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RESEARCH ARTICLE **OPEN ACCESS**

The Missing Link: Academic Motivation as a Mediator in the Relationship between Mindfulness and Critical Thinking Skills in Indonesian First-year Undergraduates

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Abstract:

Background: Critical thinking is essential for university students to deal with academic demands. Preliminary research indicates that first-year undergraduate students in Indonesia have low critical thinking skills, highlighting the importance of developing these skills early to better adapt to university life.

Objective: This research examined the role of academic motivation as a mediator between mindfulness and critical thinking skills among first-year undergraduate students in Indonesia.

Methods: Data were collected through e-flyers and questionnaires distributed *via* social media, using convenience and snowball sampling techniques. The sample included 186 first-year students (aged 18–23, M = 18.9) from the class of 2022. Critical thinking was assessed with the Analog Test, mindfulness was measured using the 15-item Five Facet Mindfulness Questionnaire (FFMQ-15), and academic motivation was evaluated with the Indonesian Short Version of the Academic Motivation Scale. Pearson correlation and regression analyses were performed.

Results: The study found a statistically significant indirect effect of mindfulness on critical thinking, mediated by intrinsic academic motivation (β = 0.010, p = 0.027, 95% CI = 0.00065–0.023). While this mediation effect was significant, the effect size was small, suggesting that while mindfulness influenced critical thinking through intrinsic motivation, its practical significance was limited.

Conclusion: This study highlights that mindfulness predicts critical thinking primarily through intrinsic academic motivation, with no significant direct effect. The small effect size suggests that other factors may also influence this relationship. Further research is needed to identify additional mediators or contextual variables.

Keywords: Academic motivation, Critical thinking skill, Mindfulness, First-year students, Indonesian undergraduates, Higher education.

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1. INTRODUCTION

In the 21st century, students are not only expected to master content but also to produce and synthesize information from a wide variety of subjects and sources [1, 2]. Mastering these skills has become essential due to the rapid advancement of science and technology in the current era of globalization, which enables individuals to access information more easily and from an ever-expanding range of sources. Consequently, education systems must anticipate the strategic use of scientific and technological tools to help students acquire these critical skills. Therefore, acquiring 21st-century skills, such as

critical thinking skills and adaptability, is now both a necessity and a requirement for students to succeed in an increasingly interconnected world [3].

The Organization for Economic Co-operation and Development (OECD) conducted a survey in 2016 to assess the skills of respondents aged 15 to 65 years from 24 countries. The survey evaluated several key information processing skills, including literacy, numeracy, and problem-solving, using scientific and technological tools [4]. The results showed that Indonesia scored lower in both literacy and numeracy skills, which are foundational skills closely linked to Higher-Order Thinking Skills (HOTS) [5]. HOTS refers to a set of advanced cognitive abilities that enables students to engage in complex reasoning, analysis, and evaluation of information and concepts. This skill also supports the development of new knowledge and perspectives [6].

Further research by Rostikawati *et al*. [7] found that Indonesian undergraduates performed below average on HOTS questions aimed at assessing critical thinking skills. Specifically, 40% of respondents scored low in critical thinking scores, while the remaining 60% failed to meet the expected standards for critical thinking [7]. These standards include the ability to identify both explicit and implicit assumptions within the information, as well as the ability to effectively communicate their understanding clearly and coherently [7]. These findings align with the research by Kirana and Kusairi [8], who reported that Indonesian undergraduates struggled with HOTS questions related to critical thinking case analysis.

The lack of critical thinking skills not only affects students' academic performance but also poses a challenge for their future employability [9]. In today's competitive global job market, critical thinking is seen as an essential skill that helps graduates handle complex tasks, solve problems, and make well-informed decisions [10]. Graduates who possess strong critical thinking abilities are better equipped to handle complex tasks and make well-informed decisions, which are essential in many professional fields [9, 10].

