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The Mediating Role of Metacognitive Beliefs in the Relationship Between Critical Thinking and Self-Efficacy

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A B S T R A C T

Purpose: The present study aimed to investigate the mediating role of metacognitive beliefs in the relationship between critical thinking and self-efficacy among university students.

Methods and Materials: This study employed a descriptive–correlational design using structural equation modeling (SEM). The statistical population consisted of undergraduate students of Islamic Azad University, South Tehran Branch, during the 2022–2023 academic year, from which 300 participants were selected through convenience sampling. Data were collected using standardized instruments, including the General Self-Efficacy Scale, the Ricketts Critical Thinking Questionnaire, and the Metacognitive Beliefs Questionnaire. Descriptive statistics (mean and standard deviation) were used to summarize the data, while inferential analyses, including correlation coefficients, regression analysis, and SEM, were conducted to test the research hypotheses. Data analysis was performed using SPSS and SmartPLS version 3 software.

Findings: The results indicated that all hypothesized relationships were statistically significant. Critical thinking had a significant direct effect on self-efficacy ($\beta = 0.383$, $T = 13.301$, $p < 0.05$) and on metacognitive beliefs ($\beta = 0.643$, $T = 14.531$, $p < 0.05$). Metacognitive beliefs also had a significant direct effect on self-efficacy ($\beta = 0.555$, $T = 17.394$, $p < 0.05$). Furthermore, the indirect effect of critical thinking on self-efficacy through metacognitive beliefs was positive and significant ($\beta = 0.356$, $p < 0.05$), confirming the mediating role of metacognitive beliefs. The structural model demonstrated acceptable explanatory power, with substantial variance explained in both metacognitive beliefs and self-efficacy.

Conclusion: The findings highlight the critical role of metacognitive beliefs as a mediating mechanism through which critical thinking influences self-efficacy. Enhancing students' metacognitive awareness and regulation can strengthen the impact of critical thinking on their perceived competence, suggesting that integrated cognitive and metacognitive interventions are essential for promoting students' academic and psychological development.

Keywords: *metacognitive beliefs, critical thinking, self-efficacy, structural equation modeling, university students*

1. Introduction

The increasing complexity of educational and psychological environments has intensified scholarly attention toward the cognitive and metacognitive processes that underpin students' learning, adaptation, and performance outcomes. Among these processes, critical thinking and self-efficacy have emerged as two fundamental constructs that significantly influence academic success, problem-solving capacity, and psychological well-being. Critical thinking, defined as a higher-order cognitive process involving analysis, evaluation, and reflective judgment, enables individuals to navigate complex information landscapes and make reasoned decisions. Self-efficacy, conceptualized as individuals' beliefs in their capacity to execute actions required to achieve specific goals, plays a pivotal role in motivation, persistence, and resilience. Contemporary research indicates that these two constructs are deeply interconnected, with critical thinking contributing to enhanced self-efficacy by fostering cognitive control, adaptive reasoning, and confidence in problem-solving abilities (Chang et al., 2021, 2022; Zarei & Valizadeh, 2020). Moreover, advances in educational technology and artificial intelligence have further highlighted the importance of integrating critical thinking and self-efficacy within modern learning contexts, as these skills are essential for effective engagement in digital and hybrid environments (Everett, 2024; Parsakia, 2023).

In parallel, metacognitive beliefs have gained considerable attention as a higher-order regulatory mechanism that governs individuals' thinking processes. Metacognition refers to one's awareness and control over cognitive activities, while metacognitive beliefs encompass individuals' assumptions, evaluations, and attitudes about their own thinking. These beliefs play a crucial role in shaping how individuals monitor, regulate, and interpret their cognitive experiences. Recent empirical studies have demonstrated that metacognitive beliefs are closely associated with a wide range of psychological and behavioral outcomes, including emotion regulation, anxiety, and cognitive flexibility (Cécillon et al., 2024; Mansueto et al., 2024; Sheikhepour & Mostafaei, 2024). Furthermore, maladaptive metacognitive beliefs have been identified as key factors in the development and maintenance of various psychological disorders, such as obsessive-compulsive symptoms, anxiety disorders, and disordered eating (Amiri & Alipour, 2024; Olivari et al., 2025; Strodl & Sorensen, 2023). These findings underscore the importance of examining metacognitive beliefs not only as independent predictors but also as mediating variables that influence the relationships among cognitive and affective constructs.

