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Mathematical Literacy Ability and Critical Thinking Significantly Influence A Person's Effectiveness In Solving Mathematical Problems

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Abstract

The objective of this research endeavor is to ascertain the extent to which an individual's capacity for critical thinking and mathematical literacy influences their efficacy in addressing mathematical problems. The study employs a document analysis strategy, systematically reviewing and synthesizing current scholarly literature to find patterns and indicators that connect mathematical literacy and critical thinking to effective problem-solving. The study looks at how common these indicators are across different academic journals and publications, to figure out if critical thinking and mathematical literacy are generally accepted as important elements in effective mathematical problem-solving. According to the data, the vast majority of the literature that was assessed specifically includes mathematical literacy and critical thinking as important factors affecting the results of problem-solving. In particular, the data demonstrates that more journals and publications favor including these indicators than do not. This indicates a substantial consensus among scholars that critical thinking, characterized by analytical reasoning, evaluation, and synthesis, alongside mathematical literacy, which is delineated as the capability to understand, apply, and interpret mathematical concepts in diverse contexts, are both crucial for effective resolution of mathematical problems. This analytical discourse underscores the imperative to integrate mathematical literacy alongside critical thinking competencies within educational paradigms to enhance students' proficiency in problem-solving. By delivering empirically grounded evaluations that possess the capacity to shape curriculum innovation, instructional methodologies, and assessment strategies tailored to promote these critical skills, the research contributes significantly to the existing dialogue concerning mathematics pedagogy.

Keywords: Mathematical literacy, ability, critical thinking, solving, Mathematical problems

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INTRODUCTION

The capability of an individual to tackle mathematical problems through proficient analysis and judicious decision-making is contingent upon their capacity for critical thinking and numerical proficiency, which encompasses mathematical literacy that entails the understanding, application, and interpretation of mathematical concepts across diverse contexts. It not only improves pupils' problem-solving skills but also considerably improves their critical thinking abilities (Setiowati et al., 2024). The research results show that students' skills in mathematical literacy greatly improve their ability to solve problems. This assertion is substantiated by a coefficient of determination quantifying 0.906. This means that 90.6% of the differences in problem-solving abilities are due to their mathematical literacy skills (Ma'ruf et al., 2024).

Recent empirical investigations have delineated the substantial impact of mathematical literacy and critical thinking on the efficacy of problem-solving, and illustrated the effectiveness of problem-based learning in augmenting these competencies across varying educational strata, yet have revealed significant deficiencies in comprehending the interplay between these elements across heterogeneous demographics and pedagogical methodologies, thereby highlighting the imperative for extensive research to clarify their synergistic effects. A recent investigation has indicated that Problem-Based Learning (PBL) substantially augments critical thinking abilities (SMD=1.254) across various educational strata, accentuates the imperative for customized implementations to enhance the interaction between mathematical literacy and critical thinking, and uncovered significant variability in results, thus emphasizing the necessity for additional inquiry to clarify the synergistic influences of these competencies within heterogeneous demographic and pedagogical frameworks (Hafizah et al.,

2024). Recent investigations have indicated that Problem-Based Learning (PBL) significantly improves critical thinking abilities that are vital for effective problem-solving, particularly among academically proficient students, while evaluations suggest that its efficacy fluctuates across various educational settings, demonstrating that while PBL provides advantages over conventional instructional methods, its predominance is not invariably assured, thereby underscoring the necessity for additional inquiry and the incorporation of supplementary strategies such as technological innovations and collaborative resources to enhance the advancement of both mathematical literacy and critical thinking across a spectrum of demographics and pedagogical approaches (Verawati et al., 2024).

Recent empirical investigations have elucidated that proficiency in mathematical literacy and critical reasoning substantially augment individuals' efficacy in resolving mathematical challenges by equipping them to scrutinize, assess, and implement mathematical principles with precision across diverse situations. This research elucidates that competencies in mathematical reasoning and critical analysis substantially facilitate the advancement of mathematical literacy, which collectively augments individuals' capacities to evaluate, implement, and proficiently resolve mathematical challenges across diverse real-world contexts, thereby underscoring the significance of acquiring both competencies in mathematics education to enhance problem-solving efficacy (Haeruman et al., 2024). This research demonstrates that mathematical literacy extends beyond mere numerical competencies to include logical reasoning and critical analytical skills that are intricately linked to higher-order thinking capabilities; consequently, the concurrent mastery of these competencies significantly augments students' abilities to comprehend, dissect, assess, and implement mathematical concepts adeptly across diverse real-world scenarios, thereby ultimately enhancing their proficiency in resolving mathematical challenges (Setiowati et al., 2024).

