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PREDICTIVE RELATIONSHIP BETWEEN MATHEMATICAL REFLECTIVE THINKING AND MATHEMATICAL LITERACY AMONG PROSPECTIVE TEACHERS

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Abstrak

Penelitian ini mengkaji hubungan prediktif antara berpikir reflektif matematis dan literasi matematis di kalangan calon guru matematika, suatu bidang yang masih relatif kurang dieksplorasi dalam penelitian pendidikan guru. Berpikir reflektif sangat terkait dengan proses kognitif dan metakognitif tingkat tinggi yang dapat mendukung individu dalam merumuskan, menafsirkan, dan mengevaluasi ide-ide matematika dalam situasi kontekstual. Oleh karena itu, penelitian ini bertujuan untuk menyelidiki sejauh mana berpikir reflektif matematis memprediksi literasi matematis di kalangan calon guru matematika. Desain korelasional kuantitatif digunakan yang melibatkan 30 calon guru matematika dari sebuah universitas swasta di Kabupaten Garut, Indonesia, yang dipilih melalui purposive sampling. Data dikumpulkan menggunakan tes berpikir reflektif matematis dan literasi matematis yang dikembangkan berdasarkan indikator berpikir reflektif Dewey dan kerangka kerja literasi matematis PISA. Instrumen tersebut menjalani validasi ahli yang melibatkan lima ahli pendidikan matematika dan pengujian validitas dan reliabilitas statistik. Analisis regresi linier sederhana mengungkapkan hubungan prediktif yang signifikan secara statistik antara berpikir reflektif dan literasi matematis ($t = 3{,}507$, $p = 0{,}002$). Berpikir reflektif menjelaskan 30,5% varians dalam literasi matematika ($R^2 = 0{,}305$), menunjukkan bahwa meskipun berpikir reflektif memberikan kontribusi yang substansial, faktor-faktor lain juga dapat memengaruhi perkembangan literasi matematis. Temuan ini menunjukkan bahwa penguatan keterampilan berpikir reflektif dapat mendukung peningkatan literasi matematis di kalangan calon guru matematika dan memberikan implikasi bagi desain pembelajaran dan praktik pendidikan guru.

Kata kunci: Kemampuan berpikir reflektif matematis; kemampuan literasi matematis; mahasiswa calon guru matematika; prediksi.

Abstract

This study examines the predictive relationship between mathematical reflective thinking and mathematical literacy among prospective mathematics teachers, an area that remains relatively underexplored in teacher education research. Reflective thinking is closely associated with higher-order cognitive and metacognitive processes that may support individuals in formulating, interpreting, and evaluating mathematical ideas in contextual situations. Therefore, this study aims to investigate the extent to which mathematical reflective thinking predicts mathematical literacy among prospective mathematics teachers. A quantitative correlational design was employed involving 30 prospective mathematics teachers from a private university in Garut Regency, Indonesia, selected through purposive sampling. Data were collected using mathematical reflective thinking and mathematical literacy tests developed based on Dewey's reflective thinking indicators and PISA mathematical literacy frameworks. The instruments underwent expert validation involving five mathematics education experts and statistical validity and reliability testing. Simple linear regression analysis revealed a statistically significant predictive relationship between reflective thinking and mathematical literacy ($t = 3.507$, $p = 0.002$). Reflective thinking explained 30.5% of the variance in mathematical literacy ($R^2 = 0.305$), indicating that although reflective thinking contributes substantially, other factors may also influence mathematical literacy development. These findings suggest that strengthening reflective thinking skills may support the enhancement of mathematical literacy among prospective mathematics teachers and provide implications for instructional design and teacher education practices.

