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Fostering Critical Thinking in Academic Writing through a Meta-Reflective Model: Integrating Self-Assessment and Inquiry-Based Learning

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Meta-reflective;
Self-assessment,
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Critical thinking;
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Abstract

Academic writing in higher education requires students to demonstrate critical and reflective thinking skills. However, writing instruction rarely provides a systematic model that integrates metacognitive reflection into the writing process. This gap causes students to experience difficulties in linking self-reflection with the development of academic argumentation. This study aims to develop and examine the effectiveness of a meta-reflective writing model that integrates self-assessment and inquiry-based learning to enhance students' critical thinking skills. The study employed a research and development (R&D) approach encompassing a preliminary study, model design, expert validation, limited trials, and effectiveness testing. The participants consisted of two expert validators and 20 students enrolled in a language education program. Validation results indicated that the model was highly feasible, with a mean score of 4.47. Findings from the limited trials demonstrated improvements in the quality of students' written argumentation. Effectiveness testing using a one-group pretest–posttest design revealed a statistically significant increase in critical thinking scores from 22.1 to 44.4 ($p < 0.001$).These findings confirm that the meta-reflective writing model is effective, practical, and relevant as a pedagogical approach for strengthening critical thinking in academic writing, although further refinement of indicators at the pre-writing stage is still required.

Kata Kunci:
Meta-reflektif;
Penilaian diri;
Pembelajaran berbasis inkuiri;
Berpikir kritis;
Penulisan akademik.

Abstrak:

Penulisan akademik di perguruan tinggi menuntut kemampuan berpikir kritis dan reflektif. Namun praktik pembelajaran menulis masih jarang menyediakan model sistematis yang mengintegrasikan refleksi metakognitif dengan proses penulisan. Kesenjangan ini menyebabkan mahasiswa kesulitan mengaitkan refleksi diri dengan pengembangan argumentasi akademik. Penelitian ini bertujuan untuk mengembangkan dan menguji efektivitas model penulisan meta-reflektif yang mengintegrasikan *self-assessment* dan *inquiry-based learning* dalam meningkatkan kemampuan berpikir kritis mahasiswa.Penelitian menggunakan pendekatan *research and development* (R&D) melalui tahapan studi pendahuluan, perancangan model, validasi ahli, uji coba terbatas, dan uji efektivitas. Subjek penelitian melibatkan dua validator ahli dan 20 mahasiswa pendidikan bahasa. Hasil validasi menunjukkan bahwa model berada pada kategori sangat layak dengan skor rata-rata 4,47. Uji coba terbatas menunjukkan peningkatan kualitas argumentasi tulisan mahasiswa. Uji efektivitas menggunakan desain *one group pretest–posttest* menunjukkan peningkatan signifikan skor berpikir kritis dari 22,1 menjadi 44,4 ($p < 0,001$). Temuan ini menegaskan bahwa model penulisan meta-reflektif efektif, praktis, dan relevan sebagai pendekatan pedagogis untuk memperkuat berpikir kritis dalam penulisan akademik, meskipun penguatan indikator pada tahap pra-menulis masih perlu dikembangkan lebih lanjut.

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INTRODUCTION

In recent years, research on academic writing has increasingly converged on the role of critical thinking as a core cognitive foundation for producing coherent, argumentative, and scholarly texts. Drawing on cognitive and metacognitive perspectives, prior studies consistently suggest that the quality of academic writing is not merely a linguistic outcome, but rather a manifestation of higher-order thinking processes such as analysis, evaluation, and self-regulation. This perspective aligns with foundational theories of critical thinking that position reasoned judgment and reflective thinking as central to academic discourse. Empirical evidence further indicates that the use of metacognitive strategies is closely associated with students' critical thinking ability and writing performance, underscoring the importance of conscious planning, monitoring, and reflection during text production (Teng, & Yue, 2023). In a related vein, argumentative writing has been widely recognized as a valid medium for eliciting and assessing critical thinking, particularly through the construction of logical reasoning and claim evidence relationships (Sato, 2022). Although both strands of research emphasize individual cognitive engagement, they differ in their analytical focus, with metacognitive studies prioritizing strategic regulation and argumentative studies emphasizing textual structure as indicators of critical thinking.