Fundamental educational theories suggest that mathematical literacy and critical thinking skills directly influence a person's capacity to approach mathematical problems. By allowing individuals to systematically analyze, evaluate, and reason effectively when solving mathematical challenges, mathematical literacy improves critical thinking abilities, which supports the core instructional concept that these skills have a direct impact on problem-solving efficacy (Nurdin et al., 2022). Students' proficiency in solving mathematical problems is significantly impacted by their analytical and critical thinking skills, which enable them to systematically analyze problems and apply logical reasoning, by basic educational theories that emphasize the direct impact of these cognitive abilities on effective mathematical problem-solving (Putu et al., 2025).

The objective of this scholarly investigation is to ascertain the extent to which mathematical literacy and critical thinking competencies affect an individual's capacity to resolve mathematical challenges. Individuals exhibiting heightened mathematical competence tend to demonstrate enhanced critical reasoning abilities in the context of problem-solving, which encompasses the capacity to discern primary arguments, recognize pertinent theorems, and assess potential solutions, thereby contributing to the objective of the research focused on investigating the interplay between mathematical literacy and critical thinking in relation to the efficacy of problem-solving (Nurdin et al., 2022). The main goal of this scholarly investigation is to investigate the important part that mathematical literacy and critical thinking play within the field of problem-solving; empirical data supporting the enhancement of a person's capacity to solve mathematical issues through critical reasoning reinforces this aim. This demonstrates that enhancing one's critical thinking skills improves one's capacity to address mathematical challenges (Putu et al., 2025).

RESEARCH METHODS

Employing a document analysis methodology, this qualitative research examines the significant influence of critical thinking and mathematical literacy competencies on an individual's ability to resolve mathematical challenges. The use of document analysis in this study to investigate how mathematical literacy ability and critical thinking have a major impact on a person's capacity to solve mathematical problems is supported by the qualitative content analysis method, which is a helpful way to methodically analyze documents to obtain relevant insights (Pinsker, 2020). In qualitative research, the value of thorough research descriptions and systematic document analysis is highlighted, supporting the methodological approach of this study in investigating how mathematical literacy and critical thinking have a major impact on a person's ability to solve mathematical problems (Mironczuk, Müller, and Pedrycz, 2024).

Using document analysis, this study examines chosen academic publications and research papers that address the impact of mathematical literacy and critical thinking on a person's capacity to solve mathematical issues. The value of using a systematic literature review and document analysis to combine results from a variety of academic articles and research reports, which is a methodology approach that is consistent with this study's selection and analysis of literature examining the impact of mathematical literacy and critical thinking on problem-solving efficacy (Ahmed and Hassan, 2025). The systematic selection and analysis of academic articles and research reports are essential for evaluating trends and influences in certain research fields. This supports the methodology of this study in using document analysis to examine literature on the relationship between mathematical literacy, critical thinking, and problem-solving effectiveness (Lin et al., 2024).

The research instrument employed in this study is a document analysis checklist created to systematically assess the information about mathematical literacy ability and critical thinking and their impact on a person's capacity to solve mathematical problems. Understanding students' thinking literacy processes in mathematical problem-solving requires a careful examination of relevant academic literature, which supports the use of document analysis to explore how mathematical literacy and critical thinking abilities influence problem-solving effectiveness (Mukhlis et al., 2024). Analyzing academic literature on students' mathematical abilities and critical thinking profiles provides valuable insights into how these competencies affect effectiveness in solving ill-structured mathematical problems and support the use of document analysis in this study (Jaelani, Hasbi, and Baharullah, 2023).

The methodical aggregation and examination of pertinent literature that addresses these competencies are utilized to ascertain the influence of mathematical literacy and critical thinking abilities on an individual's capacity to resolve mathematical issues. This study uses a similar approach to the systematic gathering and analysis of academic resources used to evaluate students' thinking literacy abilities in mathematical problem-solving to assess the effect of mathematical literacy and critical thinking on problem-solving efficacy (Mukhlis et al., 2024). In consonance with the methodological framework of the research, which encompasses the methodical gathering and evaluation of documentation related to the scrutiny of analytical and critical thinking in the realm of mathematical problem-solving abilities, the research u The empirical data indicating that critical thinking and mathematical literacy exert a considerable influence on an individual's capacity to resolve mathematical problems is meticulously examined and developed through the utilization of the scholarly articles that were compiled. Nderscores the significance of diligently amassing and assessing documents that probe into analytical and critical thinking in relation to mathematical problem-solving proficiencies (Putu et al., 2025).

The methodological framework employed in this investigation to assess and scrutinize the corpus of literature pertaining to critical thinking and mathematical literacy substantiates the inference that a comprehensive analysis of texts prioritizing analytical and critical reasoning elucidates the considerable impact of these cognitive competencies on an individual's aptitude for resolving mathematical challenges (Putu et al., 2025). This aligns with the data analysis technique utilized in this study, which systematically analyzes the collected materials to identify and interpret evidence about the significant impact of critical thinking and mathematical literacy on students' ability to solve mathematical problems (Mukhlis et al., 2024).

