RESEARCH PAPER

Lack of Text-Generative Artificial Intelligence Integrity on Critical Thinking Amongst Indonesian Masters Students: Teaching Methods as a Moderator.

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ABSTRACT

The increasing use of text-generative artificial intelligence in academic settings raises concerns regarding its lack of integrity and impact on Master's students' critical thinking. This study examines the relationship between lack of text-generative artificial intelligence integrity and critical thinking amongst Indonesian Master's degree students, with teaching methods as a moderator. A quantitative cross-sectional design was used with 70 Master's students from Indonesian universities. Lack of artificial intelligence integrity was measured using the AI Academic Integrity Scale for Postgraduate students, critical thinking was assessed using the Critical Thinking Scale, and teaching methods was measured using a self-developed scale. Moderated multiple regression analysis revealed a significant negative effect of text-generative artificial intelligence integrity on critical thinking (β=-0.45, $p<.01$). Teaching methods did not significantly moderate the relationship ($p>.05$), but showed a significant direct effect on critical thinking (β=0.32, $p<.05$). These findings highlight the importance of pedagogical strategies to reduce overreliance on artificial intelligence.

Keywords: Critical Thinking, Teaching Methods, Text-Generative Artificial Intelligence Integrity.

ABSTRAK

Peningkatan penggunaan kecerdasan buatan generatif teks dalam konteks akademik menimbulkan kekhawatiran terkait integritas serta dampaknya terhadap kemampuan berpikir kritis mahasiswa Magister. Penelitian ini menguji hubungan antara kurangnya integritas kecerdasan buatan generatif teks dengan berpikir kritis mahasiswa Magister, dengan metode pengajaran sebagai variable moderator. Penelitian menggunakan desain kuantitatif potong lintang yang melibatkan 70 mahasiswa Magister di Indonesia. Integritas kecerdasan buatan generatif teks diukur mengginakan AI Academic Integrity Scale for Postgraduate Students, berpikir kritis diukur menggunakan Critical Thinking Scale, dan metode pengajaran diukur menggunakan skala yang dikembangkan peneliti. Analisis regresi moderasi menampilkan pengaruh negative yang signifikan antara kurangnya integritas kecerdasan buatan generatif teks terhadap berpikir kritis (β=-0,45, $p<0,01$). Metode pengajaran tidak mempengaruhi hubungan tersebut ($p>0,05$), namun memiliki pengaruh langsung yang signifikan terhadap berpikir kritis (β=0,32, $p<0,05$). Temuan ini menekankan pentingnya strategi pedagogis untuk mengurangi penggunaan berlebih pada kecerdasan buatan.

***Kata Kunci**: Berpikir Kritis, Metode Pengajaran, Integritas Kecerdasan Buatan Generatif Teks*

INSTRODUCTION

Critical thinking is widely recognised a fundamental cognitive skill necessary for effective problem-solving, decision-making, and analytical reasoning (Cambridge Dictionary, n.d.-). Within the context of Master's students, critical thinking is often treated as a latent construct that is highly sensitive to both internal ethical dispositions and external environmental stimuli (Arifin et al., 2025). This process involves rigorous questioning of established academic norms and evaluation of complex evidence to make informed, high-level judgements (Rusdin et al., 2024). However, research indicates that Master's students often encounter difficulties with "advanced clarification" and the formulation of complex logical inferences, sometimes relying on "auxiliary abilities" like formatting and basic data presentation rather than demonstrating deep analytical rigour in their writing (Calma and Davies, 2025). Research indicates that higher education institutions increasingly emphasise critical thinking, with studies showing that students who develop these skills perform significantly better academically; for example, Karbalaei (2012) found a positive correlation between critical thinking ability and academic achievement, with a correlation coefficient of $r=0.65$ ($p<0.01$). As students advance academically, there is an expectation that they transition from rote memorisation to engaging in higher-order thinking processes such as analysis, synthesis, and evaluation (Facione, 2015). This shift is crucial because it enables students to critically assess information sources, recognise biases, and develop well-reasoned arguments; competencies increasingly necessary in an era dominated by vast amounts of digital information (Risko and Gilbert, 2016). Recent literature suggests that critical thinking is increasingly vulnerable to "cognitive offloading", where the lack of text-generative artificial intelligence integrity can lead to a measurable decline in intellectual originality and analytical rigor (Makrakis et al., 2025). Because critical thinking performance is not static, it functions as a critical indicator of whether a student is engaging in deep processing or merely bypassing cognitive labour through technological shortcuts (Alkam et al., 2026).

