Kognitif
Jurnal Riset HOTS Pendidikan Matematika
Volume- 5 No- 4 Page 1445 – 1458
ISSN 2776-9704 P-ISSN 2776-9984
https://doi.org/10.51574/kognitif.v5i4.3292

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How to cite : Mubarokah, H. H., Dewi, S. V., & Depi Setialesmana. (2025). Gender Differences in the Relationship Between Mathematical Disposition and Problem-Solving Skills. *Kognitif: Jurnal Riset HOTS Pendidikan Matematika*, *5*(4), 1445–1458. https://doi.org/10.51574/kognitif.v5i4.3292

To link to this artcle : https://doi.org/10.51574/kognitif.v5i4.3292

Opened Access Article

Published Online on 18 October 2025

Kognitif: Jurnal Riset HOTS Pendidikan Matematika
https://doi.org/10.51574/kognitif.v5i4.3292 Volume 5, No 4, October - December 2025, pp. 1445– 1458

Gender Differences in the Relationship Between Mathematical Disposition and Problem-Solving Skills

Hevi Haplatul Mubarokah[1*], Sinta Verawati Dewi[2], Depi Setialesmana[3]

[1,2,3]Department of Mathematics Education, Faculty of Teacher Training and Education, Universitas Siliwangi

Article Info

Article history:

Received Jun 02, 2025
Accepted Aug 21, 2025
Published Online Oct 18, 2025

Keywords:

Comparative–Correlational Design
Gender
Mathematical Disposition
Problem-Solving Skills

ABSTRACT

Mathematical disposition, which encompasses students' confidence, perseverance, curiosity, and appreciation toward mathematics, plays a significant role in shaping their approaches to problem-solving. This study aims to investigate gender-based differences in students' mathematical disposition and problem-solving ability, and to analyze the overall relationship between these variables. A quantitative approach employing a comparative–correlational design was used. Following Yount's sampling guideline, 10% of the population (comprising 39 seventh-grade students) was randomly selected through simple random sampling. Research instruments included a Likert-scale questionnaire to measure mathematical disposition and an essay-based test developed from the IDEAL problem-solving framework. Both instruments were previously validated and tested for reliability to ensure data accuracy. Data were analyzed using an independent-samples *t*-test and Spearman's rank correlation. Results revealed no significant difference in mathematical disposition between male (M = 67.26) and female students (M = 65.65), $t(37) = 0.553$, $p > 0.05$. In contrast, a significant difference was found in problem-solving ability, with male students (M = 69.42) outperforming females (M = 56.70), $t(37) = 2.77$, $p < 0.05$. Moreover, a low positive correlation ($\rho = 0.2172$) was observed between mathematical disposition and problem-solving ability. These findings suggest that gender factors may influence students' cognitive and affective engagement in mathematical problem-solving. The study contributes to the growing body of research on mathematics education by emphasizing the importance of integrating affective and cognitive dimensions in designing more personalized and effective teaching practices.

Corresponding Author:

Hevi Haplatul Mubarokah,
Department of Mathematics Education,
Faculty of Teacher Training and Education,
Universitas Siliwangi,
Jl. Siliwangi No. 24, Kahuripan, Tasikmalaya City 46115, Indonesia
Email: hevihaplatulm@gmail.com

Introduction

The persistent low performance in mathematical problem-solving among students has become a major concern in mathematics education, both nationally and internationally. The *Programme for International Student Assessment (PISA)*reports that Indonesian students' mathematical literacy remains below the average of OECD countries, particularly in contextual problem-solving indicators (OECD, 2023a). According to official data from *PISA 2022 Education GPS* (OECD, 2023b), the average mathematics score of Indonesian students was 366—substantially lower than the OECD average of 472. Only 18% of Indonesian students achieved Level 2 or above, compared to 69% in OECD countries. Almost no Indonesian students reached Level 5 or 6, while 9% of students in OECD countries did. The performance gap between advantaged and disadvantaged students in Indonesia was 34 points, below the OECD average, and female students scored six points higher than male students. The overall distribution indicates that most students are concentrated at lower proficiency levels.