Critical thinking is a manifestation of high-level thinking skills [11]. It involves a purposeful and self-regulated process that leads to interpretation, analysis, evaluation, conclusions, and explanations based on clear conceptual, methodological, criteriological, or contextual considerations [12]. Students in higher education must possess critical thinking skills, as various lecture assignments require the application of different cognitive processes [13]. Therefore, critical thinking enables students to evaluate personal and public arguments, resolve disputes, and reach more rational conclusions when addressing complex problems [14].

Students with strong critical thinking skills are better equipped to resolve challenges with greater precision, eventually achieving more effective outcomes [15]. In contrast, students with lower critical thinking skills tend to be less objective and indifferent, which hinders their ability to enhance learning. This often leads to suboptimal learning outcomes [16] and a higher risk of academic dishonesty, such as cheating [17]. Previous research has shown that a significant proportion of undergraduates possess low levels of critical thinking skills, particularly among first-year students [18-20]. Additionally, these students struggle to identify issues, interpret information accurately, and are unfamiliar with effective problem-solving strategies [18, 20].

Several reasons might contribute to the low levels of critical thinking skills of first-year undergraduates, including a lack of practical knowledge and experience, as well as challenges related to the transition from high school to university [21]. In Indonesia, many high school students engage in passive learning, relying solely on memorization without deep understanding [22, 23], which may carry over into their university studies. Furthermore, Syahfitri *et al*. [21] noted that first-year undergraduates are often hesitant to engage in investigations, analysis, and organizing knowledge, which stems from a lack of confidence in their decision-making abilities. This hesitation hinders their development of critical thinking skills, making it difficult for them to navigate the academic challenges of transitioning to university. If these difficulties are not addressed, they can negatively affect academic performance and achievement [24].

The development of critical thinking skills depends on both internal and external factors. Internal factors originate from within the individual and include physical conditions, experiences, motivation, intellectual development, learning styles, anxiety, and self-efficacy [25-27]. External factors, on the other hand, arise from the environment, such as teaching methods and parenting styles [28, 29]. While external factors can shape critical thinking, they are often beyond an individual's control. Internal factors, however, are more within the individual's ability to manage, which is why this study focuses on examining how internal factors can enhance critical thinking skills.

One of the internal factors that has been linked to critical thinking development is mindfulness. Defined as a state of focused attention and consciousness of the present moment that allows individuals to engage more fully with their experiences [30]. Vago and Silbersweig [31] stated that mindfulness helps individuals regulate their behavior more, while Noone *et al*. [32] found that mindfulness significantly promotes critical thinking skills [31]. Similarly, research by Su and Shum [33] indicates that mindfulness facilitates critical thinking skills. Moreover, mindfulness fosters meta-awareness—an awareness of one's ongoing mental states—which enhances metacognitive self-regulation and reduces cognitive biases [34]. Shapiro *et al*. [35] also support this view, reporting that mindfulness improves critical thinking by promoting better self-regulation.

While some studies [30, 32-34] have demonstrated a significant relationship between mindfulness and critical thinking skills, other research [36-38] have reported no significant link between these variables. This inconsistency suggests that mindfulness may not directly affect

critical thinking in all contexts. Instead, other factors may mediate the relationship, acting as intermediaries that help explain how mindfulness relates to critical thinking skills. Identifying these mediators could offer a more complete understanding of the mechanisms behind this relationship.

One potential mediator is motivation, which plays a crucial role in the development of critical thinking skills, as it drives individuals to engage in desired behavior [39]. Even if someone possesses the cognitive ability for critical thinking, a lack of motivation can hinder their ability to apply these skills effectively [40]. Ku's [41] research supports this view, highlighting that motivation encourages individuals to engage in more rigorous reasoning and decision-making. This suggests that motivation is an essential internal factor for the development of critical thinking skills.

Academic motivation has been shown to be closely linked to critical thinking skills in students aged 18 to 25 years [42]. High levels of academic motivation facilitate the development of critical thinking, as students are more inclined to apply higher-order thinking in their learning [42, 43]. Moreover, academic motivation itself can be predicted by mindfulness. Several studies [44-46] have found a unidirectional relationship between mindfulness and academic motivation, showing that mindfulness enhances intrinsic motivation [47, 48]. These interconnections suggest that academic motivation could serve as a key mediator in the relationship between mindfulness and critical thinking. Consequently, this study aims to examine the role of academic motivation as a mediator between mindfulness and critical thinking skills among first-year undergraduates in Indonesia.