Pedagogical research further reveals a directional shift from individual based cognitive models toward more interaction driven approaches to developing critical thinking through writing. Socially mediated learning environments, such as cooperative learning, have been shown to foster deeper critical engagement in EFL writing contexts (Zhang et.al, 2025). while dialogic instructional approaches, including Socratic questioning, strengthen students' capacity to formulate and defend arguments (Chang et al, 2024). More recent studies extend this discussion to digital writing environments, demonstrating that although Artificial Intelligence tools such as Chat GPT can support idea generation and text organization, their effective use presupposes strong critical literacy and deliberate cognitive control on the part of the writer (Salvagno, et al., 2023; Huang, & Tan, 2023). However, existing studies tend to examine critical thinking, metacognitive regulation, and AI-mediated writing as relatively separate dimensions, offering a limited explanation of how these elements interact as an integrated process within academic writing practices. Consequently, empirical evidence remains insufficient

in clarifying how such cognitive and pedagogical factors are simultaneously operationalized in contemporary higher education contexts.

Despite the growing body of research exploring the intersection between critical thinking and academic writing, persistent challenges indicate that existing pedagogical approaches have not fully addressed students' evaluative and argumentative difficulties. Empirical studies consistently report that many students struggle to critically evaluate AI-generated outputs when composing academic essays, reflecting weaknesses in higher-order evaluative capacity (Malik et al., 2023; Ou et al., 2024). Similar concerns are evident in conventional academic writing contexts, where students frequently fail to construct coherent, evidence-based scientific arguments despite having received formal writing instruction (Alshafie et al., 2025). Moreover, excessive reliance on AI tools may further diminish the depth of reasoning when critical thinking skills are insufficiently developed (Ramoni et al., 2024).

From a supervisory perspective, weak synthesis and argumentation have been identified as major obstacles in students' completion of scholarly work, suggesting that these difficulties extend beyond individual classroom practices and reflect broader instructional limitations. Pedagogical interventions such as problem-based learning and self-assessment although theoretically positioned to enhance critical reflection have also demonstrated limited and inconsistent impact in practice (Anggraeni, et al., 2023; Lin, 2025). The main gap, therefore, lies in the lack of context sensitive empirical studies that examine how critical thinking, critical literacy toward AI, and self-regulatory writing practices are integratively developed and sustained within Indonesian higher education, where academic writing instruction tends to prioritize formal structure and textual output over the systematic cultivation of evaluative and argumentative reasoning.

In response to these persistent pedagogical challenges, existing scholarship converges on three interrelated strategies for strengthening students' critical thinking in academic writing: reflective practice, argumentative competence, and information literacy. Research on AI-mediated writing highlights the importance of developing critical awareness and reflective literacy to ensure that technological assistance does not replace evaluative judgment (Darwin et al., 2024; Humphries et al., 2024). From an epistemic standpoint, understanding the nature of science has been shown to support systematic reasoning and coherent argument construction, thereby reinforcing the cognitive foundations of academic argumentation (Brock & Park, 2024).

Similarly, studies on argumentative writing consistently demonstrate its close alignment with critical thinking, suggesting that argumentation should be approached not

merely as a product-oriented skill, but as a reflective reasoning process (Beniche, 2023; Casado-Ledesma et al., 2023). Complementing these perspectives, information literacy and self-assessment practices have been identified as mechanisms that promote independent evaluation, revision, and metacognitive control in academic writing (Yu, 2023).Contextualized models further indicate that integrating local values and structured critical writing frameworks can enhance reflective analysis and disciplinary awareness (Harsono, et al., 2024a; Harsono, et al, 2024b; Harsono et al., 2024c). Nevertheless, despite their shared emphasis on critical engagement, these approaches are often implemented in isolation, and empirical evidence remains limited regarding how reflective practice, argumentation, and information literacy can be systematically and consistently integrated within a coherent academic writing pedagogy.

Responding directly to this identified research gap namely, the absence of integrative pedagogical models that systematically connect critical thinking, metacognitive regulation, and reflective engagement in academic writing, this study positions its contribution within the broader scholarly discourse on academic writing pedagogy. While previous studies have tended to address reflection, argumentation, and information literacy as largely discrete instructional components, the present study advances the field by proposing a meta-reflection writing model that integrates self-assessment and inquiry-based learning within a coherent pedagogical framework. Through this integration, critical thinking is operationalized not merely as an anticipated learning outcome, but as an ongoing cognitive and reflective process embedded in academic writing practices. Accordingly, this study aims to validate the proposed model through expert evaluation and preliminary trials, and to examine its effectiveness in enhancing students' critical thinking in academic writing contexts, thereby offering a theoretically grounded and pedagogically integrative contribution to contemporary academic writing instruction.