These findings suggest that many students struggle to apply mathematical concepts to contextual situations, an essential aspect of mathematical literacy. National studies (Yusnita, Sumarmo, & Fitriani, 2025) reveal similar issues, showing that many students still face difficulties in connecting mathematical theories with real-world contexts. These difficulties are not solely cognitive but are also closely linked to students' mathematical disposition. *Mathematical disposition* refers to attitudes, beliefs, and positive habits toward mathematics that influence how individuals perceive, understand, and solve mathematical problems. Based on NCTM indicators (as cited in Utami, Mustadi, Marsigit, & Ibrahim, 2021), mathematical disposition includes confidence in using mathematics, flexibility in mathematical tasks, persistence in completing work, curiosity about mathematics, reflection on thinking, appreciation of mathematical applications, and valuing the role of mathematics. When students perceive mathematics as difficult, irrelevant, or intimidating, their confidence and ability to apply mathematical knowledge in real contexts may diminish.

Mathematical disposition is thus a critical factor in enhancing students' critical thinking and problem-solving skills (Çelik & Özdemir, 2020; Susilo, Darhim, & Prabawanto, 2020). Çelik & Özdemir (2020) found that subdimensions of mathematical thinking (such as reasoning and problem-solving skills) significantly predict mathematical disposition in cognitive performance. This implies that higher mathematical ability correlates with stronger disposition. Similarly, Susilo et al. (2020) demonstrated that interactive media can foster positive mathematical dispositions, which in turn strengthen students' critical thinking and problem-solving skills. However, some findings reveal that the correlation between these two constructs is relatively weak, suggesting that their relationship is not always consistent and may be influenced by other factors, such as metacognitive skills, learning strategies, or instructional design.

Problem-solving skills involve both critical and creative thinking processes that enable individuals to recognize, analyze, and resolve mathematical problems. These processes include designing effective strategies, implementing appropriate procedures, and evaluating solutions. Previous studies have examined the relationship between mathematical disposition and students' problem-solving skills (Hutajulu, Wijaya, & Hidayat, 2019; Sa'dijah, Sa'diyah, Sisworo, & Anwar, 2020; Wahyuningrum, Bonyah, Yumiati, Kartono, & Wijayanti, 2024). Hutajulu et al. (2019) found a significant effect of mathematical disposition and learning motivation on problem-solving skills but did not consider gender as a factor. Yet, affective and cognitive aspects in mathematics can be influenced by gender differences. Sa'dijah et al. (2020) noted that cognitive styles influence mathematical disposition characteristics but did not explore gender-related effects. Meanwhile, Wahyuningrum et al. (2024) reported that the

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https://doi.org/10.51574/kognitif.v5i4.3292 Volume 5, No 4, October - December 2025, pp. 1445– 1458

implementation of Model-Eliciting Activities (MEAs) did not yield a significant correlation between mathematical disposition and problem-solving skills, although a positive tendency was observed.

These findings highlight the need for further exploration of factors influencing the relationship between affective and cognitive aspects of mathematics learning, particularly the role of gender. The literature review indicates a scarcity of studies integrating the three aspects (for instance, mathematical disposition, problem-solving skills based on the IDEAL model, and gender differences) within a single research framework. Therefore, the present study aims to examine differences in mathematical disposition and problem-solving skills based on gender and to analyze the relationship between these two constructs within that context.

This study offers several contributions to mathematics education research, particularly concerning the relationship between mathematical disposition and problem-solving skills. One distinctive aspect lies in its gender-based analysis, showing that while male and female students do not differ significantly in mathematical disposition, notable differences exist in their mathematical problem-solving performance. The *comparative–correlational design* employed in this study provides a more comprehensive perspective than prior studies that explored only one variable without accounting for gender as a moderating factor. Moreover, the study adopts the IDEAL model (Bransford & Stein, 1993) as a framework for assessing students' problem-solving skills through five stages: *Identify the problem, Define the goal, Explore possible strategies, Anticipate outcomes and act, and Look back and learn*. This systematic approach establishes a stronger standard for evaluating students' performance than studies using general indicators of problem solving. By integrating affective and cognitive perspectives within a gender-based context, this study deepens the understanding of how mathematical disposition may moderate students' problem-solving skills across diverse learning environments.