To provide a deeper understanding of academic motivation, this study examines the different types of motivation. According to Vallerand *et al*. [49], there are three main components to academic motivation: amotivation, extrinsic motivation, and intrinsic incentive. Intrinsic motivation involves engaging in academic activities for personal interest and satisfaction, while extrinsic motivation refers to engaging in tasks due to external incentives, such as rewards or recognition. Amotivation, on the other hand, reflects a lack of motivation or the absence of intention to engage in academic tasks. Recognizing these distinctions provides a clearer understanding, as each type of motivation may mediate the relationship between mindfulness and critical thinking skills differently.

Fig. (**1**) illustrates the research model, highlighting the proposed relationships among mindfulness, academic motivation, and critical thinking skills. Based on this model, the following hypotheses are specifically proposed: H1: Mindfulness positively predicts critical thinking skills; H2: Intrinsic academic motivation mediates the relationship between mindfulness and critical thinking skills; H3: Extrinsic academic motivation mediates the relationship between mindfulness and critical thinking skills; H4: A motivation mediates the relationship between mindfulness and critical thinking skills.

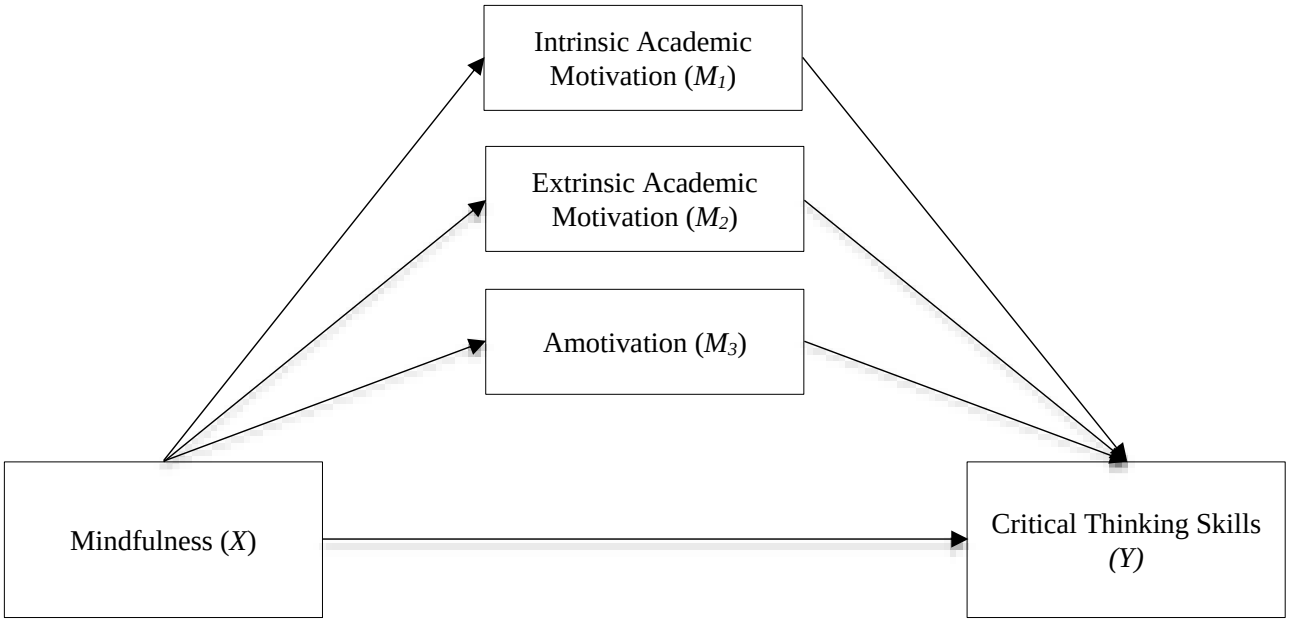

Fig. (1). Proposed research model.