The evolution of text-generative artificial intelligence, spanning from early Generative Adversarial Networks (GANs) to sophisticated Large Language Models (LLMs) like ChatGPT, has fundamentally altered the landscape of higher education (Cao et al., 2023; M. Rahman et al., 2025). Academic integrity at the Master's level is not solely about the absence of artificial intelligence; it is about the nature of the student's engagement. While the lack of integrity poses a "trans-situational threat" to independent reasoning, structured implementation has been shown to potentially improve critical thinking when used as a tool for brainstorming and theory scrutiny rather than a substitute for intellectual effort (Harahap, 2024). Ultimately, maintaining the integrity of Master's students work requires navigating the history and limitations of these generative systems to ensure they serve as a catalyst for, rather than a replacement, of rigorous scholarship essential for a Master's degree (Cao et al., 2023; Moore and Gerlich, 2025). The rapid integration of artificial intelligence tools into higher education offers both significant opportunities and notable challenges for developing critical thinking skills (Abraham, 2024). Additionally, studies reveal that 37% of Master's students admitted to using artificial intelligence tools improperly, risking breaches of academic standards (Al Maharmah et al., 2025). For instance, Zhai et al. (2024) found that over-reliance on artificial intelligence dialogue systems was associated with a 15% decline in students' critical analysis skills over a semester. This dependence often leads to cognitive offloading, where students delegate mental tasks to artificial intelligence, thereby diminishing their internal cognitive engagement (Risko and Gilbert, 2016). This trend threatens academic integrity and the authenticity of student work, especially as artificial intelligence integrated content becomes increasingly indistinguishable from human-produced material (Chan, 2025). The lack of clear institutional policies further exacerbates these issues, resulting in inconsistent practices and lack of integrity (Sheikh et al., 2023).

In response to these challenges, the role of teaching methods becomes critically important. Educational strategies that promote active engagement have been shown to significantly enhance critical thinking. Master's students benefit significantly from interactive teaching strategies that leverage social negotiation and shared responsibility; (Senthamarai, 2018) highlights that interactive methods foster a classroom environment where ideas are exchanged dynamically, which is essential for the collaborative nature of Master's students. According to Arviani et al. (2023), the role of the teacher is to implement specific strategies that challenge students to analyse, evaluate, and create rather than simply recall information. These strategies are crucial for developing the "critical thinking dispositions" necessary for

Master's students to evaluate complex data and navigate the ethical challenges of modern research (Arviani et al., 2023). Bhardwaj et al. (2025) reported a 20% improvement in students' critical thinking score when employing student-centred pedagogies compared to traditional teacher-centred methods. These approaches foster independent analysis and reduce reliance on artificial intelligence, in contrast to teacher-centred strategies, which may inadvertently reinforce dependence on technology and limit opportunities for autonomous critical evaluation (Ameliana, 2017).

In the modern research environment, Master's candidate must navigate the dual role of artificial intelligence; while it offers significant benefits for theory scrutiny and idea generation, it simultaneously presents ricks of passive learning and a potential decline in the independent reasoning necessary for original research (Rusdin et al., 2024). Ultimately, success at this level requires Master's students to transition into "productive thinking" where they can systematically evaluate their own arguments at a granual level to ensure that every inference is both robust and contextually grounded (Calma and Davies, 2025; Lin et al., 2023).

METHODS

Research Design

This study employed a quantitative cross-sectional design to examine the associations between artificial intelligence (AI) integrity, teaching methods, and critical thinking. A deductive approach was utilized to test the hypothesized moderating effect of teaching methods (student-centered vs. teacher-centered) on the relationship between AI academic integrity and the critical thinking abilities of Indonesian Master's students. The research collected data by spreading a self-report questionnaire through WhatsApp and Instagram, containing participant data, informed consent, and the research instruments.

Participant

The target population consisted of active Master's students at Indonesian universities who utilize text-generative AI for academic purposes. Participants were recruited through purposive criterion sampling to ensure information-rich cases (Campbell et al., 2020). Criteria for inclusion were: (1) current enrolment in a postgraduate program in Indonesia, and (2) active use of text-generative AI tools for research, writing, or analysis.

Based on a priori power analysis conducted using G*Power 3.1.9.7 system, the required sample size was determined through a linear multiple regression: fixed model, R^2 deviation from zero. The analysis specified an effect size of 0.181 based on the R value from Hira Pervaiz et al. (2025) and Arviani et al. (2023) as the baseline of the effect size. The effect interaction was found through the multiplication which was then used to calculate the f^2. Furthermore, a significance level (α) of 0.05, desired statistical power of 0.8, and the number of predictors tested were 3 corresponding to the number of categorical levels tested. The computation yielded a total required sample size of 64 participants.