The implications of these findings emphasize the need for inclusive and gender-sensitive learning strategies. Evidence shows that male students often outperform females in mathematical problem-solving tasks (Aisyah & Novitasari, 2023; Juniati & Manoy, 2025). Therefore, instructional approaches should consider how gender influences cognitive patterns and problem-solving strategies. This study contributes to the development of more adaptive and targeted instructional practices that can enhance students' mathematical literacy and problem-solving skills at the secondary school level. In line with this background, the present research focuses on examining the relationship between students' mathematical disposition and problem-solving skills, as well as gender-based differences in both variables. Mathematical disposition, representing the affective domain, is hypothesized to be related to problem-solving skills as part of the cognitive domain; however, this relationship from a gender perspective remains underexplored. Furthermore, this study provides an empirical foundation for developing gender-responsive learning strategies aimed at strengthening students' mathematical literacy.

Method

Research Design

This study employed a quantitative non-experimental method with a comparative–correlational design. The quantitative approach was chosen to allow for objective hypothesis testing through statistical analysis based on numerical data (Rana, Gutierrez, & Oldroyd, 2021). The comparative design was applied to compare two groups (male and female students) based on specific variables, namely mathematical disposition and mathematical problem-solving skills (Massen, Behrens, Martin, Stocker, & Brosnan, 2019). Meanwhile, the correlational design (r) was used to examine the relationship between mathematical disposition (Y_1) and mathematical problem-solving skills (Y_2) without manipulating any variables (Creswell & Creswell, 2018; Sugiyono, 2017). In this research, gender was used as a grouping variable to test differences in students' mathematical disposition and problem-solving skills between males and females. The variable of mathematical disposition served as the independent variable, while problem-solving skills functioned as the dependent variable, to determine whether a significant relationship existed between the two. This quantitative non-experimental comparative–correlational design was selected because the variables were not directly manipulated but were observed as they naturally occurred. Such a design enables researchers to identify both the relationships among variables and the differences between groups based on gender, aligning with the study's objectives and hypotheses.

Population and Sample

The population in this study consisted of all seventh-grade students at SMP Negeri 5 Tasikmalaya, totaling 386 students. To obtain a representative sample, the simple random sampling technique was employed, in which every member of the population had an equal chance of being selected without stratification. The sample size determination followed Yount's (2018) sample size table, which is recommended when the population size is fewer than 1,000 individuals. According to the Table 1, for a population ranging from 101 to 1,000, the sample size can be estimated using the following formula:

Table 1. Sample Size Determination

Population Size Range	Sample Percentage
0 – 100	100%
101 – 1,000	10%
1,001 – 5,000	5%
5,001 – 10,000	3%
≥ 10,001	1%

Note. The sample proportion was determined according to Yount's (2018) guidelines for populations under 10,000.

$$n = N \times 10\%$$
$$n = 386 \times 10\%$$
$$n = 38{,}6 \approx 39$$

where:
n = required sample size
N = population size
10% = sample proportion

Thus, the final sample consisted of 39 seventh-grade students. This sampling approach was chosen to ensure that the data collected would accurately represent the population and allow the researcher to examine the relationship between mathematical disposition and problem-solving skills without any intervention or manipulation of variables. Such a procedure enhances the external validity of the findings and allows for more accurate generalization to a broader population.

Instruments and Procedures

In collecting data, this study employed two main instruments: a questionnaire to measure mathematical disposition and an essay test to evaluate mathematical problem-solving skills. An illustration of both instruments is presented in Figure 1.