2. METHODOLOGY

2.1. Research Design

This study used a cross-sectional design to examine the relationships between mindfulness, academic motivation, and critical thinking skills among first-year undergraduate students in Indonesia. Descriptive statistics (means, standard deviations, minimums, and maximums) were calculated to provide an overview of the characteristics of the study variables. Pearson correlation was used to assess the strength and direction of the relationships between mindfulness, critical thinking, and academic motivation.

Additionally, regression analysis tested the mediating role of different types of academic motivation in the relationship between mindfulness and critical thinking. Cronbach's alpha was calculated for each variable to ensure the reliability of the instruments. Validity was assessed using Confirmatory Factor Analysis (CFA) to verify the construct validity of the measurement scales. All analyses, including reliability and validity tests, were conducted using JASP v. 0.16.4.

2.2. Data Collection Procedure

Data collection was conducted from February to March 2023. Respondents were mainly first-year undergraduates, class of 2022. A combination of convenience and snowball sampling methods was adopted. Convenience sampling focused on the distribution of posters and a questionnaire link through the following social media platforms, Instagram and Twitter, including instant messaging apps such as Line and WhatsApp. In terms of snowball sampling, the personal network of respondents was used, including connections with the Student Executive Board and students' associations, to share relevant information with those who met the stipulated criteria. This method enabled broader dissemination through social and organizational networks. Despite the geographic diversity of respondents, social media and messaging platforms supported effective selection across various locations. Respondents were selected informally through these networks rather than the official university channels.

To determine the minimum sample size required for the study, we conducted a power analysis using G*Power v.3.1.9.7. The results indicated that at least 89 participants were needed. However, the study aimed for a sample size larger than this minimum to improve the accuracy of the research.

2.3. Measurement Instruments

Three instruments were used in this study: the Analog Test to measure critical thinking, the 15-item Five Facet Mindfulness Questionnaire (FFMQ-15) for mindfulness, and the Academic Motivation Scale (Indonesian Short Version) for academic motivation. The reliability and validity were assessed using Cronbach Alpha and Confirmatory Factor Analysis (CFA), respectively. Model fit was evaluated using several major indices, including chi-square, CFI, TLI, SRMR, and RMSEA. The cut-off criteria used were (1) CFI > 0.90, (2) TLI > 0.90, (3) RMSEA < 0.08, and (4) SRMR < 0.08 [49, 50].

2.3.1. The Analog Test

The Analog Test, developed by Suleeman and Christia [50], was designed to assess critical thinking skills based on two dimensions, namely logical (including inference and evaluation) and analytical thinking. This is consistent with the APA Delphi Report, which identifies analysis, evaluation, and inference as core cognitive skills. The Analog Test was selected because it effectively measured engagement in the cognitive processes, which was also fundamental to HOTS. The research reported that Indonesian undergraduates exhibited suboptimal performance during HOTS tasks, particularly in critical thinking, such as recognizing assumptions, evaluating arguments, and solving complex problems. However, by focusing on logical and analytical thinking, the Analog Test supported the cognitive demands required for developing HOTS, providing a relevant and targeted assessment. The test was conducted on 121 students from Jakarta, Bogor, Depok, Tangerang, and Bekasi. The reliability and validity tests performed by Suleeman and Christia [50] showed that the instruments were both reliable and valid. Furthermore, the instruments were constructed in line with the Indonesian context, enhancing their relevance to the research population.

The Analog Test exhibited acceptable reliability and validity, with Cronbach $\alpha = 0.83$ and corrected item-total correlations (Crit) within the range of 0.24 to 0.54, depicting good internal consistency and item performance. The Crit values reflected how each item correlated with the overall test score, with higher values suggesting better performance in terms of measuring the intended construct. Using DWLS as the estimator, CFA results showed CFI = 1.00, TLI = 1.04, RMSEA = 0.00, and SRMR = 0.07, confirming that the instrument was valid and provided a good fit.