Instruments

Critical thinking was measured using the Critical Thinking Test (CTT) developed by Fajrianthi et al. (2016). Based on the Watson-Glaser Critical Thinking Appraisal (WGCTA) and developed through Item Response Theory (IRT), the CTT assesses five dimensions: inference, recognition of assumptions, deduction, interpretation, and evaluation of arguments. The instrument consists of 26 scenarios with 68 items. Previous psychometric evaluations reported an internal consistency coefficient of 0.83 and strong construct validity with RMSEA values ranging from 0.026 to 0.070 (Fajrianthi et al., 2016).

Ethical engagement with AI was assessed using the AI Academic Integrity Scale for Postgraduate Students (Maharmah et al., 2025). This 17-item scale utilizes a 5-point Likert-type format across three dimensions: ethical use of AI, awareness of integrity risks, and academic writing support. High scores indicate a higher level of integrity in AI usage. The scale demonstrates robust psychometric properties, including excellent fit indices ($\chi^2/df = 2.484$, CFI = .958, RMSEA = .041$) and a composite reliability of 0.752 (Maharmah et al., 2025).

A researcher-developed 9-item scale was used to measure students perceived exposure to student-centered learning (SCL) versus teacher-centered learning (TCL). Items covered instructional practices such as group discussions, discovery learning, and problem-based learning (Pritchard & Woollard, 2010; Zahara & Afni, 2015). Responses were recorded on a 4-point Likert scale (1 = *Completely does not match my experience* to 4 = *Very much matches my experience*). Higher aggregate scores represent a more student-centered instructional environment. The scale was validated through the Content Validity Index (CVI) and internal reliability testing.

Data Analysis

The primary data analysis technique will be Moderated Multiple Linear Regression conducted using Jamovi medmod(Windows). This method is specifically employed to test the core moderation hypothesis: whether learning methods alters the association between text-generative artificial intelligence integrity and critical thinking. Prior to the regression, the independent and dependent variable will be mean-centred (converted to z-scores) automatically by Jamovi medmod system. This critical step minimises potential multicollinearity and ensures that the main effects are interpretable. The interaction term will then be manually computed by multiplying the two centred variables (text generative artificial intelligence integrity x teaching methods).

RESULTS

Pearson correlation results showed a significant negative relationship between AI integrity and critical thinking ($r = -0.41$; $p < 0.001$) and between teaching methods and critical thinking ($r = -0.43$; $p < 0.001$). Furthermore, a strong positive correlation was observed between AI integrity and teaching methods ($r = 0.68$; $p < 0.001$). Regression analysis results demonstrated that AI integrity significantly predicted a decrease in critical thinking skills ($b = -0.157$; $SE = 0.070$; $p = 0.026$), as did teaching methods ($b = -0.326$; $SE = 0.119$; $p = 0.006$). However, moderation regression analysis showed that teaching methods did not significantly influence the relationship between AI integrity and critical thinking amongst Master's students ($b = 0.0115$; $SE = 0.0137$; $p = 0.404$). Simple slope analysis confirmed that despite visual differences in gradients, the interaction effect failed to reach statistical significance at either low ($p = 0.077$) or high ($p = 0.202$) levels.

DISCUSSION

The results of this study confirm that the lack of text-generative artificial intelligence integrity significantly predicts a decrease in critical thinking skills (β=-0.157, p=0.026). This finding aligns with the concept of cognitive offloading as described by Risko and Gilbert (2016). When students rely on text-generative artificial intelligence to generate answers or structure arguments, they bypass the essential cognitive struggles required for high-level analysis. Beyond the immediate loss of germane load, such reliance and dishonesty may lead to Kosmyna et al. (2025) term "cognitive debt. Unlike a single instance of offloading, cognitive debt refers to the cumulative deficit in mental processing power that occurs when students consistently use artificial intelligence for complex tasks. Over time, this "debt" may make it increasingly difficult for Master's students to reclaim the deep analytical skills required for their level of study, as the mental "muscles" for critical inquiry are rarely exercised (Moore and Gerlich, 2025). Consequently, the "efficiency" of artificial intelligence comes at the cost of the higher order thinking skills and critical dispositions required for master's students' success (Arviani et al., 2023; Gkintoni et al., 2025).

