).

b. Simultaneous Hypothetical Test

A simultanious hypotetical test is intended to examine the effect of learning interest and social skill variables on algebraic reasoning simultaneously. This test involved F-test with a significance criteria less than 0,05. The simultaneous test in this study was presented in Table 9.

Table 9. Simultaneous Hypothetical Test

A Grouping Data	F	sig	Prerequisites for hypothetical test	Conclusion
Learning interest and social skill to algebraic reasoning	4,345	0,014	0,014 < 0,05	There is a significance effect

Table 7 shows that simultaneously, students' learning interest and social skill have a significant effect on algebraic reasoning. Learning interest and social score have a contribution on enhanching of students' algebraic reasoning. The other analyses also

confirmed that the regression model for the relation of learning interest (X_1) and social skill (X_2) on algebraic reasoning (Y) can be written as an equation $Y = 82{,}06 + 0{,}008X_1 + 0{,}266X_2$ with R-square 0,042 (4,2%). The regression model represented the contribution of each independent variable on algebraic reasoning, while R-square presented the percentage contribution of learning interest and social skill on algebraic reasoning.

Based on the result, learning interest has no effect on students algebraic reasoning. This finding was different from previous studies, which found that learning interests have a contribution on mathematics achievement, including in algebra (Dores et al., 2023; Kusuma et al., 2020; Pratiwi & Mashuri, 2020; Salifu & Bakari, 2022; Wong & Wong, 2019). Grigg et al. (2018) found that learning interest and mathematics achievement were reciprocally associated over time. The different finding may be based on other factors in the study, such as the use of learning models. Such as Pratiwi & Mashuri (2020) revealed that students's algebraic reasoning has an association with learning interest in cooperative integrated reading and composition with realistic approach. Kusuma et al. (2020) also revealed that there is a relation between students learning interests and creative reasoning and mathematics problem solving in the application of the treffinger learning model.

The finding is in line with Hidayati & Munandar (2023), which revealed that learning interests have no influence on the mathematics conceptual understanding of eighth grade middle school students. The result also supports the Ginne et al. (2024) study, which found that learning interest has no significant effect on understanding of mathematics concepts. In the social skill variable, the study found that there was an effect of students social skills on algebraic reasoning. It corresponds with the previous study that revealed that social skills have an effect on students achievement (Busnawir et al., 2023; Caemmerer & Hajovsky, 2022; Christ et al., 2017; Feser et al., 2023b; Khoirunikmah et al., 2023; Mulyana et al., 2023). However, Busnawir et al. (2023) exposed that social skills have an indirect effect on mathematics literacy. Social skills have an effect on mathematics literacy moderating by digital literacy-dispositions.

Simultaneously, the result confirmed that learning interest and social skills together have an effect on students algebraic reasoning. Learning interest and social skills have a contribution in increasing students algebraic reasoning, with 4,2% of the contribution percentage. The result supports the study by Doctoroff et al. (2016), which found that learning interest and social skills were correlated with mathematics achievement. Learning interest and social skills were the factors that contributed in mathematics achievement (Khoirunikmah et al., 2023; Salifu & Bakari, 2022). This result confirmed that to improve algebraic reasoning, it is not enough for students to have a high learning interest; students must also have high social skills.

D. CONCLUSION AND SUGGESTIONS

Curents studies confirmed that learning interest and social skills simultaneously have an effect on students algebraic reasoning. It shows that students with a high learning interest and social skill have high algebraic reasoning. Separately, the result revealed that learning interest has no effect on students algebraic reasoning, while social skills have an effect on students algebraic reasoning. As a suggestion, to improve the students social skill, collaborative learning

approaches, such as group discussions, peer tutoring, and cooperative problem-solving, should be encouraged to improve both communication and reasoning abilities. The future research is expected to examine the effect of each aspect or indicator that constructs learning interest and social skills variables on students algebraic reasoning. The future study should also pay attention to the student's initial ability in mathematics.

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REFERENCES

Andini, W., & Suryadi, D. (2017). Student Obstacles in Solving Algebraic Thinking Problems. *Journal of Physics: Conference Series*, *895*. https://doi.org/10.1088/1742-6596/895/1/012091

Azwar, S. (2022). *Penyusunan Skala Psikologi Edisi 2*. Pustaka pelajar.