The Analog Test evaluated critical thinking based on two main dimensions, namely logical (items 1 to 16) and analytical thinking (items 17 to 22), with a total of 22 multiple-choice items. The overall score for critical thinking was derived from the entire 22 sample items, shown in Appendix 1.

2.3.2. The Five Facet Mindfulness Questionnaire (FFMQ-15)

Baer *et al*. [51] developed the 15-item Five Facet Mindfulness Questionnaire (FFMQ-15) to assess mindfulness across five dimensions: observing, describing, acting with awareness, non-judgment, and non-reactivity. Since it lacked an Indonesian version, the questionnaire was adapted through a rigorous process including translation, back-translation, expert judgment, readability, and pilot testing.

The questionnaire was translated into Indonesian and then translated back to English to ensure accuracy. Subsequently, expert judgment was conducted to review the translation concerning mindfulness. Readability

testing was conducted on 5 students aged 18 to 25 to ensure the language was easily understood, with no significant revisions needed. Finally, the questionnaire was distributed to 60 undergraduates from various Indonesian universities to finalize the usability.

Each item was rated on a 5-point Likert scale (1 = very rarely to 5 = always), with the total calculated by summing the scores. Although the FFMQ-15 was multidimensional, it can be used unidimensionally by summing the scores across all items, as reported by Baer *et al*. [51]. A typical sample item is 'I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.' The Indonesian version of the FFMQ-15 had a Cronbach α of 0.56 and Crit = 0.03 – 0.36, showing moderate internal consistency. The results of the CFA showed a good model fit (CFI = 1.00, TLI = 1.00, RMSEA = 0.00, SRMR = 0.06, and estimator DWLS).

2.3.3. Academic Motivation Scale (AMS)-Short Indonesian Language Version

The Academic Motivation Scale (AMS) was developed by Vallerand *et al*. [49] and adapted into Indonesian by Natalya [52]. AMS-Short Indonesian Language Version consisted of 15 items assessing the three dimensions of academic motivation, namely (a) intrinsic (seven items), (b) extrinsic (six items), and (c) amotivation (two items). The score for each dimension was calculated separately based on the total items. Each item was rated on a 6-point Likert scale, ranging from 1 (strongly disagree) to 6 (strongly agree). An example item is, 'In general, I do this to prove to myself that I can succeed in my studies.'

This instrument showed reliability with Cronbach α values of 0.87, 0.81, and 0.73 for intrinsic, extrinsic, and amotivation, depicting strong reliability. Additionally, all items showed good internal validity, with corrected item-total correlations (Crit) ranging from 0.61 to 0.73, 0.49 to 0.650, and 0.57 for intrinsic, extrinsic, and amotivation. CFA results represented CFI = 1.00, TLI = 1.00, RMSEA = 0.00, and SRMR = 0.07 with DWLS as an estimator, implying a good model fit. The use of DWLS as the estimator supported the validity of the instrument in measuring the intended constructs.

2.4. Data Analysis Procedure

Data analysis followed several steps using JASP v. 0.16.4. First, Pearson's correlation assessed the relationships between mindfulness (X), intrinsic academic motivation (M_1), extrinsic academic motivation (M_2), amotivation (M_3), and critical thinking skills (Y), alongside descriptive statistics (means, standard deviations, and reliability coefficients).

Although the initial plan was to conduct a multiple mediation analysis including intrinsic, extrinsic academic motivation, and amotivation, Pearson's correlation indicated that only intrinsic academic motivation had significant correlations with both mindfulness and critical thinking skills. Consequently, the mediation analysis was limited to intrinsic academic motivation as the mediator.

The mediation analysis was performed using a bootstrapping procedure with 5000 resamples to estimate 95% confidence intervals (CIs) for the indirect effects. Mediation was considered significant if the CIs excluded zero, with a significance level set at $p < 0.05$.

