

Enhancing Students' Writing Skills through Learning Models and Levels of Critical Thinking of Students

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ABSTRACT

Objective: This study aimed to investigate variations in English writing proficiency based on learning models (Project-Based Learning and Cooperative Learning) and students' critical thinking levels. **Method:** This research employs a quantitative methodology, notably utilising a quasi-experimental design. This design integrates the non-equivalent control group method with a two-way factorial design methodology (2 x 3 ANOVA). 300 students participated in this study. Each group consisted of one hundred and fifty-five students. All students were competent Indonesian speakers. The first experimental group was given the PjBL learning model, while the second group was given the cooperative learning model. The employed sampling method is random sampling. **Results:** This study yielded three research findings: (1) disparities in writing proficiency among students adhering to distinct learning paradigms (PjBL versus Cooperative), evidenced by a significant value of $F=6.921$ and $\text{sig}.<0.05$ (2) Variations in writing proficiency among students classified according to high, medium, and low levels of critical thinking were significantly demonstrated with a F value of 5.836 and a significance level of $p<0.05$. (3) The interaction effect between learning models and students' critical thinking levels on writing skills was also significantly evidenced with a F value of 6.917 and a significance level of $p<0.05$. **Novelty:** The study's novelty lies in its integrative approach simultaneously comparing two constructivist learning models while analyzing how critical thinking shapes their impact on writing skills. By bridging theoretical inquiry with pedagogical practice, this research contributes to the refinement of writing instruction, and the advancement of educational theory.

INTRODUCTION

Effective writing instruction integrates multiple skills and cognitive strategies rather than treating them as isolated tasks. Writing is a crucial academic competence that requires students to combine accurate grammar, rich vocabulary, clear organization, and thoughtful ideas in coherent discourse (Hyland, 2022).

The text lists grammar, style, mechanics, lexical choice, and evaluation as components of writing and notes that writing is an intellectual act of turning ideas into organized discourse (Sofiya et al., 2018; Widosari et al., 2017; Winarni et al., 2021). It also recognizes writing as shaped by cognitive, linguistic, and psychological dimensions (Graham et al., 2018). However, these points are asserted rather than analytically connected. A deeper critical framing would emphasize that the challenge of writing lies not simply in having many subskills, but in coordinating them simultaneously under time and memory constraints. Without explicitly addressing this integration problem, the introduction risks recasting a complex theoretical issue as a familiar slogan ("writing is hard") instead of an argument that logically motivates the study.

The reported issues syntax, cohesion, coherence, paragraph structure, diction, orthography, and recurring grammar errors in plurals, articles, verb forms, clauses, passive voice, and prepositions mirror well-documented EFL writing difficulties (Widosari et al., 2017; Winarni et al., 2021). Yet the diagnosis remains largely descriptive. By presenting student weaknesses without examining their instructional origins, the argument risks implying that deficits reside mainly in learners rather than in the learning ecology. This is important because the kind of intervention proposed later (PjBL or cooperative learning) will only be persuasive if the introduction shows how those models target the causes rather than merely the symptoms of weak writing.

The proposal to address writing problems through innovative models is reasonable, and the text identifies PjBL and cooperative learning as student-centered paradigms that foster inquiry, collaboration, and autonomy. PjBL is framed as authentic and inquiry-driven, integrating problem solving and reflection (Mutakinati et al., 2018; Nugroho et al., 2019) and promoting creativity and critical thinking (Aguilera & Ortiz-Revilla, 2021; Fan & Cai, 2022; Hanif et al., 2019; Tiruneh et al., 2017). Still, the introduction's stance toward PjBL is more promotional than analytical. It names PjBL's strengths but does not sufficiently problematize its conditions of success. Even within the text, the admission that findings are inconsistent at higher educational levels signals that PjBL is not inherently effective across contexts. A critical introduction would foreground this conditionality earlier: PjBL demands extensive time, teacher expertise in project design, strong scaffolding for language and reasoning, and assessment systems that reward process as well as product. Without these conditions, PjBL may become uneven, privileging students who already have stronger autonomy or language resources. The text gestures toward inconsistency but stops short of explaining why this inconsistency might occur or why MAN 1 Serang is a setting where those constraints could be especially salient.