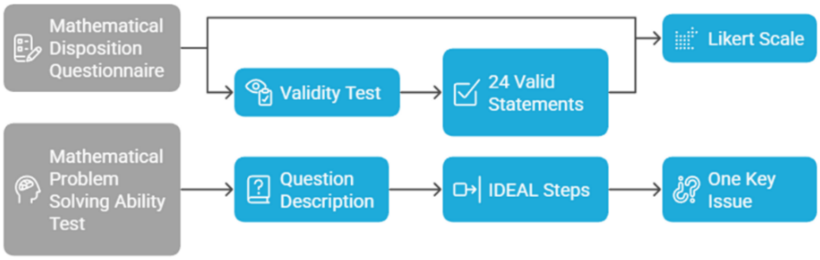

Figure 1. Research Instruments

Mathematical disposition questionnaire was developed based on indicators adopted from the *National Council of Teachers of Mathematics (NCTM)*, including confidence in using mathematics, flexibility in completing mathematical tasks, perseverance in solving problems, curiosity toward mathematics, reflection on one's own thinking, appreciation of mathematical applications, and valuing the role of mathematics. The initial version of the questionnaire consisted of 30 statement items; however, after validity testing, only 24 items met the established criteria and were retained for use in the study. The questionnaire employed a Likert scale to measure students' attitudes toward mathematics. In addition, an essay-type test was used to assess students' problem-solving skills. This instrument was designed based on the *IDEAL* model proposed by Bransford & Stein (1993), which includes five systematic stages: *Identify the problem, Define the goal, Explore possible strategies, Act on the plan, and Look back*. The test items were constructed to cover all five stages, ensuring that students' performance could be evaluated comprehensively according to each phase of the IDEAL framework. The combination of these two instruments enabled a comprehensive and systematic analysis of the relationship between mathematical disposition and problem-solving skills. This integration supports the generation of valid conclusions and provides a solid foundation for developing more effective learning strategies. Data collection was conducted in two main stages: (1) the administration of the mathematical disposition questionnaire and (2) the implementation of the mathematical problem-solving test. The overall procedure is illustrated in Figure 2.

Figure 2. Data Collection Stages

The distribution of questionnaires was conducted prior to the administration of the test, aiming to gather data on students' attitudes, beliefs, and tendencies toward mathematics. The questionnaire consisted of 24 statements measured using a Likert scale, designed to capture students' mathematical disposition comprehensively. After completing the questionnaire, students participated in a performance-based assessment to measure their cognitive abilities in mathematical problem-solving. This essay-type test was developed following the IDEAL framework (*Identify the problem, Define the goal, Explore possible strategies, Act on the plan, and Look back*) proposed by Bransford & Stein (1993). The test aimed to evaluate how students systematically approached and solved mathematical problems. Students' responses were subsequently analyzed to identify patterns of thinking, problem-solving strategies, and the correlation between mathematical disposition and problem-solving skills. Through this structured and sequential data collection process, the study sought to obtain a more comprehensive understanding of the interaction between students' affective (disposition) and cognitive (problem-solving) aspects in mathematics learning.

Analysis

The data analysis method applied in this study involved a series of systematic analytical procedures designed to ensure valid and accurate results. Descriptive analysis was conducted on the questionnaire data using the Successive Interval Method (Marynets & Pantova, 2024), which allowed ordinal data to be converted into interval scales and categorized into three levels: high, medium, and low. Meanwhile, data obtained from the mathematical problem-solving skills test were analyzed based on the scores achieved at each stage of the problem-solving process and then classified into five categories, ranging from *very low* to *very high* performance. Before the instruments were used in the main study, validity and reliability tests were performed to ensure their accuracy and consistency. Instrument validity was examined using Pearson's Product Moment correlation (Okwonu, Asaju, & Arunaye, 2020), which measured the extent to which the questionnaire and test accurately reflected the intended variables. Instrument reliability was assessed using Cronbach's Alpha (Barbera, Naibert, Komperda, & Pentecost, 2021) to determine the internal consistency of the measurement results.

The validity testing showed that all items in the mathematical disposition questionnaire met the required standards, indicating a sufficient to very strong level of validity and reliability. The essay-type test was also empirically tested to ensure its validity and reliability. The results revealed a validity coefficient of r = 0.999919, categorized as *very strong*, and a reliability coefficient of α = 0.63061, indicating a high level of internal consistency. Therefore, the instruments were considered appropriate for measuring the research variables.