METHOD

This study employed a Research and Development (R&D) design based on the instructional design model proposed by Branch (2011), which provides systematic procedures for developing, validating, and evaluating educational innovations. The study aimed to develop and examine the effectiveness of a meta-reflective writing model that integrates self-assessment and inquiry-based learning to enhance students' critical thinking in academic writing. The R&D process was conducted through three core stages.

The first stage focused on model development, which included a preliminary study comprising a literature review and needs analysis, followed by model design grounded in reflective learning theory (Radović et al., 2023) and metacognitive strategy development (Loksa et al., 2022). The second stage involved model validation and limited trials, where expert validation was conducted to assess content relevance, construct coherence, and pedagogical feasibility, followed by a small-scale classroom implementation to examine the model's practicality. The third stage consisted of effectiveness testing to evaluate the model's impact on students' critical thinking and academic writing performance.

Two experts participated in the validation stage, specializing in learning strategies and academic writing pedagogy. Validation data were collected using an expert judgment instrument comprising 15 indicators across three aspects: content relevance, construct design, and practicality, rated on a four-point Likert scale (1 = not valid to 4 = very valid). The participants in the trial and effectiveness stages were undergraduate students enrolled in an Academic Writing course in a Language Education Program. Quantitative data included expert validation scores, pretest and posttest results of students' critical thinking and writing performance, while qualitative data were obtained from students' reflective notes and classroom observations.

Data collection was conducted sequentially across the three stages: expert validation during model development, a limited classroom trial involving students' essay writing through five meta-reflective stages (prewriting, drafting, self-reflection, revision, and finalization), and an effectiveness test using a one-group pretest–posttest design. Quantitative data were analyzed using descriptive statistics, the Shapiro–Wilk normality test, and paired-sample t-tests with a significance level of $\alpha = 0.05$. Qualitative data were analyzed thematically to identify patterns of change in students' critical thinking and academic writing quality. All statistical analyses were performed using IBM SPSS Statistics version 26.

RESULT AND DISCUSSION

Expert Validation of the Meta-Reflective Writing Model

The meta-reflective writing model integrating self-assessment and inquiry-based learning was first subjected to expert validation to examine its feasibility prior to classroom implementation. Two experts, one in learning strategies and one in academic writing pedagogy, evaluated the model across three dimensions: content, construction, and applicability. The validation results indicate that the model achieved a consistently high level of feasibility across all evaluated aspects.

For the content aspect, the model obtained an average score of 4.5, reflecting strong conceptual alignment, theoretical relevance, coherence of indicators, appropriateness of learning outputs, and effective integration of reflective components. These results suggest that the model is theoretically grounded and aligned with the objective of fostering students' critical thinking in academic writing. The construction aspect yielded an average score of 4.4, indicating clarity of instructional stages, internal consistency of instruments, integration among model components, and clarity of language and format. This finding demonstrates that the model is systematically organized and pedagogically comprehensible. The applicability aspect also achieved an average score of 4.5, reflecting high practicality, efficiency, ease of implementation, and strong potential to support critical thinking development in authentic learning contexts.

Validation Aspect	Validator 1	Validator 2	Average	Comments
Content	4.5	4.5	4.5	Highly Feasible
Construction	4.4	4.4	4.4	Highly Feasible
Applicability	4.5	4.5	4.5	Highly Feasible
Overall Average	–	–	4.47	Highly Feasible

Table 1. Summary of Expert Validation Scores

Based on the established feasibility range (4.21–5.00), the overall validation score of 4.47 places the model in the "Highly Feasible" category. Although minor revisions were recommended, particularly for clarifying critical thinking indicators in the pre-writing phase and enriching examples of reflection rubric use, the model was deemed suitable for instructional application. These results confirm that the meta-reflection writing model effectively integrates self-reflection and inquiry-based learning as complementary mechanisms for strengthening critical thinking (Gholam, 2019; Ülger, 2016).

Results of the Limited Classroom Trial

Following expert validation, a limited classroom trial was conducted to examine the practicality of the model and its initial impact on students' critical thinking in academic writing. Ten undergraduate students enrolled in an Academic Writing course participated in the trial, representing diverse writing proficiency levels.

Students implemented the meta-reflective framework through five sequential stages: pre-writing, drafting, self-reflection using a rubric, revision, and finalization. Academic writing tasks were contextualized through Madurese local wisdom topics, including Pamekasan batik, Rokat Tase', traditional healing practices, local culinary traditions, and indigenous agricultural systems. Students engaged in field observations

and interviews, developed initial drafts, and subsequently evaluated their work using structured reflection rubrics.