Battista, M. T. (2016). *Reasoning and sense making in the elementary grades, prekindergarten-grade 2*. The National Council of Teachers of Mathematics.

Blanton, M. L., & Kaput, J. J. (2005). Characterizing a Classroom Practice That Promotes Algebraic Reasoning. *Journal for Research in Mathematics Education*, *36*(5), 412–446. https://doi.org/https://doi.org/10.2307/30034944

BSKAP. (2022). *Capaian Pembelajaran Mata Pelajaran Matematika Fase A - Fase F*.

BSKAP. (2024). *Keputusan BSKAP Kemdikbudristek tentang Capaian pembelajaran pada pendidikan anak usia dini, jenjang pendidikan dasar, dan jenjang pendidikan menengah pada kurikulum merdeka* (Patent 032/H/KR/2024). Kemdikbudristek.

Busnawir, B., Kodirun, K., Sumarna, N., & Alfari, Z. (2023). Analysis of the Effect of Social Skills and Disposition of Digital Literacy on Mathematical Literacy Ability. *European Journal of Educational Research*, *12*(1), 59–69. https://doi.org/10.12973/eu-jer.12.1.59

Caemmerer, J. M., & Hajovsky, D. B. (2022). Reciprocal Relations Between Children's Social and Academic Skills Throughout Elementary School. *Journal of Psychoeducational Assessment*, *40*(6), 761–776. https://doi.org/10.1177/07342829221097186

Carraher, D. W., & Schliemann, A. D. (2007). Early algebra and algebraic reasoning. In J. F. K. Lester (Ed.), *Second Handbook of Research on Mathematics Teaching and Learning Vol II.* (pp. 669–705). Information Age Publishing.

Christ, S. E., Stichter, J. P., O'Connor, K. V., Bodner, K., Moffitt, A. J., & Herzog, M. J. (2017). Social Skills Intervention Participation and Associated Improvements in Executive Function Performance. *Autism Research and Treatment*, *2017*(1), 1–13. https://doi.org/10.1155/2017/5843851

Creswell, J. W. (2012). *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research* (Fourth). Pearson Education.

Doctoroff, G. L., Fisher, P. H., Burrows, B. M., & Edman, M. T. (2016). Preschool children's interest, social-emotional skills, and emergent mathematics skills. *Psychology in the Schools*, *53*(1), 390–403. https://doi.org/10.1002/pits.21912

Dores, O. J., Sopia, N., & Aming, A. (2023). Analisis hubungan minat belajar terhadap kemampuan penalaran matematis siswa kelas X (Analysis of the relationship of learning interest on mathematics reasoning ability of students at 10th grade). *Jurnal Riset Pendidikan Matematika Jakarta*, *5*(2), 55–64. https://doi.org/10.21009/jrpmj.v5i2.23086

Emefa, A. J., Miima, F. A., & Bwire, A. M. (2020). Impact of motivation on junior high school students' interest in reading comprehension in Hohoe Municipality: a literature based review. *African Journal of Emerging Issues (AJOEI)*, *2*(8), 1–16.

Erviana, T. (2019). Kemampuan Penalaran Matematis Siswa Dalam Memecahkan Masalah Aljabar Berdasarkan Gaya Kognitif Field Independent. *Alifmatika: Jurnal Pendidikan Dan Pembelajaran Matematika*, *1*(1), 61–73. https://doi.org/10.35316/alifmatika.2019.v1i1.61-73

Feser, M. S., Haak, I., & Rabe, T. (2023a). Disentangling the relationship between mathematical achievement, social skills, and social status in inclusive classrooms. *Empirische Sonderpädagogik*, *13*(2), 148–166. https://doi.org/10.25656/01

Feser, M. S., Haak, I., & Rabe, T. (2023b). Disentangling the relationship between mathematical achievement, social skills, and social status in inclusive classrooms. *Empirische Sonderpädagogik*, *13*(2), 148–166. https://doi.org/10.25656/01

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to Design and Evaluate Research in Education*. McGraw-Hill.