The theoretical foundation for the mediating role of metacognitive beliefs is rooted in metacognitive models, which posit that individuals' beliefs about thinking processes influence how they respond to internal and external stimuli. According to these models, metacognitive beliefs shape cognitive attentional syndromes, including worry, rumination, and threat monitoring, which in turn affect emotional and behavioral outcomes. Empirical evidence supports this framework, demonstrating that metacognitive beliefs can mediate the relationship between various psychological constructs, such as stress, attachment styles, and self-image, thereby influencing individuals' overall functioning (Chaudhary et al., 2024; Cusimano, 2024; Kashani Vahid et al., 2024). Additionally, research has shown that metacognitive beliefs are significantly related to interpersonal functioning and social anxiety, further highlighting their central role in psychological processes (Strand et al., 2023). These insights suggest that metacognitive beliefs may serve as a key mechanism through which cognitive abilities such as critical thinking impact broader psychological outcomes, including self-efficacy.

Within educational settings, the interaction between critical thinking, problem-solving skills, and metacognitive processes is particularly salient. Critical thinking enhances students' ability to evaluate information, generate solutions, and make informed decisions, while metacognitive beliefs facilitate the monitoring and regulation of these cognitive processes. Studies have demonstrated that training programs focused on critical thinking and problem-solving can significantly improve students' self-efficacy by fostering greater cognitive awareness and control (Hoseinkhani et al., 2022; Kamali Zarch & Aryan, 2020). Similarly, interventions targeting metacognitive skills have been shown to enhance learning outcomes, academic performance, and psychological resilience (Baher et al., 2024; Esmaeili et al., 2024). These findings indicate that metacognitive beliefs may act as a bridge linking cognitive skills and motivational constructs, thereby amplifying the effects of critical thinking on self-efficacy.

Recent studies have further emphasized the role of contextual and individual factors in shaping metacognitive beliefs and their impact on psychological outcomes. For instance, research has shown that metacognitive beliefs are influenced by factors such as emotional security, ambiguity

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tolerance, and social experiences, which in turn affect individuals' cognitive and behavioral responses (Kheyri et al., 2024; Sabzipour et al., 2024; Zarei & Khoshouei, 2023). Moreover, metacognitive beliefs have been linked to academic behaviors such as procrastination and self-regulated learning, suggesting their relevance in educational contexts (Samiee Zafarghandi et al., 2022). In clinical populations, interventions targeting metacognitive processes, such as metacognitive therapy and reflection-based approaches, have demonstrated effectiveness in improving recovery-oriented beliefs and psychological functioning (Musket et al., 2024). These findings highlight the multifaceted nature of metacognitive beliefs and their potential to influence a wide range of outcomes across different domains.

Despite the growing body of research on critical thinking, self-efficacy, and metacognitive beliefs, there remains a need for integrative models that examine the interplay among these constructs within a unified framework. While previous studies have established direct relationships between critical thinking and self-efficacy, as well as between metacognitive beliefs and various psychological outcomes, the mediating role of metacognitive beliefs in the relationship between critical thinking and self-efficacy has received limited empirical attention. Understanding this mediating mechanism is essential for developing targeted interventions that enhance students' cognitive and motivational capacities. Such insights can inform the design of educational programs that promote not only critical thinking skills but also the metacognitive awareness necessary for effective self-regulation and confidence in one's abilities.

Given the theoretical and empirical significance of these constructs, the present study seeks to address this gap by examining the mediating role of metacognitive beliefs in the relationship between critical thinking and self-efficacy among university students. By integrating perspectives from cognitive psychology, educational psychology, and metacognitive theory, this research aims to provide a comprehensive understanding of how higher-order cognitive processes interact to influence students' beliefs about their capabilities. Therefore, the aim of the present study is to investigate the mediating role of metacognitive beliefs in the relationship between critical thinking and self-efficacy among university students.

2. Methods and Materials

2.1. Study Design and Participants

The present study employed a descriptive–correlational design using structural equation modeling (SEM). The statistical population consisted of all undergraduate students of Islamic Azad University, South Tehran Branch, during the 2022–2023 academic year, from which 300 students were selected as the sample using a convenience sampling method.