Before hypothesis testing, a series of statistical assumption tests was conducted to ensure that the data met the criteria for statistical analysis. The chi-square test (Shen, Panda, & Vogelstein, 2022) was applied to examine whether the data followed a normal distribution. Furthermore, a linearity test Khedidja & Moussa (2022) was performed to verify whether the relationship between variables Y_1 (mathematical disposition) and Y_2 (problem-solving skills) was proportional and linear prior to further inferential analysis. At the hypothesis testing stage, inferential analyses were carried out to identify the relationships and differences among variables. The independent-samples t-test was used to determine whether there were significant differences in mathematical disposition and problem-solving skills between male and female students. The formula for the *t*-test is presented as follows:

$$s_p = \sqrt{\frac{(n_{X_1} - 1)s_{X_1}^2 + (n_{X_1} - 1)s_{X_2}^2}{n_{X_1} + n_{X_2} - 2}}$$

The *t*-test formula used to compare the mean scores between the two independent groups (male and female students) is expressed as follows:

$$t = \frac{\bar{Y}_{X_1} - \bar{Y}_{X_2}}{\sqrt{s_p^2 \cdot \left(\frac{1}{n_{X_1}} + \frac{1}{n_{X_2}}\right)}}$$

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To test the difference in mean scores between two independent groups (Tian & Cao, 2023) (male and female students) an independent-samples t-test was employed, as there was no direct relationship between individuals in the two groups. Prior to conducting the t-test, tests of normality and homogeneity of variances were carried out to ensure that the data distribution and equality of variances met the basic assumptions required for the application of the t-test. If the variances of the two groups were homogeneous, the analysis used the pooled variance approach. Conversely, when the assumption of homogeneity was violated, Welch's t-test was applied as an alternative method. Furthermore, Pearson's or Spearman's correlation tests were conducted to determine the degree of relationship between mathematical disposition and problem-solving skills. When the data satisfied the parametric assumptions, Pearson's Product-Moment correlation was used. However, when the assumptions were not met, the Spearman rank-order correlation was employed instead. In this study, the data did not meet the normality assumption; therefore, the Spearman correlation coefficient (ρ) was used to analyze the relationship between the two variables.

Results

This section presents the findings of the study in a clear and detailed manner, supported by empirical evidence. The study aimed to examine students' mathematical disposition and mathematical problem-solving skills among seventh-grade students, and to analyze their relationship based on gender differences.

Data on Mathematical Disposition and Problem-Solving Skills

Data on mathematical disposition were collected through questionnaires distributed to 39 seventh-grade students of class VII-G, consisting of 19 male and 20 female students. The data covered two main variables: mathematical dispositionand problem-solving skills. Figure 3 illustrates the distribution of mathematical disposition and problem-solving skill categories by gender.

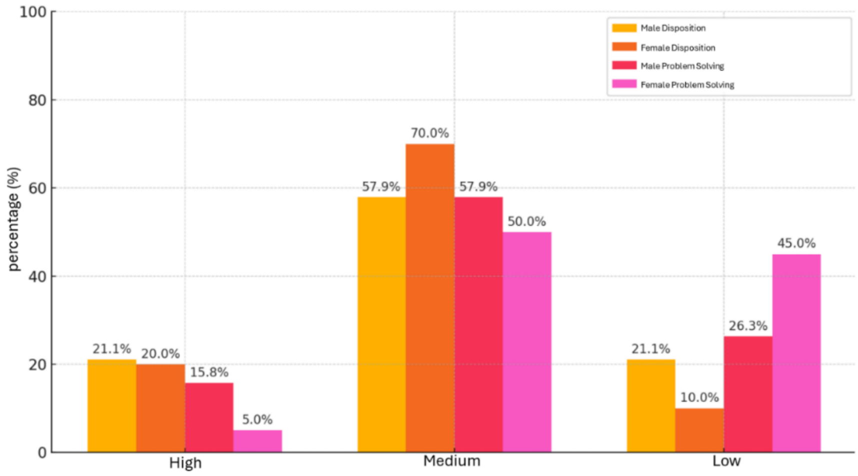

Figure 3. Distribution of Mathematical Disposition and Problem-Solving Skills by Gender