Ginne, Y., Kariman, D., & Yusri, R. (2024). The Influence of Learning Interest on Understanding of Mathematical Concepts in Class XI PH 1 Students at SMKN 6. *AlphaMath : Journal of Mathematics Education*, *10*(1), 1. https://doi.org/10.30595/alphamath.v10i1.19705

Gresham, F. M., & Elliott, S. N. (2008). *Social skills improvement system: Intervention guide*. Pearson Assessments.

Grigg, S., Perera, H. N., McIlveen, P., & Svetleff, Z. (2018). Relations among math self efficacy, interest, intentions, and achievement: A social cognitive perspective. *Contemporary Educational Psychology*, *53*(2), 73–86. https://doi.org/10.1016/j.cedpsych.2018.01.007

Hermawan, I., & others. (2019). *Metodologi Penelitian Pendidikan (Kualitatif, Kuantitatif dan Mixed Method)*. Hidayatul Quran.

Hidayati, H. A., & Munandar, D. R. (2023). The Influence of mathematics learning interest on the conceptual understanding of eighth-grade middle school students. *Union: Jurnal Ilmiah Pendidikan Matematika*, *11*(1), 136–142. https://doi.org/10.30738/union.v11i1.13639

Kalayci, Ö., Yigit, E., & Akkaya, R. (2023). Investigation of the Relationships between Number Sense, Algebraic Reasoning, and Mathematical Achievement of 8th Grade Students. *Technology, Innovation and Special Education Research*, *3*(2), 170–206. www.tiserjournal.com

Khoirunikmah, B., Marmoah, S., & Indriayu, M. (2023, July). The effect of social skills on student learning outcomes with self-efficacy as a moderating variable. *The Third International Conference on Innovations in Social Sciences Education and Engineering (ICoISSEE)-3*. https://doi.org/https://conference.loupiasconference.org/index.php/icoissee3/article/view/429

Kusuma, J. W., Jefri, U., Hidayat, A., & Hamidah, H. (2020). Application of Treffinger Learning Model to Improve Creative Reasoning and Mathematical Problem Solving Skills as Well as Student Learning Interests. *JTAM (Jurnal Teori Dan Aplikasi Matematika)*, *4*(2), 204. https://doi.org/10.31764/jtam.v4i2.2840

Lepak, J. R., Wernet, J. L. W., & Ayieko, R. A. (2018). Capturing and characterizing students' strategic algebraic reasoning through cognitively demanding tasks with focus on representations. *Journal of Mathematical Behavior*, *50*(January), 57–73. https://doi.org/10.1016/j.jmathb.2018.01.003

Levin, M., & Walkoe, J. (2022). Seeds of algebraic thinking: a Knowledge in Pieces perspective on the development of algebraic thinking. *ZDM - Mathematics Education*, *54*(6), 1303–1314. https://doi.org/10.1007/s11858-022-01374-2

Maulida, R. (2024). Identifikasi Kemampuan Berpikir Aljabar Dan Resiliensi Matematis Dalam Pemecahan Masalah SPLDV Berdasarkan Gaya Kognitif. *Gudang Jurnal Multidisiplin Ilmu*, *2*(2020), 1–8. https://doi.org/https://doi.org/10.59435/gjmi.v2i8.674

Mulyana, F. R., Suherman, A., Mahendra, A., Subarjah, H., & Hidayat, Y. (2023). Enhancing social skills: Reliability and validity of the Indonesian version of SSIS-RS among physical education students. *Journal Sport Area*, *9*(1), 11–19. https://doi.org/10.25299/sportarea.2024.vol9(1).13492

NCTM. (2000). *Principless and Standards for School Mathematics*. NCTM.

NCTM. (2016). *Focus in high school mathematics: Reasoning and sense making*. NCTM inc.

OECD. (2023a). *PISA 2022 Results (Volume I): The State of Learning and Equity in Education*. OECD Publishing. https://doi.org/https://doi.org/10.1787/53f23881-en.

OECD. (2023b). *PISA 2022 Results (Volume I): The State of Learning and Equity in Education*. OECD Publishing. https://doi.org/https://doi.org/10.1787/53f23881-en.