3. RESULTS

A total of 265 students completed the survey; however, only 186 met the criteria for analysis. The exclusion criteria eliminated respondents who were not first-year students and those who failed the attention check embedded in the online questionnaire. An example of the attention check question was, 'Please select number 3 to answer this question,' which ensured respondents were paying attention while completing the survey. This step led to the exclusion of 79 respondents. Additionally, there was no missing data in the responses, as the survey was administered *via* Google Forms, where all required questions were marked with an asterisk (*) to ensure completeness.

The 186 participants were aged 18 to 23 years (M = 18.91, SD = 0.96, 78% females). Most students attended University in Java (52.1%), followed by Sumatera (12.9%), Bali (8.6%), Kalimantan (5.9%), Sulawesi (5.4%), Papua (5.4%), and Nusa Tenggara Timur (9.6%).

Table 1. Descriptive statistic, cronbach alpha, and pearson correlation analysis among variables (n=186).

Variables	1	2	3	4	5
1. Critical Thinking Skills	–	-	-	-	-
2. Mindfulness	0.042	–	-	-	-
3. Intrinsic Academic Motivation	0.183*	0.335***	–	-	-
4. Extrinsic Academic Motivation	0.204**	0.064	0.524***	–	-
5. Amotivation	-0.252***	-0.114	-0.546***	-0.442***	–
M	16.33	45.99	32.33	29.44	4.19
SD	4.14	6.09	5.65	4.94	1.98
Min	2.00	32.00	9.00	12.00	2.00
Max	22.00	65.00	42.00	36.00	11.00
α	0.83	0.56	0.87	0.81	0.73

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 1 presents the descriptive statistics for the research variables along with the results of the Pearson correlation analysis. The analysis revealed that mindfulness did not have a significant direct relationship with critical thinking skills (r = 0.042, $p > 0.05$), indicating that Hypothesis 1 is rejected. Similarly, extrinsic academic motivation and amotivation also did not show significant direct correlations with mindfulness, suggesting that these two variables are unlikely to mediate the relationship between mindfulness and critical thinking skills. Therefore, Hypotheses 3 and 4 are rejected.

However, Table 1 shows a moderate positive correlation between mindfulness and intrinsic academic motivation (r = 0.335, $p < 0.001$), suggesting that individuals with higher mindfulness tend to have higher intrinsic motivation. Furthermore, intrinsic academic motivation showed a weak positive relationship with critical thinking skills (r = 0.183, $p < 0.05$), indicating that individuals with higher intrinsic motivation exhibit slightly better critical thinking skills.

Although mindfulness did not directly correlate with critical thinking, its significant relationship with intrinsic academic motivation, coupled with the positive correlation between intrinsic motivation and critical thinking, suggests that intrinsic motivation may serve as a mediator. This finding implies that the effect of mindfulness on critical thinking skills may occur indirectly through its relationship with intrinsic academic motivation. Thus, Hypothesis 2 is supported, and further regression analysis can be conducted to test the mediation effect.

Table 2. Results of the mediation analysis.

Effect	Path	β	SE	95% CI		z	p
				Lower	Upper		
Total	Mindfulness → Critical Thinking	0.007	0.012	-0.013	0.027	0.577	0.564
Indirect	Mindfulness → Intrinsic Academic Motivation → Critical Thinking	0.010	0.005	0.001	0.024	2.214	0.027*
Direct	Mindfulness → Critical Thinking	-0.004	0.013	-0.025	0.016	-0.280	0.779

The mediation analysis in Table 2 shows that mindfulness did not predict critical thinking skills, as both the direct and total effects were non-significant. These results imply that mindfulness did not have a meaningful overall impact on critical thinking skills when both direct and indirect effects were considered. However, a significant indirect effect was observed, indicating that mindfulness predicts critical thinking skills through its relationship with intrinsic academic motivation. Although the effect size was relatively small, it suggests that mindfulness had a modest but measurable impact on critical thinking skills *via* intrinsic motivation. This finding implies that while intrinsic motivation serves as a mediator in this relationship, its practical significance in predicting critical thinking skills remains limited.