As shown in Figure 3, the majority of both male and female students fell into the moderate category of mathematical disposition. However, a larger proportion of female students (70%) were classified as moderate compared to male students (57.89%). The proportion of students in the high category was relatively balanced between males and females (around 20%), while the low category was more frequent among male students (21.05%). This indicates that while students generally exhibited a positive attitude toward mathematics, their disposition had not yet developed optimally. In terms of problem-solving skills, male students showed a higher proportion in the high and very high categories (combined 73.68%), whereas female students tended to fall into the low category (45%). This suggests a noticeable gender difference in cognitive performance, even though their mathematical dispositions were relatively similar.

Significance of Mathematical Disposition

An independent-samples t-test was performed to determine whether male and female students differed significantly in mathematical disposition. The results indicated that male students had a mean score of 67.26 (SD = 10.63), whereas female students had a mean score of 65.65 (SD = 7.35). The pooled standard deviation was calculated using the following formula:

$$s_p = \sqrt{\frac{\left(n_{X_1} - 1\right)s_{X_1}^2 + \left(n_{X_1} - 1\right)s_{X_2}^2}{n_{X_1} + n_{X_2} - 2}} = 9{,}09465$$

Applying the *t*-test formula yielded:

$$t = \frac{\bar{Y}_{X_1} - \bar{Y}_{X_2}}{\sqrt{s_p^2 \cdot \left(\frac{1}{n_{X_1}} + \frac{1}{n_{X_2}}\right)}} = 0{,}552868 \approx 0{,}553$$

with degrees of freedom (df) = 37. Since $t_{calculated} = 0.553 < t_{table} = 2.026$ at $\alpha = 0.05$, the null hypothesis (H_0) was accepted, indicating no significant difference in mathematical disposition between male and female students. The significance value obtained was p = 0.553 (p > 0.05), and the mean difference between the two groups was 1.613, with a standard error of 2.941. The 95% confidence interval ranged from –4.378 to 7.604, which includes zero, confirming that the observed difference was not statistically significant. These findings suggest that gender does not play a significant role in influencing students' mathematical disposition within this sample. Consequently, enhancing mathematical disposition should focus on universal approaches such as reflective learning strategies and confidence-building activities rather than gender-based differentiation.

Significance of Problem-Solving Skills

An independent-samples t-test was also conducted to analyze gender-based differences in problem-solving skills. The results showed that male students had a mean score of 69.42 (SD = 12.44), whereas female students had a mean score of 56.70 (SD = 15.91). The pooled standard deviation was calculated as $S_p = 14.33$, and the computed t-value was t = 2.77, which exceeded the critical value $t_{table} = 2.026$ ($\alpha = 0.05$, df = 37). Therefore, H_0 was rejected, indicating a statistically significant difference between male and female students in problem-solving skills. These results confirm that male students outperformed their female counterparts in mathematical problem-solving. Hence, gender appears to be a contributing factor influencing students' cognitive performance in solving mathematical problems within this study context.

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Correlation Between Mathematical Disposition and Problem-Solving Skills

To identify the relationship between mathematical disposition and problem-solving skills, the study used the Spearman rank-order correlation because the data did not meet the linearity assumption. This non-parametric correlation measures both the direction and strength of the relationship between the ranked values of the two variables. The dataset consisted of 39 paired scores of mathematical disposition and problem-solving skills, which were each ranked and compared. The total squared difference of ranks was Σd^2 = 7,734, and the correlation coefficient was calculated using the following formula:

$$(\rho) = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$$

$$(\rho) = 1 - \frac{6\sum d_i^2}{n(n^2-1)} = 1 - \frac{6 \times 7734}{39(39^2-1)} = 0{,}21720 \approx 0{,}2172$$

The result showed a low positive correlation (ρ = 0.2172) between mathematical disposition and problem-solving skills. This indicates that students with higher mathematical disposition tended to exhibit slightly higher problem-solving skills, although the relationship was weak and not sufficient for strong generalization. This finding implies that while mathematical disposition has some influence on problem-solving performance, other factors—such as metacognitive strategies, prior knowledge, and instructional design—may also play significant roles. Therefore, a more comprehensive instructional approach is needed to enhance students' mathematical problem-solving skills effectively.