2.2. Measures

The Sherer General Self-Efficacy Questionnaire: The Sherer General Self-Efficacy Questionnaire (1998) consists of 17 items, each rated on a Likert scale ranging from strongly disagree (1) to strongly agree (5). This instrument measures three dimensions of behavior: initiation of behavior, persistence in completing behavior, and resistance when facing obstacles. A moderate negative correlation has been reported between the self-efficacy questionnaire scores and Rotter's Internal–External Locus of Control Scale. Additionally, a positive correlation was found between the Marlowe–Crowne Social Desirability Scale and the self-efficacy questionnaire, and correlations were also observed between scores on alienation and personal competence questionnaires and self-efficacy scores (Sherer et al., 1982). Barati (2014), cited in Vaghari (2000), assessed the reliability of the self-efficacy questionnaire using the split-half method. The reliability coefficient calculated using the Spearman–Brown formula was 0.76 for equal-length halves and 0.76 for unequal-length halves, while the Guttman split-half coefficient was 0.75. The Cronbach's alpha coefficient indicating internal consistency was reported as 0.79. Based on the obtained values for validity and reliability in the present study, it can be stated that the construct validity is confirmed, as Cronbach's alpha (0.71) and composite reliability (0.82) exceed 0.70, and the average variance extracted (AVE = 0.61) is greater than 0.50. Convergent validity is also confirmed, as composite reliability is above 0.70, AVE is lower than composite reliability and greater than 0.50; furthermore, discriminant validity is supported since AVE is greater than MSV (0.41) and ASV (0.28).

The Ricketts Critical Thinking Questionnaire: The original form of this questionnaire was developed by Ricketts (2005). It consists of 33 items and includes three subscales (Beyabanagard, 2011). The first part includes 11 items measuring creativity, the second part includes 9 items

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assessing perfection, and the third part includes 13 items measuring commitment. All items are scored on a five-point Likert scale ranging from strongly disagree to strongly agree. Beyabanagard (2011) reported test–retest reliability coefficients for the total sample, female participants, and male participants as 0.77 and 0.67, respectively, indicating acceptable reliability. The reliability of the Ricketts Critical Thinking Questionnaire was also reported by Izadi-Fard and Sepasi Ashtiani (2010), who obtained Cronbach's alpha coefficients of 0.94 for the total sample, 0.95 for female participants, and 0.92 for male participants. Based on the obtained validity and reliability indices in the present study, the construct validity is confirmed, as Cronbach's alpha (0.83) and composite reliability (0.85) are above 0.70, and AVE (0.57) is greater than 0.50. Convergent validity is also supported since composite reliability exceeds 0.70, AVE is lower than composite reliability and greater than 0.50; discriminant validity is confirmed as AVE is greater than MSV (0.29) and ASV (0.26).

The Metacognitive Beliefs Questionnaire: The Metacognitive Beliefs Questionnaire was developed by Schraw and Dennison (1994) to assess metacognitive beliefs among adolescent and adult learners. This scale consists of 52 items encompassing two major components: knowledge of cognition and regulation of cognition. The questionnaire evaluates metacognitive beliefs across multiple dimensions, including declarative knowledge, procedural knowledge, conditional knowledge, planning, information management strategies, debugging strategies, comprehension monitoring, and evaluation of the learning process. Items are rated on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree). The total score is calculated by summing the responses to all items. Schraw and Dennison reported the reliability of the questionnaire using Cronbach's alpha as 0.93. Based on the validity and reliability indices obtained in the present study, construct validity is confirmed, as Cronbach's alpha (0.80) and composite reliability (0.84) exceed 0.70, and AVE (0.52) is greater than 0.50. Convergent validity is also supported, as composite reliability is above 0.70, AVE is lower than composite reliability and greater than 0.50; discriminant validity is confirmed since AVE is greater than MSV (0.31) and ASV (0.24).

2.3. Data Analysis

Data analysis was conducted using structural equation modeling (SEM) with the statistical software packages SPSS and SmartPLS version 3.

3. Findings and Results

Table 1 presents the mean and standard deviation of the study variables.

Table 1

Descriptive Statistics of the Study Variables

Variable	N	Mean	Standard Deviation
Metacognitive Beliefs	300	46.15	4.13
Self-Efficacy	300	31.32	7.33
Critical Thinking	300	86.82	10.11
Problem Solving	300	11.86	3.15

Based on Table 1, it can be observed that the highest mean is related to the critical thinking variable, while the lowest mean corresponds to the problem-solving variable. Additionally, the highest standard deviation is associated with critical thinking, and the lowest standard deviation is related to problem solving.