Keywords: *mathematical literacy; mathematical reflective thinking; predicting; prospective mathematics teachers.*

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INTRODUCTION

Reflective thinking has been widely discussed as an essential higher-order cognitive process in teacher education. Reflective thinking, as proposed by Dewey (1933), entails the thoughtful evaluation of beliefs and existing knowledge through sustained inquiry and evidence-based reasoning. According to Adadan & Oner (2018), reflective thinking involves an active and purposeful engagement in developing and refining one's understanding of concepts and experiences, while Mathew et al. (2017) emphasized its role in learning from experience and improving professional practice. Although these perspectives differ in emphasis, they collectively suggest that reflective thinking involves critical examination, evaluation, and reconstruction of one's thinking process.

Reflective thinking in learning process can facilitate in selecting problem-solving strategies and solving the problems effectively (Muzaimah & Noer, 2019; Öztürk, 2020). Furthermore, individuals with reflective thinking ability excel at organizing three metacognitive processing skills, including monitoring, evaluating, and planning (Adadan & Oner, 2018). From those definitions, it can be said that reflective thinking ability will increase teaching skills for prospective mathematics teachers, as teaching needs competence in planning, observing, and evaluating learning processes.

Reflective thinking is also closely associated with metacognitive processes, including planning, monitoring, and evaluating problem-solving strategies. Individuals with strong reflective thinking skills tend to regulate their thinking processes more effectively and critically examine the appropriateness of their strategies (Adadan & Oner, 2018). Such processes are relevant to mathematical literacy because literacy requires not only procedural knowledge but also the ability to interpret contextual situations, select suitable strategies, and evaluate solutions critically. Therefore, reflective thinking may serve as an important cognitive mechanism that supports mathematical literacy development.

This study adopts Dewey (1933) indicators of reflective thinking: awareness of the problem, analysis and evaluation, connection and interpretation, logical conclusion, and reflection on the thinking process. These indicators suggest a potential relationship with mathematical literacy skills.

Currently, mathematical literacy serves as a fundamental principle in mathematics curriculum development in Indonesia. This condition highlights the urgency of preparing prospective mathematics teachers with strong literacy skills. Mathematical literacy can be understood as the competence to engage with mathematical concepts by identifying relevant information, applying appropriate mathematical procedures, and interpreting the resulting conclusions in different contexts (Fanggidae et al., 2024; Sumarni et al., 2022; Sumarni et al., 2023; Yusmarina et al., 2023).

Findings from PISA 2022 (OECD, 2023a, 2023b) imply that Indonesian students' literacy skills require significant improvement. This challenge underscores the importance of equipping prospective mathematics teachers with strong literacy skills, as such competence will serve as a foundation for fostering literacy among their future students (Lestari et al., 2019; Lestari et al., 2023; Murtafiah et al, 2021; Nuraeni et al., 2025). In this study, the indicators of mathematical literacy adopted are those from PISA

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Levels 4 to 6, as these are deemed appropriate for the subject group of prospective mathematics teachers and are potentially connected to reflective thinking indicators.

The correlation between reflective thinking and mathematical literacy lies in the promotion of deep understanding. Students with strong reflective thinking skill do not accept information, but also involve reflecting, evaluating, and criticizing the way they identify and solve the problems. In terms of literacy context, this is very crucial as students require to grasp the mathematical meaning in various real-world contexts, rather than solving the mathematical questions procedurally (OECD, 2018). Reflective thinking also facilitates revision and strategy improvement. Students with better reflective thinking skill are able to identify and correct errors; thus, they transform the learning to be more meaningful. In literacy context, students do not merely answer the correct answer, but also select strategies efficiently, accurately, and contextually appropriate (OECD, 2018).

Despite its importance, several studies have reported that prospective mathematics teachers continue to experience difficulties in developing mathematical literacy skills (Dirgantoro, et al., 2025; Melissa, 2025; Nuraeni, et al., 2025; Selek, 2024). Difficulties commonly include connecting mathematical concepts to real-life situations, interpreting contextual problems, and constructing logical mathematical arguments. Such conditions are concerning because insufficient literacy competencies among prospective teachers may affect their future capacity to develop students' literacy skills.