OECD. (2023c). *PISA 2022 Results (Volume II): Learning During – and From – Disruption*. OECD Publishing. https://doi.org/https://doi.org/10.1787/a97db61c-en

Permatasari, D., Azka, R., & Fikriya, H. (2021). Exploring students' algebraic thinking in generational activities and their difficulties. *Beta: Jurnal Tadris Matematika*, *14*(1), 53–68. https://doi.org/10.20414/betajtm.v14i1.418

Polat, Ö., Sezer, T., & Atış-Akyol, N. (2022). Collaborative learning with mind mapping in the development of social skills of children. *Participatory Educational Research*, *9*(1), 463–480. https://doi.org/10.17275/per.22.25.9.1

Pratiwi, M., & Mashuri. (2020). Algebraic Thinking Ability Viewed From Students' Interest Learning In Cooperative Integrated Reading and Composition (Circ) With Realistic Approach. *PRISMA, Prosiding Seminar Nasional Matematika*, *3*, 418–425. https://journal.unnes.ac.id/sju/index.php/prisma/

Prinantyo, A. (2023). *Belajar dari Skor PISA 2022*. Kompas.

Salifu, A. S., & Bakari, A. (2022). Exploring the Relationship Between Students' Perception, Interest and Mathematics Achievement. *Mediterranean Journal of Social & Behavioral Research*, *6*(1), 13–20. https://doi.org/10.30935/mjosbr/11491

Sholihah, U., & Listanti, A. M. (2022). Analyzing s tudents ' mathematical reasoning from the perspective of learning interest. *Beta: Jurnal Tadris Matematika*, *15*(2), 157–166. https://doi.org/10.20414/betajtm.v15i2.535

Somasundram, P. (2021). The Role of Cognitive Factors in Year Five Pupils' Algebraic Thinking: A Structural Equation Modelling Analysis. *Eurasia Journal of Mathematics, Science and Technology Education*, *17*(1), 1–12. https://doi.org/10.29333/ejmste/9612

Stevens, T., & Olivárez, A. (2005). Development and evaluation of the mathematics interest inventory. *Measurement and Evaluation in Counseling and Development*, *38*(3), 141–152. https://doi.org/10.1080/07481756.2005.11909775

Sugiyono. (2019). *Statistika untuk Penelitian (Cetakan ke-30)*. CV Alfabeta.

Sumani, S., Kadafi, A., Purnomosasi, L. K. D., & Prasasti, P. A. T. (2022). The Impact of "Kampus Mengajar MBKM Program" on Students' Social Skills. *Pegem Egitim ve Ogretim Dergisi*, *12*(3), 220–225. https://doi.org/10.47750/pegegog.12.03.23

Syawahid, M. (2022). Penalaran Aljabar Mahasiswa Calon Guru Matematika Dalam Pemecahan Masalah Matematika Menggunakan Pisa Framework. In *AKSIOMA: Jurnal Program Studi Pendidikan Matematika* (Vol. 11, Issue 2, p. 1208). researchgate.net. https://doi.org/10.24127/ajpm.v11i2.5006

Syawahid, M., & Afifurrahman, A. (2024). Student's Functional Thinking Obstacle in Solving a Linier Pattern Problem. *AIP Conference Proceedings*, *3235*. https://doi.org/10.1063/5.0234351

Tikkun, S. R. (2018). *A study of the factors influencing algebraic problem solving by individuals with visual impairments*. Northern Illinois University.

Ünal, Z. E., Ala, A. M., Kartal, G., Özel, S., & Geary, D. C. (2023a). Visual and Symbolic Representations as Components of Algebraic Reasoning. *Journal of Numerical Cognition*, *9*(2), 327–345. https://doi.org/10.5964/jnc.11151

Ünal, Z. E., Ala, A. M., Kartal, G., Özel, S., & Geary, D. C. (2023b). Visual and Symbolic Representations as Components of Algebraic Reasoning. *Journal of Numerical Cognition*, *9*(2), 327–345. https://doi.org/10.5964/jnc.11151

Wong, S. L., & Wong, S. L. (2019). Relationship between interest and mathematics performance in a technology-enhanced learning context in Malaysia. *Research and Practice in Technology Enhanced Learning*, *14*(1). https://doi.org/10.1186/s41039-019-0114-3