To test the research hypotheses, structural equation modeling (SEM) was employed, with statistical significance serving as the criterion for evaluation. Figure 1 illustrates the research model in terms of the significance of path coefficients using T-values. In this model, all structural equations (path coefficients) are tested using the T-statistic. According to this criterion, a path coefficient is considered significant at the 95% confidence level if the T-value falls outside the range of -1.96 to 1.96; otherwise, the coefficient is not statistically significant. As shown in Figure 1, the T-values for all paths exceed the critical value of |1.96|, indicating significant relationships among the study variables. The T-value for the relationship between metacognitive beliefs and students' self-efficacy is 17.394, demonstrating a direct effect of metacognitive beliefs on self-efficacy. The T-value for the relationship between metacognitive beliefs and students' critical thinking is 14.531, indicating a significant direct effect. Furthermore,

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the T-value for the relationship between critical thinking and self-efficacy is 13.301, reflecting a significant direct effect of critical thinking on self-efficacy.

Figure 1

Model with Beta Coefficients

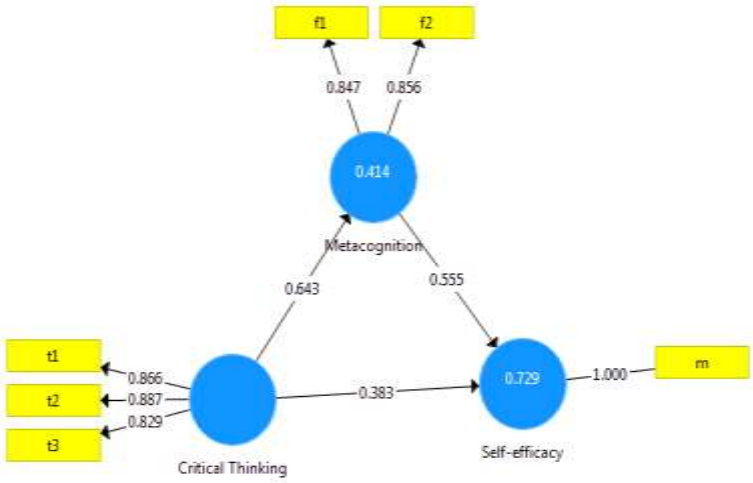


Figure 2

Model with T-Values

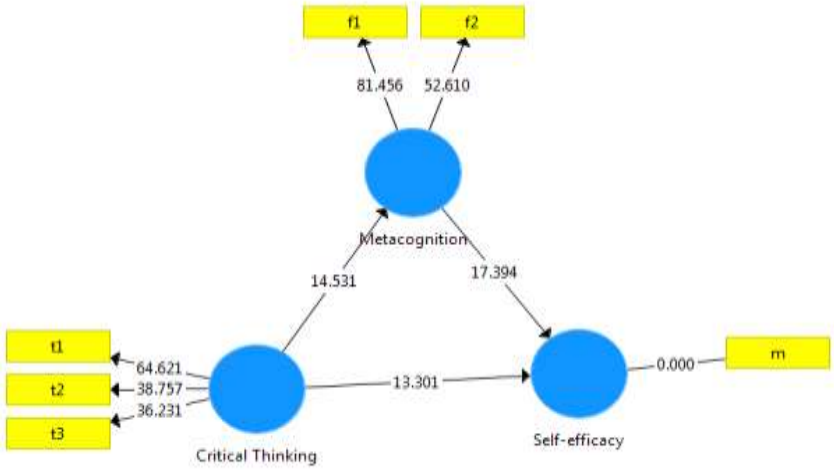


Figure 2 presents the tested model based on standardized path coefficients. These coefficients indicate the strength and magnitude of the relationships between variables. Some researchers suggest that a path coefficient greater than 0.10 represents a meaningful effect within the model. The values displayed on the paths represent the path coefficients, the values inside the circles for endogenous variables indicate the coefficient of determination (R^2), and the values on the arrows of latent variables represent factor loadings. The R^2 value reflects the proportion of variance in the dependent variable explained by the independent variable. According to the model, 67.2% of the variance in metacognitive beliefs and 69.8% of the variance in self-efficacy are explained by critical thinking. A summary of the structural equation modeling results is presented in Table 2.