Based on the observed relationship between reflective thinking and mathematical literacy, it is suspected that one contributing factor to weak mathematical literacy is the limited reflective thinking ability of students. However, the relationship between mathematical reflective thinking and mathematical literacy remains under-explored, especially among prospective mathematics teachers. Hence, this study is significant as a foundation for advancing mathematical literacy through the strengthening of reflective thinking skills.

Previous studies have extensively examined reflective thinking and mathematical literacy as separate constructs. Some studies investigated reflective thinking in relation to teaching performance and self-efficacy, while others focused on mathematical literacy development among prospective teachers. However, empirical studies examining the predictive relationship between mathematical reflective thinking and mathematical literacy among prospective mathematics teachers remain limited. Moreover, previous studies have rarely explored this relationship quantitatively within teacher education contexts. Therefore, the novelty of this study lies in examining mathematical reflective thinking as a predictor of mathematical literacy among prospective mathematics teachers throught a quantitative approach.

Based on these considerations, this study aims to investigate the predictive relationship between mathematical reflective thinking and mathematical literacy among prospective mathematics teachers. The findings are expected to contribute theoretically to understanding the role of reflective thinking in mathematical literacy development and practically to provide implications for instructional design and teacher education programs.

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METHODS

This study aimed to examine the predictive relationship between mathematical reflective thinking and mathematical literacy among prospective mathematics teachers. In response to the research objective, the study applied a quantitative correlational framework and analyzed the data through simple linear regression to evaluate the predictive influence of mathematical reflective thinking on mathematical literacy ability.

The study was conducted at a private university in Garut Regency, Indonesia, with a sample of 30 Mathematics Education students. A purposive sampling strategy was employed to recruit participants who met the following criteria: 1) being enrolled in the Mathematics Education program; 2) students actively participating in mathematics-related coursework; 3) students who had completed foundational mathematics courses relevant to mathematical literacy and reflective thinking processes. Purposive sampling was selected because the study required participants with characteristics aligned with the research objectives.

Although the sample size may be considered relatively limited for broad generalization, this study was intended to provide preliminary empirical evidence within a specific teacher education context. Therefore, the conclusions drawn from this study should be interpreted within their contextual boundaries and viewed as preliminary evidence of the predictive relationship between reflective thinking and mathematical literacy among prospective mathematics teachers. Consequently, the findings should be interpreted cautiously and should not be generalized to all prospective mathematics teachers in Indonesia without further empirical evidence obtained from larger and more diverse samples.

Data collection took place in June 2025 using two instruments specifically developed for this study: a mathematical reflective thinking test and a mathematical literacy test. The reflective thinking instrument was developed based on Dewey's framework, comprising five indicators measured through five essay items. Each item was scored on a scale ranging from 0 to 4, resulting in a maximum possible score of 20 points for the entire instrument. Item 1 assessed students' ability to clearly understand a mathematical problem, Item 2 assessed their ability to analyze relevant information and evaluate solution approaches, Item 3 examined their ability to establish connections between mathematical concepts and real-life contexts, Item 4 evaluated their ability to draw logical conclusions, and Item 5 measured their ability to critically review the problem-solving process by identifying and correcting errors. An example of a reflective thinking test item corresponding to Indicator 3 is presented below:

Sebuah peternakan memiliki maksimum 1000 kg pakan/hari untuk memberi makan dua jenis ternak yaitu kambing dan sapi. Setiap ekor kambing membutuhkan 4 kg pakan/hari, sedangkan setiap ekor sapi membutuhkan 35 kg pakan/hari.

a. *Jika jumlah kambing yang dipelihara adalah x dan jumlah sapi adalah y, tuliskan pertidaksamaan yang menggambarkan batasan jumlah pakan.*
b. *Jika peternakan ingin memelihara tepat 24 ekor kambing, tentukan kemungkinan jumlah sapi yang dapat dipelihara.*
c. *Jelaskan bagaimana konsep pertidaksamaan linear dapat membantu dalam pengambilan keputusan di bidang peternakan.*