The theoretical positioning of PjBL in constructivism is sound: learning is treated as contextual, actively built, and socially mediated (Anazifa & Djukri, 2017; Purwaningsih et al., 2020). The comparison to Problem-Based Learning usefully clarifies that PjBL culminates in a tangible product, whereas PBL foregrounds inquiry as the main outcome (H. Chen & Yang, 2021; Siew & Ambo, 2018). Meanwhile, cooperative learning is introduced as a collaborative, goal-oriented group approach that supports idea exchange and collective problem solving (Gillies, 2016; Nasri & Biria, 2016). This is a credible parallel model for comparison. Yet here too, the framing remains generalized. Cooperative learning encompasses different structures (peer review, collaborative drafting, jigsaw tasks, role-based teams), and these structures vary in their cognitive payoff. Developing writing skills extends beyond effective communication, serving as a catalyst for critical thinking. By organizing ideas, constructing coherent arguments, and evaluating evidence, learners engage in deep analysis, identify assumptions, and synthesize perspectives. Writing thus functions as both a cognitive and expressive tool, enabling students to transform information into rigorous, evidence-based reasoning and bridging the gap between articulation and higher-order analytical thinking. Because MAN 1 Serang students show extensive grammatical and organizational problems, peer collaboration may not automatically yield improvement unless supported by clear roles and feedback training. The current introduction does not yet show awareness of these tensions, which weakens the comparative logic.

The clearest contribution of the introduction lies in its identification of a research gap: most studies examine PjBL or cooperative learning in isolation, measure writing holistically, and rarely analyze distinct subcomponents such as coherence, organization, grammar, and mechanics. This is a meaningful gap because different pedagogies plausibly support different aspects of writing. The introductory argument would be even stronger if it sharpened this point into a more explicit theoretical prediction namely, that inquiry-driven PjBL may be more likely to strengthen global rhetorical qualities, while cooperative learning may more strongly support revision, cohesion, or local accuracy through peer scaffolding. At present, the gap is stated, but its implications for the study's design are not fully developed.

The inclusion of critical thinking (CT) as a moderating factor is another important strength, since CT is repeatedly tied to higher-order writing quality (Tiruneh et al., 2017). The introduction argues that CT has been underexplored in relation to pedagogy and writing outcomes, and it draws on evidence that embedding CT indicators enhances analytical capacities (Nugroho et al., 2019). Still, the CT section partly drifts away from the central writing focus by leaning heavily on physics-education examples. While CT is cross-disciplinary, a critical introduction should prioritize writing-specific CT literature and only then use physics studies as supporting parallels. Otherwise, CT risks appearing imported rather than organically tied to L2 composition. Likewise, grounding CT in Bloom's higher levels (Al-Salmani & Thacker, 2021) is sensible, but the text could acknowledge that Bloom describes task complexity more than stable reasoning disposition. This limitation does not undermine the study; naming it would increase conceptual rigor. Similarly, critical thinking denotes a cognitive process used to achieve a logical conclusion, which eventually influences the decision to accept or act upon a proposition (Bhat & Bisati, 2025; Stanovic, 2025). This concept suggests that critical thinking is a deliberate and intentional endeavour aimed at attaining specific aims or objectives (Normile, 2025; Rezaee & Saleh, 2025; Steinert et al., 2025).

This study aimed to investigate variations in English writing proficiency based on learning models (Project-Based Learning and Cooperative Learning) and students' critical thinking levels. Conducted within the authentic setting of a state madrasah (MAN 1 Serang), in addition, the benefits of this research are to provide important information for curriculum developers and educational policy makers to consider the integration of active and collaborative learning models in language and literature subjects. This research provides contextually grounded evidence from Indonesian secondary education, where such comparative investigations are scarce. The study's novelty lies in its integrative approach simultaneously comparing two constructivist learning models while analyzing how critical thinking shapes their impact on writing skills. By bridging theoretical inquiry with pedagogical practice, this research contributes to the refinement of writing instruction, the advancement of educational theory, and the formulation of contextually relevant teaching strategies that prepare learners for the cognitive and communicative demands of the twenty-first century. This framework addresses the voids that have been identified and establishes a foundation for the investigation of the subsequent research questions: 1) Are there any differences in the writing abilities of students when using learning models such as PjBL and cooperative? 2) Is there a distinction in the writing abilities of students with high, medium, and low levels of critical thinking? 3) Is there an interaction effect between the learning models (PjBL and cooperative) and critical thinking on students' writing skill?.

RESEARCH METHOD

Research Design

This study uses a quasi-experimental, non-equivalent control-group design with a 2×3 factorial ANOVA (two factors, one with 2 levels and one with 3 levels). This study employs a factorial methodology to investigate the effects of two separate treatment variables, considered as factors, on the target population (Creswell & Poth, 2016). A non-equivalent control group design involves selecting a cohort from a specific demography, doing a pretest, and thereafter implementing the intervention. Subsequent to the therapy, participants undergo a post-test to assess the treatment's impact on the group (Creswell, 2014).