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Table 2

Results of Hypothesis Testing

Relationship Between Variables	T-value	Direct Effect	Indirect Effect	Total Effect	Result
Critical Thinking → Metacognitive Beliefs	14.531	0.643	–	0.643	Supported
Metacognitive Beliefs → Self-Efficacy	17.394	0.555	–	0.555	Supported
Critical Thinking → Self-Efficacy	13.301	0.383	–	0.383	Supported
Critical Thinking → Metacognitive Beliefs → Self-Efficacy	0.820	0.350	–	0.356	Supported

The results presented in Table 2 indicate that the direct effect of critical thinking on self-efficacy, with a path coefficient of 0.383, is positive and significant. Additionally, the indirect effect of critical thinking on self-efficacy through the mediating variable of metacognitive beliefs is 0.356, which is also positive and significant. Based on these findings, the research hypothesis is confirmed. Therefore, it can be concluded that students' metacognitive beliefs play a mediating role in the relationship between critical thinking and self-efficacy.

4. Discussion and Conclusion

The findings of the present study provide robust empirical support for the hypothesized structural relationships among critical thinking, metacognitive beliefs, and self-efficacy, with particular emphasis on the mediating role of metacognitive beliefs. The results indicated that critical thinking exerts a direct and significant positive effect on self-efficacy, suggesting that individuals who possess higher levels of analytical reasoning, reflective judgment, and evaluative thinking tend to report stronger beliefs in their own capabilities. This finding aligns with previous empirical evidence demonstrating that critical thinking enhances students' confidence in managing academic challenges and executing complex cognitive tasks (Chang et al., 2021, 2022; Zarei & Valizadeh, 2020). Moreover, the significant relationship observed in this study is consistent with research indicating that educational interventions aimed at strengthening critical thinking skills lead to improvements in self-efficacy and academic performance, highlighting the functional role of cognitive competencies in shaping motivational constructs (Hoseinkhani et al., 2022; Kamali Zarch & Aryan, 2020). In line with these findings, studies in digital and technology-enhanced learning environments have also shown that critical thinking serves as a foundational skill that enables learners to navigate complex information systems, thereby reinforcing their sense of competence and efficacy (Everett, 2024; Parsakia, 2023).

In addition to the direct effects, the present study revealed a significant and positive relationship between metacognitive beliefs and self-efficacy. This finding underscores the importance of individuals' beliefs about their own thinking processes in shaping their confidence in performing tasks and overcoming challenges. Metacognitive beliefs influence how individuals monitor and regulate their cognitive activities, which in turn affects their perceived competence and persistence in goal-directed behavior. This result is consistent with prior research demonstrating that adaptive metacognitive beliefs are associated with improved emotion regulation, cognitive flexibility, and psychological well-being (Cécillon et al., 2024; Mansueto et al., 2024). Furthermore, the positive association between metacognitive beliefs and self-efficacy aligns with studies indicating that interventions targeting metacognitive processes, such as metacognitive therapy and cognitive regulation training, can enhance individuals' confidence in their abilities and promote adaptive functioning (Baher et al., 2024; Esmaeili et al., 2024). The findings also resonate with clinical and developmental research suggesting that maladaptive metacognitive beliefs contribute to psychological distress and reduced self-efficacy, particularly in populations experiencing anxiety, obsessive-compulsive symptoms, or emotional dysregulation (Amiri & Alipour, 2024; Olivari et al., 2025; Strodl & Sorensen, 2023).

Another key finding of this study is the significant positive relationship between critical thinking and metacognitive beliefs. This relationship indicates that individuals who engage in higher levels of critical analysis and reflective reasoning are more likely to develop adaptive beliefs about their cognitive processes. From a theoretical perspective, this finding supports metacognitive models that emphasize the interdependence of cognitive and metacognitive processes, wherein critical thinking serves as a catalyst for the development of metacognitive awareness and regulation. Empirical evidence further supports this relationship, demonstrating that critical thinking training enhances metacognitive skills and promotes more effective

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cognitive monitoring and control (Hoseinkhani et al., 2022; Samiee Zafarghandi et al., 2022). Additionally, research has shown that metacognitive beliefs are shaped by cognitive engagement and learning experiences, suggesting that individuals who actively engage in analytical thinking are more likely to develop sophisticated metacognitive frameworks (Chaudhary et al., 2024; Cusimano, 2024).