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The mathematical literacy instrument was developed based on the PISA mathematical literacy framework and consisted of three essay items representing three mathematical literacy indicators. Each item was scored on a scale ranging from 0 to 4, resulting in a maximum possible score of 12 points for the entire instrument. Item 1 assessed student's ability to construct and communicate mathematical explanations and arguments (Level 4), Item 2 evaluated their ability to apply systematic and planned problem-solving strategies (Level 5), and Item 3 measured their ability to solve abstract mathematical problems by demonstrating creativity and flexible thinking (Level 6). An example of a mathematical literacy test item corresponding to Item 3 is presented below:

Dua bilangan real positif x dan y memenuhi sistem persamaan berikut:

$$\begin{cases} x + \frac{1}{y} = 5 \\ y + \frac{1}{x} = 3 \end{cases}$$

Dari sistem persamaan tersebut, bagaimana Anda menentukan nilai x dan y yang memenuhi?

Kemudian, jika sistem persamaan diubah menjadi:

$$\begin{cases} x + \frac{k}{y} = 5 \\ y + \frac{k}{x} = 3 \end{cases}$$

Tentukan nilai x dan y, jika:

i) $k = 0$
ii) $k > 1$
iii) $k < 1$

Berdasarkan temuan tersebut, apakah nilai x dan y bergantung pada parameter k? Jelaskan pendapat Anda!

To evaluate students' mathematical reflective thinking skills, a test comprising five essay-based questions was administered, while the mathematical literacy test consisted of 3 items designed according to PISA Level 4 – 6. The content validity was evaluated by five mathematics education experts, after which validity testing was conducted using the Pearson Product Moment correlation test, and instrument reliability was examined using Cronbach's Alpha. All calculations were performed using IBM SPSS version 24 software. Findings from the psychometric evaluation demonstrated that all items across the mathematical reflective thinking and mathematical literacy instruments satisfied validity requirements. Moreover, the mathematical reflective thinking test showed strong internal consistency, with a reliability coefficient of 0.66, placing it within the high category, while the reliability of the mathematical literacy test was in the medium classification with a coefficient of 0.48.

Prior to estimating the regression model, diagnostic evaluations were performed to assess key statistical assumptions, namely normality, linearity, heteroscedasticity, and autocorrelation. The purpose of these evaluations was to establish the suitability of the data for regression-based inference. Within the analytical framework, mathematical reflective thinking functioned as the explanatory variable, while mathematical literacy represented the response variable. Statistical processing was conducted using IBM SPSS Statistics 24 and involved descriptive analyses, assumption diagnostics, and simple linear regression techniques.

Participation in this study was voluntary, and participants' identities and personal information were treated confidentially and intended only to support the objectives of the present study.

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RESULTS AND DISCUSSION

To examine the predictive relationship between mathematical reflective thinking and mathematical literacy among prospective mathematics teachers, a simple linear regression analysis was conducted. Prior to performing the regression analysis, several classical assumption tests were carried out to ensure that the data met the statistical assumptions required for an appropriate regression model. These tests included normality, linearity, heteroscedasticity, and autocorrelation analyses.

The normality test for both reflective thinking test and mathematical literacy test showed that the data were normally distributed. The Kolmogorov–Smirnov test results are presented in Table 1.

Table 1. One-Sample Kolmogorov–Smirnov Test of Normality.

	N	**30**
Normal Parameters[a,b]	Mean	0.000
	Std. Deviation	1.658
Most Extreme Differences	Absolute	0.106
	Positive	0.106
	Negative	-0.092
Test Statistic		0.106
Asymp. Sig. (2-tailed)		0.200[c,d]

a = Test distribution is Normal
b = Calculated from data
c = Lilliefors Significance Correction
d = This is lower bound of the true significance

Based on Table 1, the Kolmogorov-Smirnov test produced an Asymp. Sig. Value of 0.200, which exceeded the significance threshold of 0.05. This result indicates that the data were normally distributed. The fulfillment of the normality assumption suggests that the data distribution adequately supports the use of parametric analysis and strengthens the appropriateness of applying a regression model in this study. Subsequently, a linearity test was performed to both data groups to see whether there was a significant linear relationship between reflective thinking and mathematical literacy. This test is also a classical assumption test or a prerequisite test before performing a simple linear regression test. SPSS 24 was used to process the test. The results of the ANOVA linearity test are presented in Table 2.