4. DISCUSSION

This study examined the relationship between mindfulness and critical thinking skills among first-year undergraduates in Indonesia, focusing on academic motivation—intrinsic, extrinsic, and amotivation—as a mediator. It was hypothesized that mindfulness would predict critical thinking skills (H_1) and that intrinsic academic motivation (H_2), extrinsic academic motivation (H_3), and amotivation (H_4) would each mediate the relationship between mindfulness and critical thinking skills. The results partially supported these hypotheses, with Hypothesis 2 confirmed and Hypotheses 1, 3, and 4 rejected. Specifically, the study found that mindfulness does not directly predict critical thinking skills but does so indirectly through intrinsic academic motivation.

The lack of a significant direct effect of mindfulness on critical thinking (H_1) aligns with previous research that has also reported non-significant relationships between these two variables [36-38]. This suggests that while mindfulness itself may not directly enhance critical thinking, it can predict critical thinking when students are more intrinsically motivated. Intrinsic academic motivation, therefore, plays a crucial role as a mediator in this relationship, as shown by the significant indirect effect. These findings are consistent with prior research indicating that mindfulness fosters greater intrinsic motivation by promoting self-awareness and attentiveness [44-46].

Smyth *et al*. [53] emphasized that self-awareness gained from mindfulness helps individuals recognize key personal goals and align their actions with their values, which in turn increases intrinsic motivation. A meta-analysis by Li *et al*. [54] similarly found that both trait mindfulness and systematic mindfulness interventions significantly enhance motivation, particularly intrinsic motivation, more so than extrinsic motivation. It also highlights mindfulness as an accessible, cost-effective practice that can positively increase motivation and, by extension, improve life quality [54]. However, further research is necessary to explore other motivational types and their varying effects across different contexts.

In terms of academic motivation and critical thinking skills, this study supports previous research that has found a strong positive relationship between these two variables [42, 43, 47]. A study by Berestova *et al*. [42] also showed that students with high intrinsic academic motivation are more likely to exhibit better critical thinking skills, demonstrating that academic motivation may act as a predictor of cognitive skill development. High academic motivation has been consistently associated with better academic outcomes, personal growth, and enhanced decision-making and reflection abilities [55-59]. Moreover, this relationship appears to be reciprocal; increased motivation strengthens critical thinking, and enhanced critical thinking further fuels motivation [43, 60].

Despite these findings, this research has limitations that must be acknowledged. First, the cross-sectional design of this study limits the ability to establish causal

relationships between mindfulness, academic motivation, and critical thinking skills. Thus, longitudinal studies are needed to explore how these relationships will develop over time. Second, while efforts were made to ensure cultural relevance, some nuances of mindfulness may not have been fully captured. Cultural differences in how mindfulness is perceived and practiced likely played a role in participant responses, and future research should conduct further validation of the adapted measure to ensure its reliability and accuracy within the Indonesian cultural context.

Finally, several confounding variables, such as personality traits, previous educational experiences, and social support systems, may have contributed to the relationships observed in this study. Addressing these confounding factors in future research could offer a more comprehensive understanding of the relationship between mindfulness, academic motivation, and critical thinking skills.

CONCLUSION

In conclusion, this research showed that intrinsic academic motivation played a significant role in the relationship between mindfulness and critical thinking skills of first-year undergraduates. This result focused on the significance of academic motivation as an internal factor that contributed to critical thinking skills. Therefore, critical thinking skills were enhanced through high academic motivation, even in the absence of mindfulness. This present research also reported that increased academic motivation depended on the level of mindfulness, suggesting mindfulness training was an effective strategy to enhance students' academic motivation. However, it was recommended that the faculties and policymakers in higher education should integrate mindfulness training into the curriculum with the aim of improving academic motivation and enhancing the critical thinking skills of first-year undergraduates. The results served as a basis for educators and policymakers to develop more comprehensive and effective educational strategies. This research contributed to the advancement of education theory and provided practical information to enhance and cultivate students' critical thinking skills in the 21st century.