Participant

This research was conducted at Madrasah Aliyah Negeri 1 Serang. 300 students participated in this study. The study sample was selected using a random number table, a pre-generated chart of numbers arranged in rows and columns that enables unbiased random selection. To apply this method, each member of the population (N = 1,000) was first assigned a unique identification number. A starting point on the table was chosen at random, and numbers were read sequentially horizontally, vertically, or diagonally. Participants whose assigned numbers matched the numbers in the table were selected, while numbers outside the population range or duplicates were skipped. This process continued until the required sample size (n = 300) was reached. The use of a random number table ensures that each population member has an equal probability of selection, minimizing selection bias and producing a representative sample. Each group consisted of one hundred and fifty-five students. All students were competent Indonesian speakers. The first experimental group was given the PjBL learning model, while the second group was given the cooperative learning model. This study also tested the students' critical thinking skills. The population in this study consisted of 1,000 students from Madrasah Aliyah Negeri 1 Serang, Indonesia.

Instruments

The data gathering instruments comprised a writing assessment and a critical thinking questionnaire. All assessments were pre-tested in the preceding semester, and the student characteristics assessed closely mirrored those of genuine eleventh-grade English students. Validity and dependability were evaluated by Pearson Product-Moment Correlation. These metrics were established in alignment with recognised evaluation criteria in academic writing research, ensuring their relevance and appropriateness for the intended student demographic. The application of Cohen (1994) framework, which offers a systematic and proven structure for writing evaluation, significantly improved the reliability and objectivity of the assessment process. Assessments were conducted on students in both the experimental and control groups prior to the intervention (pre-test) and subsequent to the intervention (post-test), along with evaluations from the pre-and post-treatment questionnaires. Two autonomous English teachers were designated as assessors of the students' writing. The assessment criteria were derived from Cohen (1994) and encompassed content, organisation, language, grammar, and mechanics.

Table 1. Writing Test Assessment Rubric (Cohen, 1994)

Score	Criteria	Description
5 (Very Good)	Organization, Content & Development, Grammar and Style, Vocabulary	The grammar is superb, exhibiting good sentence diversity. The lexicon The composition is exceptionally organised, featuring solid paragraphs and distinct transitions. The concepts are distinctly articulated, well developed, and supported by compelling arguments. The grammar is superb, exhibiting good sentence diversity. The lexicon is abundant, exact, and diverse. Orthography and Punctuation.
4 (Good)	Organization, Content & Development, Grammar and Style, Vocabulary	The composition is consistent and features appropriate transitions. Thoroughly developed, yet certain sections are somewhat weaker. There are minor grammatical flaws that do not impede comprehension. significantly diverse and contextually suitable. Several inaccuracies, although they do not impede comprehension.
3 (Fair)	Organization, Content & Development, Grammar and Style, Vocabulary	The wording is clear; yet, the transitions between sections are abrupt. Content and idea development is comprehensible; yet, it is inadequately elaborated or lacking substantiating proof. Grammatical errors occur regularly, yet remain comprehensible. The vocabulary is constrained and occasionally lacks contextual relevance. Multiple mistakes that may hinder comprehension.
2 (Poor)	Organization, Content & Development, Grammar and Style, Vocabulary	The prose lacks clarity, and the paragraphs are incoherent. Content and Development Concepts are inadequately elaborated, exhibiting a deficiency in clear evidence or reasoning. Numerous grammatical faults that hinder comprehension. The vocabulary is significantly restricted and frequently lacks contextual relevance. Numerous flaws that obstruct comprehension.
1 (Very Poor)	Organization, Content & Development, Grammar and Style, Vocabulary	The writing lacks a coherent framework. Content and development Concepts are ambiguous or inadequately elaborated. Numerous grammatical faults render it difficult to comprehend. Vocabulary is exceedingly limited and frequently misapplied. Numerous flaws that are challenging to comprehend.

Data collection procedure and data analysis

The data collection occurred in two phases. The preliminary stage entailed formulating writing guidelines employing several writing approaches. Additionally, the researchers created educational situations for each class in accordance with the school's English curriculum. The researchers subsequently created the research instruments. The second phase concurrently entailed the execution of a writing and critical thinking methodology, encompassing data gathering activities, such as the administration of pre- and post-tests. In the initial week, participants completed a writing evaluation to gather data on students' writing competencies. Participants were subsequently given a student critical thinking assessment to gather data on their critical thinking levels. From the second to the fourteenth week, participants in both treatment groups the experimental group utilising the PjBL learning model and the control group employing the cooperative learning model attended one meeting weekly. Every class session endured for 100 minutes. The choice to have participants in both treatment groups the PjBL learning model class and the cooperative learning model class attend a weekly session from the second to the fourteenth week fulfilled various pedagogical and practical objectives, including: 1). Facilitating structured and concentrated learning;

Participants in the weekly sessions were permitted to engage in a methodical and focused educational setting without experiencing inhibition. 2). Designate time for reflection and execution; both educational frameworks necessitate extensive cognitive engagement, encompassing introspection, critical evaluation, and the enhancement of writing proficiency. 3). Alleviate cognitive overload. Weekly meetings create a consistent cadence that alleviates participant apprehension, hence promoting sustained advancement. 4). Determine a suitable duration for comparison; a 14-week interval (from weeks two to fourteen) offers sufficient exposure to the intervention while ensuring a pragmatic timetable for the study's objectives. Weekly sessions guarantee consistent exposure for both groups, establishing a controlled setting for evaluating the effectiveness of the writing skills. The weekly program adeptly balances profundity and accessibility, promoting active learning while providing ample opportunity for personal reflection and comprehension.