Table 2. Linearity Test Results (Anova).

			Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Literacy * Reflective	Between Groups	(Combined)	50.767	12	4.231	1.123	0.403
		Linearity	35.043	1	35.043	9.303	0.007
		Deviation from Linearity	15.724	11	1.429	0.380	0.947
	Within Groups		64.033	17	3.767		
	Total		114.800	29			

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As shown in Table 2, the significance value for Deviation from Linearity was 0.947 (> 0.05), indicating that the relationship between mathematical reflective thinking and mathematical literacy was linear. This result implies that increases in reflective thinking scores tend to be accompanied by consistent increases in mathematical literacy scores. Consequently, the assumption required for applying simple linear regression was satisfied. The next step was testing for heteroscedasticity.

This heteroscedasticity test is the next classical assumption test that must be performed. This test is performed to determine whether there are differences in variance and residuals between one observation and another in a linear regression model. The heteroscedasticity test analysis uses SPSS 24, with the following scatterplot results presented in Figure 1.

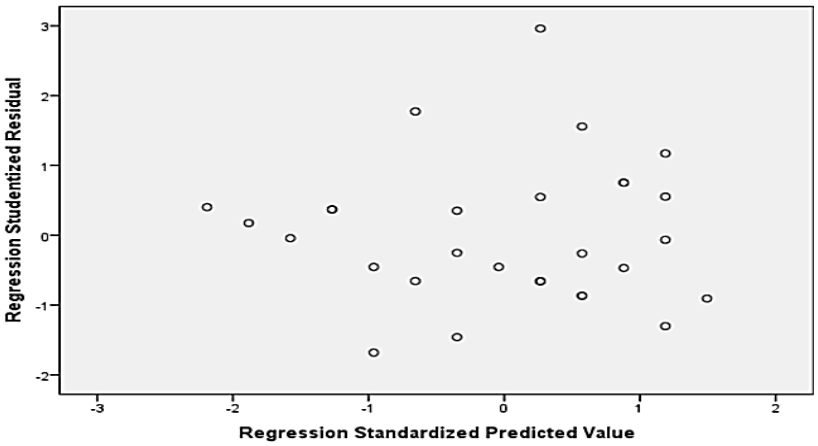

Figure 1. Scatterplot of Heteroscedasticity Test with Literacy as the Dependent Variable

Figure 1 illustrates the heteroscedasticity test results. The scatterplot points appear randomly distributed without forming a systematic pattern. This finding indicates that the residual variances remained relatively constant across observations, suggesting homoscedasticity. Therefore, the regression model did not violate variance assumptions and can be considered statistically appropriate.

This autocorrelation test is conducted to determine whether there is a correlation between variables sorted by time, thus indicating that one data item is influenced by previous data. This autocorrelation test analysis was performed using SPSS 24, with the following results presented in Table 3.

Tabel 3. Runs Test of Autocorrelation.

Test Value[a]	**-0.261**
Cases < Test Value	15
Cases >= Test Value	15
Total Cases	30
Number of Runs	12
Z	-1.301
Asymp. Sig. (2-tailed)	0.193

a = Median

Based on Table 3, the Asymp. Sig. value obtained from the Runs Test was 0.193 (> 0.05), indicating the absence of autocorrelation among residuals. This result suggests that the observations were independent and that the regression model was free from serial correlation issues.

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Based on these test results, it is concluded that the research data meets the classical assumptions, allowing for a simple linear regression test. The simple linear regression analysis was performed using SPSS 24, with the following results presented in Table 4.