Discussion

This study focused on examining the relationship between students' mathematical disposition and problem-solving skills, as well as analyzing gender-based differences in both variables. The results revealed that there was no statistically significant difference in mathematical disposition between male and female students. However, a significant difference was found in mathematical problem-solving skills, with male students outperforming female students. Additionally, the correlation test showed a positive but weak relationship (ρ = 0.2172) between mathematical disposition and problem-solving skills. These findings align with the main objective of this study, to investigate how mathematical disposition and problem-solving skills interact in the context of gender. Although the initial hypothesis assumed significant gender differences in both variables and a positive correlation between them, the results confirmed only one of these assumptions: the significant difference in problem-solving skills based on gender.

From a scientific perspective, these findings can be interpreted from two viewpoints. First, the absence of a significant difference in mathematical disposition between genders suggests that students' attitudes, interests, and confidence toward mathematics are relatively balanced across male and female students in this sample. This implies that the affective dimension of mathematics learning can be developed universally without gender-based differentiation. This finding is consistent with Putri, Priyadi, & Khoirunnisa (2023), who reported that cognitive styles, rather than gender, have a greater influence on students' mathematical disposition.

Second, the significant difference in mathematical problem-solving skills indicates that gender influences the cognitive dimension of mathematics learning. This result is consistent with Fioriti et al. (2024) and Boman & Wiberg (2024), who emphasized that cognitive factors (such as reasoning ability, information processing, and problem-solving) and affective factors (such as emotion, motivation, anxiety, and attitudes toward learning) jointly shape academic performance, particularly when gender differences are considered. Earlier literature, such as Gallagher et al. (2000), also reported that male and female students tend to exhibit different patterns in mathematical problem-solving, with males generally being more flexible in selecting solution strategies. These findings highlight the need for gender-responsive instructional approaches, especially to strengthen female students' problem-solving strategies.

The positive but weak correlation ($\rho = 0.2172$) between mathematical disposition and problem-solving skills implies that an increase in mathematical disposition does not necessarily lead to a corresponding improvement in problem-solving skills. This finding supports the argument that mathematical disposition is not the sole determinant of students' ability to solve mathematical problems. This is consistent with the results of previous studies (Fitri & Hasyim, 2018; Lestari & Andinny, 2023; Pratiwi, Mulyono, & Supriyono, 2018), which revealed that while students with higher mathematical disposition often demonstrate better problem-solving performance, the correlation between these two constructs is not statistically strong. These results reinforce the importance of adopting a more comprehensive instructional approachthat not only develops mathematical disposition but also cultivates students' cognitive processes, problem-solving strategies, and metacognitive skills.

The novelty of this study lies in two key aspects. First, it reveals a gender-based disparity in problem-solving performance that is not accompanied by a corresponding difference in mathematical disposition. Second, it suggests that other factors beyond mathematical disposition (such as thinking strategies, metacognitive ability, and instructional design) may play a greater role in shaping students' problem-solving skills. Conceptually, the findings demonstrate that problem-solving skills do not always correlate directly with mathematical disposition but may instead be influenced by other cognitive and affective variables that function independently or interactively. Theoretically, these findings challenge the traditional assumption that mathematical disposition and problem-solving skills develop in parallel, offering instead the perspective that they may progress differently depending on learning context and pedagogical strategy. This opens new opportunities for future studies to identify alternative variables that exert stronger effects, including gender-related factors, and to broaden the understanding of how affective and cognitive dimensions interact in mathematics learning.