The most significant contribution of the present study lies in the confirmation of the mediating role of metacognitive beliefs in the relationship between critical thinking and self-efficacy. The results indicated that critical thinking not only directly influences self-efficacy but also exerts an indirect effect through metacognitive beliefs. This finding provides empirical support for the proposition that metacognitive beliefs function as an intermediary mechanism that translates cognitive competencies into motivational outcomes. In other words, individuals with strong critical thinking skills are more likely to develop adaptive metacognitive beliefs, which in turn enhance their self-efficacy. This mediating pathway is consistent with theoretical frameworks suggesting that metacognitive processes regulate the impact of cognitive abilities on behavioral and emotional outcomes (Kashani Vahid et al., 2024; Strand et al., 2023). Moreover, the observed mediation effect aligns with studies demonstrating that metacognitive beliefs play a central role in linking cognitive processes to psychological functioning across various domains, including academic achievement, interpersonal relationships, and mental health (Kheyri et al., 2024; Sheikhepour & Mostafaei, 2024).

The explanatory power of the structural model, as indicated by the substantial proportions of variance explained in metacognitive beliefs and self-efficacy, further highlights the importance of integrating cognitive and metacognitive perspectives in understanding students' psychological functioning. The finding that critical thinking accounts for a significant portion of the variance in both metacognitive beliefs and self-efficacy suggests that it serves as a foundational construct in the development of higher-order cognitive and motivational processes. This is consistent with research indicating that critical thinking is closely associated with academic behaviors such as self-regulation, problem-solving, and adaptive learning strategies (Zarei & Khoshouei, 2023). Additionally, the strong predictive role of metacognitive beliefs in self-efficacy underscores their significance as a target for educational and psychological interventions. Studies have shown that enhancing metacognitive awareness and regulation can lead to improvements in students' academic performance, emotional resilience, and overall well-being (Cécillon et al., 2024; Sabzipour et al., 2024).

Furthermore, the findings of this study can be interpreted within the broader context of contemporary psychological research that emphasizes the dynamic interplay between cognitive, metacognitive, and emotional processes. The significant relationships observed among the study variables suggest that self-efficacy is not solely determined by cognitive abilities but is also influenced by individuals' beliefs about their thinking and their capacity to regulate cognitive processes. This perspective is supported by research highlighting the role of metacognitive beliefs in shaping individuals' responses to uncertainty, stress, and emotional challenges (Chaudhary et al., 2024; Mansueto et al., 2024). In this regard, the present study contributes to the growing body of literature that advocates for a multidimensional approach to understanding psychological functioning, one that integrates cognitive, metacognitive, and affective components.

Overall, the results of the present study provide compelling evidence for the interconnected nature of critical thinking, metacognitive beliefs, and self-efficacy, as well as the central role of metacognitive beliefs in mediating these relationships. By demonstrating that metacognitive beliefs serve as a key mechanism through which critical thinking influences self-efficacy, this study offers valuable insights for both theory and practice. These findings highlight the importance of fostering not only cognitive skills but also metacognitive awareness and regulation in educational and clinical settings. Interventions that simultaneously target critical thinking and metacognitive beliefs may be particularly effective in enhancing students' self-efficacy and promoting adaptive psychological functioning.

One of the limitations of the present study is the use of a convenience sampling method, which may limit the generalizability of the findings to broader populations. Additionally, the cross-sectional design of the study restricts the ability to draw causal inferences about the relationships among the variables. The reliance on self-report measures may also introduce response biases, such as social desirability or inaccurate self-assessment. Furthermore, the study was conducted within a specific cultural and educational context, which may influence the applicability of the findings to other settings.

Future research is recommended to employ longitudinal and experimental designs to examine the causal relationships among critical thinking, metacognitive beliefs, and self-

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efficacy. Researchers should also consider exploring additional mediating and moderating variables, such as emotional intelligence, motivation, and personality traits, to gain a more comprehensive understanding of these relationships. Expanding the study to diverse populations and educational contexts can further enhance the generalizability of the findings. Moreover, the development and evaluation of intervention programs that simultaneously target cognitive and metacognitive processes would provide valuable insights into their practical applications.

In terms of practical implications, the findings of this study suggest that educators and practitioners should prioritize the development of both critical thinking skills and metacognitive awareness in students. Educational programs and curricula should incorporate strategies that promote reflective thinking, cognitive monitoring, and self-regulation. Additionally, training programs aimed at enhancing metacognitive beliefs can help students develop greater confidence in their abilities and improve their academic and psychological outcomes. By fostering an integrated approach to cognitive and metacognitive development, it is possible to create learning environments that support students' overall growth and success.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the study and participated in the research with informed consent.

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