The trial results indicate that students were able to follow the meta-reflective stages systematically and demonstrated observable improvements in critical thinking behaviors. Specifically, students showed increased ability to identify issues, critically analyze empirical data, evaluate theoretical perspectives, and construct coherent and logically supported arguments. These outcomes suggest that the integration of self-assessment and inquiry-based learning effectively supports both reflective reasoning and evidence-based academic writing (Wale & Bishaw, 2020; Wale & Bogale, 2021).

Although students initially experienced challenges in understanding critical thinking indicators and integrating field data with theory, iterative reflection and peer feedback enabled them to identify weaknesses and revise their arguments more effectively. Overall, the trial confirmed that the model is practical and pedagogically functional, providing a strong foundation for effectiveness testing.

Effectiveness Test: Pretest–Posttest Results

The effectiveness of the meta-reflective writing model in enhancing students' critical thinking was examined using a one group pretest–posttest design. Prior to implementation, students' critical thinking scores ranged from 18 to 29, with a mean score of 22.1. Following the intervention, posttest scores increased substantially, ranging from 38 to 48, with a mean score of 44.4.

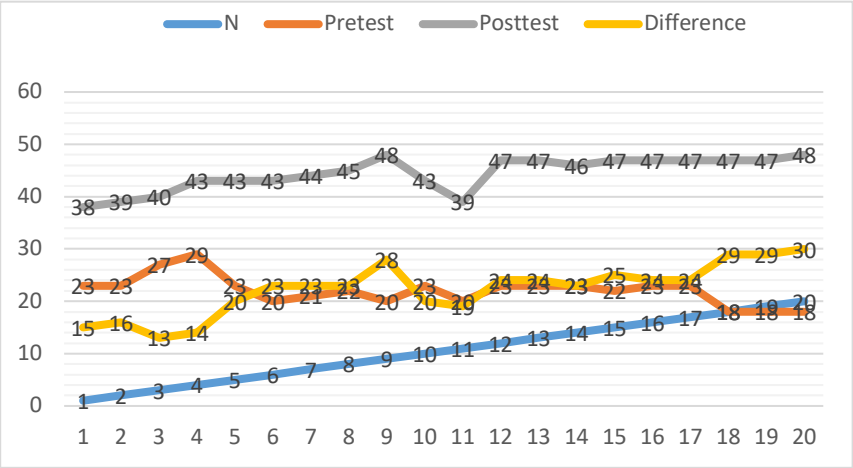

Figure 1. Students' Pretest and Posttest Scores

Before conducting inferential analysis, a Shapiro Wilk normality test was performed on the difference scores (posttest – pretest). The results indicated that the data were normally distributed (W = 0.936, p = 0.197), allowing for further parametric testing.

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pretest	22.10	20	2.751	.615
	Posttest	44.40	20	3.267	.731

Table 2. Paired Samples Statistics

As shown in Table 2, the posttest mean score nearly doubled compared to the pretest, indicating a substantial improvement in students' critical thinking performance following the implementation of the model. To determine whether this improvement was statistically significant, a paired sample t-test was conducted.

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
Pair	Pretest				Lower	Upper			
1	Posttest	-22.300	4.985	1.115	-24.633	-19.967	-20.005	19	.000

Table 3. Results of the Paired Samples Test

The results reveal a highly significant difference between pretest and posttest scores ($p < .001$), with a confidence interval that does not cross zero. This confirms that the meta-reflective writing model produced both statistically and practically significant gains in students' critical thinking skills, with an average gain score of approximately 22 points.

Strengthening Critical Thinking through Meta-Reflective Writing

The findings of this study demonstrate that the meta-reflective writing model effectively enhances students' critical thinking within academic writing contexts. The substantial gains observed between pretest and posttest scores (Tables 2 and 3) indicate that the integration of self-assessment with inquiry-based learning facilitates higher-order cognitive processes, including analysis, evaluation, and inference. Importantly, these improvements suggest that critical thinking development did not occur incidentally; rather, it emerged through a structured sequence of reflective inquiry that required students to repeatedly interrogate their assumptions, evidence, and argumentative decisions across successive stages of the writing process.

Consistent with Putikadyanto et al., (2024) and Yuendita & Dina (2024), the pre-writing stage grounded in local Madurese wisdom functioned as a critical entry point for contextualized inquiry. Instead of serving merely as thematic content, locally situated issues enabled students to engage in authentic problem identification, thereby strengthening epistemic curiosity and an inquiry-oriented stance toward knowledge construction (Morris, 2025; Ullrich et al., 2024).This contextual anchoring appears to

mitigate the abstraction gap often encountered in academic writing, allowing students to move more fluidly between lived experience and analytical reasoning.