The practical implications of this study underscore the importance of developing instructional models that not only foster mathematical disposition but also enhance students' metacognitive strategies. One promising approach is gender-responsive teaching, which consciously avoids gender stereotypes, provides equal participation opportunities, and uses problem contexts that are relevant to both genders. Teachers can also implement problem-based learning with balanced contextual issues, metacognitive strategy training coupled with emotional support to reduce math anxiety, and collaborative learning with rotating roles to prevent dominance by a particular gender. Creating a safe space for mathematical discussion is also crucial, ensuring that all students, especially females, can express ideas and test strategies without social pressure. Such approaches are expected to promote more equitable development of mathematical problem-solving skills among students. Furthermore, future research should explore mediating and moderating variables such as self-efficacy, learning strategies, and cognitive styles in the relationship between mathematical disposition and problem-solving skills. Expanding the sample context and employing mixed-methods designs could also yield richer insights into the complex interaction between affective and cognitive factors in mathematics learning.

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Conclusion

This study concludes that mathematical disposition was relatively balanced between male and female students, indicating that both groups shared similar attitudes, confidence, and persistence toward mathematics. However, male students demonstrated stronger problem-solving skills, suggesting that gender differences may be more pronounced in the cognitive dimension than in the affective one. The findings reveal a positive but weak association between mathematical disposition and problem-solving skills, meaning that while students with a more positive disposition tend to perform better in solving problems, this relationship is not strong enough to imply direct causation. These results align with the study's purpose of examining how affective and cognitive factors interact in mathematics learning through a gender-based perspective. The findings suggest that strengthening mathematical disposition alone may not automatically improve problem-solving skills; rather, both aspects need to be cultivated in tandem through instructional practices that connect motivation, reflection, and strategic reasoning.

Accordingly, learning designs should integrate affective and cognitive development, encouraging students to build confidence and perseverance while explicitly learning effective problem-solving strategies. Approaches such as gender-responsive metacognitive scaffolding and context-based collaborative learning can help reduce gender disparities, foster engagement, and support more equitable achievement. Although the findings provide meaningful insights, the study was limited by its small sample size, single-school context, and restricted instruments. Future research should involve larger and more diverse samples, adopt mixed-methods or longitudinal designs, and incorporate variables such as self-efficacy, cognitive strategy use, and math anxiety. Such studies could offer a deeper understanding of how affective and cognitive factors jointly influence students' mathematical learning processes.

Conflict of Interest

The authors declare that there is no conflict of interest.

Authors' Contributions

H.H.M. contributed to topic selection and framework design, data collection and analysis, as well as manuscript writing and revision. S.V.D. provided academic supervision, content evaluation, and final manuscript refinement. D.S. assisted with technical guidance, validation, and review, as well as the completion of the thesis. The overall contribution percentages for conceptualization, preparation, and review are as follows: H.H.M.: 45%, S.V.D.: 30%, and D.S.: 25%.

Data Availability Statement

The authors declare that the data supporting the findings of this study will be made available by the corresponding author, [H.H.M.], upon reasonable request.

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Author Biographies

	**Hevi Haplatul Mubarokah** is an undergraduate student in the Department of Mathematics Education, Faculty of Teacher Training and Education, Universitas Siliwangi, Tasikmalaya, Indonesia. Her research interests include mathematical problem-solving, students' affective attitudes, and innovative mathematics learning. Email: hevihaplatulm@gmail.com
	**Sinta Verawati Dewi**, is a lecturer in the Department of Mathematics Education, Faculty of Teacher Training and Education, Universitas Siliwangi. Her teaching and research areas include child development, educational management, mathematics teaching methodology, combinatorial mathematics, differential equations, mathematical modeling, real analysis, and information technology literacy. Email: sintaverawati@unsil.ac.id
	**Depi Setialesmana**, is a lecturer in the Department of Mathematics Education, Faculty of Teacher Training and Education, Universitas Siliwangi. His teaching focuses on microteaching, mathematical computer applications, development and production of instructional media, mathematical modeling, ICT and mathematics learning media, and inferential statistics. Email: depisetialesmana@unsil.ac.id