This is statistically supported by the Moderation Estimates in Table 4.8, which show a significant negative effect of text-generative artificial intelligence on critical thinking (Estimate=-0.157, p=0.026). Furthermore, the Simple Slope Estimates (Table 4.9) reveal that at an average level of student's engagement, the negative impact remains significant (Estimate=-.157, p=0.027). These values show that Master's students with low text-generative artificial intelligence integrity score also had a low critical thinking score. As Georgiou (2025) suggests, such lack of integrity can lead to lazy thinking, where students default to artificial intelligence generated outputs rather than engaging in the deep processing. In the context of Indonesian higher education, where testing-oriented environments already challenge the cultivation of critical thinking (Wilson and Defianty, 2024), the availability of text-generative artificial intelligence may exacerbate the tendency to prioritise the final answer over the intellectual process. From

the perspective of Cognitive Load Theory (Van Merriënboer and Sweller, 2005), when students use artificial intelligence to bypass academic tasks, they eliminate the "germane load", the mental effort required to construct long-term knowledge schemas. Furthermore, the lack of text-generative artificial intelligence integrity may reflect a shift in students' perceptions. Chan (2025) suggests that students are redefining academic misconduct as plagiarism, viewing artificial intelligence as a tool for efficiency rather than a breach of ethics. This particularly relevant for Master's students who may use artificial intelligence to manage heavy research workloads (Hanh and Duyen, 2025). The observed decline in critical thinking skills carrier serious implications for master's students transitioning into the professional sphere. If Master's students consistently utilise text-generative artificial intelligence to bypass analytical tasks, they risk entering the workforce with a "competency gap" (Indrašienė et al., 2021). This lack of independent reasoning and analytical depth could significantly limit their professional growth and adaptability in complex real-world work environments (Indrašienė et al., 2021).

The moderation estimates in Table 4.8 shows that teaching methods had a significant main effect on critical thinking (Estimate=-0.325). Interestingly, the negative coefficient suggests that a shift away from student centredness is associated with lower critical thinking scores. The estimate value for teaching methods (-0.3258) is significant than that of text-generative artificial intelligence integrity (-0.1572) suggests that the classroom environment is a predictor of critical thinking than the technology students use. This result supports the argument by Ameliana (2017) that the pedagogical approach is a fundamental driver of learning quality. While the moderation results for teaching methods were non-significant, the specific type of instruction may be a determining factor. Arifin et al. (2025) highlights that inquiry-based learning is particularly effective at fostering critical thinking skills through structured exploration. This suggests that general student centredness might be insufficient to counter the immediate convenience provided by artificial intelligence shortcuts (Zhai et al., 2024). The negative coefficient in this model suggests that as the environment becomes less student centred, critical thinking scores tend to decrease. This aligns with Bhardwaj et al. (2025), who state that student centred strategies are essential for redefining learning in the modern era. When students are passive recipients of information, they have fewer opportunities to practice the "Higher Order Thinking Skills" and critical thinking dispositions identified by Arviani et al. (2023).

The findings of this study are the rejection of the alternative hypothesis (p=0.404). Although it was predicted that a student centred teaching approach would buffer or protect students from the negative effects of text-generative artificial intelligence integrity, the data suggests that teaching methods do not significantly alter this relationship. The results from the Interaction Term in Table 4.8, which yielded a non-significant result (Estimate=0.011, p=0.404). Additionally, the simple slope estimates (Table 4.9) visually reinforce that although the negative impact of text-generative artificial intelligence integrity was numerically stronger in teacher centred environments (Estimate=-0.218) than in students centred ones (Estimate=-0.095), neither slope reached statistical significance (p=0.77, p=0.202). This indicates that while teaching style slightly alters the intensity of the relationship, it does not do so effectively enough to be considered a statistical moderator. As noted by Zhai et al. (2024), the efficiency of artificial intelligence dialogue systems is so high that it can override even the best designed student centred tasks. If the student perceived the artificial intelligence as a reliable "shortcut", the pedagogical environment may not be enough to prevent the decline in critical engagement. The decision to dishonestly use text-generative artificial intelligence is often driven by a desire for cognitive offloading (Risko and Gilbert, 2016) to manage academic stress. This suggests that the problem is not just how we teach, but how students perceive the utility of artificial intelligence in their academic life (Kang et al., 2024).

CONCLUSION

The study reveals a significant negative association between the lack of text-generative artificial intelligence integrity and the critical thinking skills of Master's students, though the statistical analysis demonstrates that teaching methods do not moderate this association. The detrimental impact of low text-generative artificial intelligence integrity remains constant regardless of whether the academic environment is teacher centred or student centred.

THANK YOU

The writer offers their sincere thank you to Dr. Rahkman Ardi, M.Psych., as the writers supervisor for his guidance, insight, and continuous support throughout the research process, along with family, friends, research participants, and everyone who has played a role in creating this research paper.

DECLARATION OF POTENTIAL CONFLICT OF INTEREST

Ni Gusti Ayu Purnami Luise and Rahkman Ardi do not work for, consult with, own shares in, or receive funding from any company or organization that might benefit from the publication of this manuscript.

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