Table 4. Results of Simple Linear Regression.

Model		Unstandardized Coefficient		Standardized Coefficient Beta	t	Sig.
		B	Std. Error			
1	(Constant)	2.041	1.115		1.831	0.078
	Reflective	0.338	0.096	0.552	3.507	0.002

Dependent variable: Literacy

Based on Table 4, the regression equation obtained was: $Y = 2.041 + 0.338X$. The positive regression coefficient indicates that mathematical reflective thinking and mathematical literacy exhibit a positive predictive relationship. The coefficient value suggests that higher reflective thinking scores tend to be associated with higher mathematical literacy scores among prospective mathematics teachers.

In educational context, this finding may indicate that students who frequently engage in reflective processes, such as analyzing solutions, evaluating reasoning, and reconsidering problem-solving strategies, are more likely to demonstrate stronger literacy skills when dealing with contextual mathematical situations.

The significance value (p = 0.002) indicates that the predictive relationship observed in this study was statistically significant. Furthermore, the standardized coefficient (β = 0.552) suggests a moderate relationship between reflective thinking and mathematical literacy. This finding implies that reflective thinking contributes meaningfully to variations in literacy performance among prospective mathematics teachers.

To find out how much influence mathematical reflective thinking ability has on mathematical literacy ability, the SPSS output presents simple linear regression test presented in Table 5.

Table 5. Coefficient of Determination.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.552[a]	0.305	0.280	1.688

a. Predictors: (Constant), Reflective.

Table 5 shows that reflective thinking explained 30.5% of the variance in mathematical literacy (R^2 = 0.305). This finding indicates that reflective thinking contributes substantially to mathematical literacy, however, a larger proportion of variance (69.5%) remains explained by other factors not examined in this study.

Several factors may potentially contribute to mathematical literacy development, including metacognitive ability, self-efficacy, prior mathematical experience, learning strategies, and

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instructional experiences. Consequently, mathematical literacy should be viewed as a multidimensional construct influenced by various cognitive and educational factors.

The regression analysis revealed a statistically significant predictive relationship between mathematical reflective thinking and mathematical literacy, with a coefficient of determination of 30.5%. This finding suggests that reflective thinking explains nearly one-third of the variance in mathematical literacy among prospective mathematics teachers. Although this contribution is substantial, a larger proportion of variance remains unexplained, indicating that mathematical literacy development may also be influenced by additional cognitive and non-cognitive factors.

The implication of this finding is that efforts to enhance reflective thinking skills among prospective teachers will likely contribute to their mathematical literacy. This is particularly significant, as prospective mathematics teachers are expected not only to master subject content but also to foster literacy among their future students (Nuraeni et al., 2025). Furthermore, reflective thinking has been shown to influence teaching performance (Ariany, 2024), enhance teachers' instructional awareness (Ariany et al., 2023), and supports the process of self-evaluation and helps improve the quality of problem solving (Atmaja & Kholid, 2023).

In the context of prospective mathematics teachers, this finding carries practical significance because reflective thinking developed during university learning experiences may influence future teaching practices. Prospective teachers who frequently engage in reflective activities such as evaluating reasoning processes, revising problem-solving strategies, and critically examining contextual situations may later transfer these practices into classroom instruction and support students' mathematical literacy development.

According to Dewey (1933) reflective thinking is an active and continuous process in processing experiences logically and meaningfully to acquire deeper understanding and a more directed thought. The findings of this study appear to reinforce these theoretical perspectives by providing empirical evidence that reflective thinking is associated with stronger mathematical literacy performance. This finding is also consistent with the study conducted by Yang et al. (2026), which highlighted that reflective thinking is considered an essential 21st-century skill and contributes significantly to mathematical literacy. Rather than functioning merely as a supporting concept, reflective thinking in this study may explain how prospective mathematics teachers critically process information, evaluate solutions, and construct meaningful mathematical understanding in contextual situations.