Analysis of students' writing revealed three dominant patterns of improvement: enhanced argumentative coherence, stronger integration of theory and data, and increased analytical depth. During the drafting and revision stages, students increasingly refined their arguments through reflective evaluation and feedback, aligning with the critical thinking indicators articulated by Silva et al. (2025). This iterative process reflects what Reyes & Gonzalo (2025) describe as reflective revision, whereby learners internalize evaluative standards for their own arguments rather than relying solely on external correction. Nevertheless, persistent challenges in inferential reasoning and theoretical integration were observed, particularly in culturally rich topics such as ritual practices and traditional arts. These findings indicate that while contextual familiarity enhances engagement, it does not automatically translate into theoretical abstraction, supporting the arguments of Trein et al. (2023) and Wang et al. (2022) regarding the necessity of explicit scaffolding to connect empirical observation with conceptual frameworks.

The Role of Self-Assessment in Metacognitive Regulation

A key contribution of this study lies in the strategic integration of self-assessment at the initial stages of inquiry. Unlike conventional inquiry-based learning models that prioritize external exploration, the meta-reflective model embeds structured self-reflection to enhance metacognitive awareness both before and during knowledge construction (Alt & Raichel, 2020; Mannion, 2021). This design supports learners in monitoring cognitive readiness, identifying gaps in reasoning, and regulating learning strategies throughout the writing process(Tang et al., 2024; Yang & Yang, 2023).

The observed improvements challenge assumptions that students lack the capacity for meaningful self-reflection(Colomer, 2018; To & Panadero, 2019). When supported by clearly articulated rubrics and guided reflective prompts, students demonstrated increased accountability, more deliberate reasoning, and a greater willingness to revise their claims (Katser et al., 2025). Despite its demonstrated effectiveness, expert feedback and classroom observations indicate the need for clearer articulation of critical thinking indicators during the pre-writing phase. As Abdalah & Berger (2025) caution, insufficient instructional clarity may increase cognitive load and constrain learners' ability to allocate cognitive resources effectively. Consequently, future refinements of the model should incorporate more explicit exemplars, discipline-specific prompts, and scaffolded guidance

to support interdisciplinary reasoning, particularly in facilitating the transition from contextual data to theoretical interpretation.

Overall, the findings align with and extend prior research highlighting the benefits of integrating self-assessment and inquiry-based learning (Arifin, 2025; Lu et al., 2021; Qamariyah et al., 2021). Unlike earlier studies that treat reflective practice, argumentation, and inquiry as discrete pedagogical components, this study provides empirical evidence that their systematic integration within a meta-reflective writing framework yields more coherent and sustainable gains in critical thinking. Accordingly, this study contributes to academic writing pedagogy by conceptualizing critical thinking not as an end product of instruction, but as a sustained reflective process embedded within writing practice. While the proposed model is both conceptually robust and practically feasible, further research is warranted to examine its longitudinal impact and adaptability across diverse disciplinary and cultural contexts.

CONCLUSION

This study demonstrates that the meta-reflective writing model integrating self-assessment and inquiry-based learning is highly effective in enhancing students' critical thinking skills, particularly in academic writing contexts. Expert validation classified the model as "highly feasible," achieving an average score of 4.47 across three core dimensions content relevance, structural design, and practical applicability indicating its conceptual soundness and instructional viability. Findings from the preliminary classroom trial further reveal that students were able to engage systematically with the stages of pre-writing, draft development, reflection, revision, and finalization, which corresponded with observable improvements in key critical thinking indicators, including analytical reasoning, evaluation, logical justification, and reflective judgment. Moreover, results from the effectiveness test employing a one-group pretest–posttest design show a statistically significant increase in critical thinking performance, with mean scores rising from 22.1 in the pretest to 44.4 in the posttest ($p < 0.001$).

From a theoretical standpoint, the proposed model extends contemporary reflective learning theory by bridging Mezirow's transformative learning and Schön's reflective practice, thereby situating academic writing within a broader continuum of experiential and metacognitive learning frameworks. Collectively, these findings confirm that the meta-reflective model is both theoretically robust and pedagogically effective in promoting the development of critical thinking. Nevertheless, further refinement is warranted,

particularly in clarifying critical thinking indicators during the pre-writing phase and strengthening instructor scaffolding to facilitate deeper connections between empirical field data and interdisciplinary theoretical perspectives, thereby optimizing the model's instructional impact.

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