THEORETICAL IMPLICATIONS

This study provides a better understanding of the relationship between mindfulness, academic motivation, and critical thinking skills in first-year undergraduate students, specifically in Indonesia. By demonstrating that intrinsic motivation mediates the link between mindfulness and critical thinking, it provides how psychological constructs are related to cognitive skills essential for academic success. The findings suggest that mindfulness is associated with increased intrinsic motivation, which, in turn, is connected to better critical thinking. This highlights the role of intrinsic motivation as a key mediator in the relationship between mindfulness and critical thinking in cognitive skill development.

Additionally, the study points to the potential of mindfulness as a tool for improving cognitive processes in higher education. It lays the groundwork for future research on how mindfulness interventions might support academic performance, particularly in fostering critical thinking skills, which are often underdeveloped in early undergraduate education. This emphasizes the importance of integrating motivational and cognitive approaches to support students' academic development better.

PRACTICAL IMPLICATIONS

Integrating mindfulness practices aimed at enhancing intrinsic motivation could be an effective strategy for improving critical thinking skills among first-year undergraduate students in Indonesia. Faculty might introduce mindfulness activities that promote self-awareness and engagement, which may lead to increased intrinsic motivation and, consequently, better critical thinking skills. Faculty can foster a supportive learning environment by encouraging collaborative learning and offering opportunities for self-directed inquiry, both of which can nurture intrinsic motivation. By incorporating mindfulness-based approaches, faculty can help students strengthen not only their emotional and motivational skills but also their ability to think critically and analytically. This study's findings suggest that higher education institutions should reconsider their methods for developing critical thinking skills. Understanding the relationship between mindfulness, academic motivation, and critical thinking can guide faculty in implementing holistic programs that prepare first-year students for academic success and lifelong learning.

AUTHORS' CONTRIBUTIONS

It is hereby acknowledged that all authors have accepted responsibility for the manuscript's content and consented to its submission. They have meticulously reviewed all results and unanimously approved the final version of the manuscript.

LIST OF ABBREVIATIONS

OECD	=	The Organization for Economic Co-operation and Development
HOTS	=	Higher-Order Thinking Skills
CFA	=	Confirmatory Factor Analysis
FFMQ-15	=	Five Facet Mindfulness Questionnaire
AMS	=	Academic Motivation Scale

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This research included respondents who were reviewed and approved by the Faculty of Psychology, Universitas Indonesia, Indonesia, under Ethics Approval No. 199/FPsi.Komite Etik/PDP.04.00/2023.

HUMAN AND ANIMAL RIGHTS

All human research procedures followed were in accordance with the ethical standards of the committee

responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from the participants.

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data and supportive information are available upon request from the corresponding author [R.S].

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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Declared none.

APPENDIX

Appendix 1. Sample Items for the Analog Test

Instruction:

For questions 1 to 16, there are two statements followed by five possible conclusions, with only one correct option. Read the statements carefully and select the conclusion that logically follows the information provided.

Answer questions 17 to 22 based on the information provided in the options. Each question provided five possible answers, with only one correct option. Take time to think before carefully selecting the appropriate answer.

Aspect of Critical Thinking	Item Number	Sample Item
Logical Thinking	1 – 16	Everyone who is going to board an interprovincial bus must buy a ticket. Some people will travel from Jakarta to Bandung by bus. a) Not everyone will board the bus. b) Some people will travel to Bandung. c) If going to Bandung, everyone must board the bus. d) Some people who are going to board the bus to Bandung must buy a ticket. e) Everyone traveling to Bandung must board the bus.
Analytical Thinking	17 – 22	Questions 17, 18, and 19 were based on the following information in a 100-meter race, there are six participants A, B, C, D, E, and F. At the end of the race, the following was observed: • A finished before D. • B finished ahead of D but after C. • E finished last. • C finished after F. • A finished after C. 17. What position did A finish in at the end of the race? a) Second place b) Third place c) Fourth place d) Fifth place e) Sixth place

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