In relation to mathematical literacy, reflective thinking may function as an important cognitive mechanism supporting students in evaluating, monitoring, and improving problem-solving strategies. Students with strong reflective thinking skills are able to critically evaluate and revise their problem-solving strategies to create more meaningful learning experiences. Problem-solving ability is recognized as an essential skill for individuals, while reflective thinking is viewed as an important component that facilitates and strengthens the problem-solving process (Toraman et al., 2020). This is in line

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with the approach of mathematical literacy, which require the students to not only correct answers, but also use efficient, relevant strategies that are based on logic (OECD, 2018).

The present findings support earlier research highlighting the persistently low level of mathematical literacy demonstrated by prospective mathematics teachers (Dirgantoro, et al., 2025; Melissa, 2025; Nuraeni, et al., 2025). Specifically, the challenges in connecting mathematical concepts to real-life contexts and building logical mathematical arguments continue to occur. The findings further suggest that limited reflective thinking skills may be among the factors contributing to the relatively low mathematical literacy performance observed among prospective mathematics teachers. Therefore, strengthening reflective thinking may contribute to the development of mathematical literacy among prospective mathematics teachers.

Furthermore, the remaining unexplained variance (69.5%) indicates that mathematical literacy should not be viewed as a single-factor construct. Other factors, such as metacognitive ability, self-efficacy, prior learning experiences, and instructional approaches, may also contribute to literacy development. This finding opens opportunities for future studies to investigate more comprehensive models involving multiple variables. In particular, the use of multiple linear regression analysis may provide a more complete understanding of the relative contribution of various factors to the development of mathematical literacy among prospective mathematics teachers.

This study has several limitations that should be considered. First, the sample size was relatively limited and involved participants from a specific educational context, which may restrict broader generalization. Second, the study examined only one predictor variable, whereas mathematical literacy may be influenced by multiple cognitive and contextual factors. Therefore, future studies involving larger and more diverse samples and additional variables are recommended.

CONCLUSIONS

The analysis provided evidence of a significant predictive link between mathematical reflective thinking and mathematical literacy in the context of prospective mathematics teachers. Reflective thinking explained 30.5% of the variance in mathematical literacy, suggesting that prospective mathematics teachers who demonstrated stronger reflective thinking skills were more likely to exhibit better mathematical literacy performance. Although reflective thinking contributed substantially, mathematical literacy remains a multidimensional competence influenced by additional factors beyond the scope of this study.

The findings provide theoretical support for the view that reflective thinking represents an important cognitive process associated with the development of mathematical literacy. The results also provide evidence that reflective thinking facilitates the continuous examination and adjustment of problem-solving strategies, contributing to a more comprehensive understanding of matehmatical concepts.

The practical implications of this study emphasize the importance of incorporating reflective learning experiences into mathematics teacher education programs as a means of strengthening critical professional competencies. Such activities may include literacy-based mathematical tasks,

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reflective discussions, meta-cognitive questioning, and problem-based learning activities that encourage prospective teachers to analyze and evaluate their thinking processes. Strengthening these learning practices may support prospective teachers in developing both reflective thinking and mathematical literacy competencies.

Considering the relatively limited sample size, the use of purposive sampling, and the cross-sectional nature of the research design, the findings should be interpreted with appropriate caution. The cross-sectional design captures participants' characteristics at a single point in time and therefore does not allow conclusions regarding changes or developments over time. In addition, the use of purposive sampling may limit the representativeness of the sample and the broader generalizability of the findings. Future studies are recommended to involve larger and more diverse samples, employ probability-based sampling techniques when feasible, and examine additional variables that may influence mathematical literacy, such as metacognitive ability, self-efficacy, learning experiences, and instructional factors. Furthermore, longitudinal studies and multiple linear regression analyses are recommended to provide a more comprehensive understanding of the factors contributing to mathematical literacy among prospective mathematics teachers.

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