RESULT AND DISCUSSION

In order to furnish a thorough elucidation of the ways in which mathematical literacy and critical thinking abilities impact the efficacy of mathematical problem-solving, a comparative examination was undertaken involving three pertinent scholarly articles. Each article was scrutinized to ascertain the degree to which it encompasses fundamental indicators pertinent to these competencies and their influence on students' capacity to resolve mathematical challenges. The objective of the analysis is to underscore the similarities and disparities in the profundity of discourse, the specificity of indicators, and the overarching methodology employed by each journal in investigating the interrelationship among mathematical literacy, critical thinking, and problem-solving. The subsequent table encapsulates the principal findings derived from this analysis, providing insights into the manner in which each article enhances the comprehension of these significant educational constructs.

Table 1. Journal Analysis Results

Article Title	Explanation
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Artikel 1	In the first journal, certain indicators are articulated with adequate specificity. Nevertheless, there exist several indicators that lack explicit elucidation, despite their potential implicit association with critical thinking competencies and mathematical literacy.
Artikel 2	The second journal underscores the impact of both competencies on mathematical problem-solving as a whole; however, it fails to elaborate on the specific metrics employed in the instrument or the discourse. This journal accentuates the significance of critical thinking capabilities in the analysis and evaluation of concepts, including proficiency in identifying errors, yet it does not thoroughly address other metrics such as the application of concepts or logical reasoning in problem-solving.
Artikel 3	The third journal places greater emphasis on the interconnection between mathematical literacy and critical thinking, underscoring the significance of comprehending fundamental concepts, recognizing patterns, synthesizing ideas, implementing concepts, and scrutinizing problems through diverse methodologies. These indicators are regarded as the fundamental components of mathematical literacy and critical thinking, despite not consistently being articulated in the format of systematic research instruments.

The examination of the three journals in Table 1 reveals different levels of detail in how mathematical literacy and critical thinking skills influence problem-solving abilities. The first article outlines several key indicators but does not directly address others that may relate to critical thinking and mathematical literacy. This selective focus suggests that, while some areas of problem-solving are well explored, a complete framework that includes all relevant skills is lacking. The second article emphasizes the overall impact of both skills on problem-solving. It particularly notes how critical thinking aids in analyzing and evaluating concepts like error detection. Nevertheless, it fails to deliver an exhaustive analysis of particular strategies, such as the implementation of mathematical principles or the utilization of logical reasoning, which are critical for comprehending the manner in which these competencies facilitate proficient problem-solving. This gap highlights the need for future research to use more detailed tools that can capture the complex nature of mathematical literacy and critical thinking in practice.

Conversely, the third manuscript emphasizes the substantial correlation between mathematical literacy and critical cognition, focusing on the imperative of grasping essential principles, discerning patterns, integrating concepts, and employing diverse problem-solving methodologies. These components are acknowledged as essential elements of both mathematical literacy and critical thinking, although they are not invariably represented through systematic research methodologies. This perspective highlights the interdependence of these competencies and their collective impact on students' capacity to address intricate mathematical challenges. Moreover, the holistic viewpoint articulated in the third article corresponds with pedagogical best practices that promote the amalgamation of conceptual understanding, analytical reasoning, and adaptive strategy implementation in the realm of mathematics education.

The collective insights derived from these three academic journals underscore the intricate nature of quantifying and promoting mathematical literacy and critical thinking within educational environments. Furthermore, they substantiate the premise that students who demonstrate proficiency in these domains are more adept at discerning fundamental concepts, selecting pertinent theorems, and conducting critical evaluations of solutions—abilities that are essential for proficient problem-solving.

The analysis indicates that although notable advancements have been achieved in acknowledging the significance of these competencies, there persists a necessity for more holistic and systematic methodologies in both scholarly research and pedagogical practices to fully actualize their potential in augmenting students' effectiveness in mathematical problem-solving.

Literacy and thinking skills improve problem-solving. The importance of mathematical literacy as a foundation for students' thinking, which includes the ability to understand, analyze, and evaluate mathematics critically. Students with good mathematical literacy tend to be better able to identify problems, design solution strategies, and reflect on the results obtained (Mukhlis et al., 2024). The study confirms that students' skills in literacy, critical thinking, and communication each play a role. Through a review of multiple studies, it was found that students with strong critical thinking skills are more capable of identifying key information in math problems, evaluating different strategies, and choosing the most effective approach. This highlights the essential role of critical thinking in developing deeper mathematical understanding and more accurate problem-solving abilities (Suryawan, 2023).

CONCLUSION

Critical thinking and literacy enhance problem-solving. Critical thinking allows individuals to analyze situations from multiple angles and avoid biased judgments, leading to more effective solutions. Literacy equips individuals with the ability to comprehend instructions and information accurately, which is essential for identifying problems and applying suitable strategies.

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