The experimental group received instruction via the PjBL learning model, while the control group was taught using the cooperative learning model. The implementation of the PjBL learning paradigm in Class A comprised six stages. The initial method was draughting, subsequently amending independently, and finally generating a second version for comments from educators and peers. The fifth phase involves creating a final draft, while the sixth step includes reflecting on the achievements seen in the final document. Between the second and fourteenth meetings, the PjBL learning model designates a 20-minute period at the end of each session for participants to write a reflective journal on their learning experiences. The reflection diary includes a course review, insights gained, and an assessment of personal development resulting from the experience. Participants are required to retain all their work, including in-class worksheets, reflections on feedback from teachers, composition drafts, projects, and evidence of their learning portfolio. In the sixth phase, the instructor delineates a plan on the board, detailing submission deadlines for outlines, initial drafts, revisions, and publishing timelines. The instructor provides an assessment rubric from the outset, enabling students to comprehend the anticipated standards of writing quality, encompassing topic, structure, language, and mechanics, including grammar and punctuation.

During the implementation phase, the educator reinforces the text genre to be utilised, namely the structure and linguistic characteristics of descriptive texts. Students subsequently engage in basic research pertinent to the issue, including observation, reviewing literature, or performing brief interviews. Subsequently, students develop a framework that encompasses the central thesis, supporting arguments, and a conclusion. Upon the teacher's approval of the outline, pupils compose the initial draft. The instructor traverses the classroom, offers illustrative sentences, aids in vocabulary choice, and reinforces the proper application of tenses and coherent devices. Upon completion of the draft, the process proceeds to peer review, when students exchange their papers and offer input utilising a straightforward checklist that assesses clarity of ideas, suitability of genre structure, diversity of language, and grammatical precision. The instructor underscores the importance of courteous and constructive feedback, fostering a supportive classroom environment aimed at enhancing writing quality. The subsequent phase involves revision and editing. Students amend their manuscripts in accordance with peer and instructor comments, subsequently assembling a final document.

The cooperative learning concept was implemented simultaneously in Class B through four stages. The initial process involved planning, followed by draughting, rewriting, and ultimately compiling the final form of the participants' works. Each session in the cooperative learning model class included a break of approximately 20 minutes after the teaching session. The instructor commenced the course by presenting the day's writing aim, such as composing a recount essay regarding a holiday event or a descriptive text about a preferred character. The instructor presented examples of brief texts and enquired about their structural attributes (identification-description for descriptive texts), emphasising significant linguistic components such as tense usage, adjectives, and conjunctions. Following the establishment of a preliminary understanding, the teacher organised students into small, heterogeneous groups of 4–5 individuals to guarantee a diversity of abilities within each group. Each group was assigned a common topic, after which members collaborated through cooperative stages: initially, they engaged in brainstorming to compile ideas, essential vocabulary, and principal sentences; subsequently, the teacher circulated to ensure all members participated and provided assistance with vocabulary or sentence structure challenges. The group collaboratively constructs an outline, establishing the opening paragraph, the sequence of ideas, and the concluding paragraph, subsequently allocating draughting responsibilities: one student composes the first paragraph, another the second, and so forth, while an additional member serves as a “language checker” to review grammar and vocabulary. Upon completion of all paragraphs, the group amalgamates the drafts and engages in peer editing: members review each other's work, offering kind and specific feedback (such as fixing tenses, enhancing details, or proposing more precise terminology), after which the group revises the drafts into a final edition. To enhance individual accountability in collaborative efforts, the instructor requests that each participant document a significant change they achieved or one of their most exemplary sentences from their modifications, ensuring that their individual contributions are evident. At the conclusion of the course, each group presents their work to the class or displays it on the classroom wall (a gallery walk), while the other groups offer concise feedback on both topic and language. The instructor concludes the lesson with a collective reflection: students articulate their insights gained from collaborative work, noting that ideas are more nuanced, grammatical errors are more readily identifiable, and writing becomes more manageable due to shared efforts. The instructor underscores that effective writing necessitates collaboration, revision, and reciprocal support, aligning with the fundamental tenets of cooperative learning.

The data analysis process commences with the presentation of descriptive statistical analyses, corresponding to the difficulties and hypotheses specified in this study. This analysis encompasses mean scores, variability metrics (standard deviation), minimum and maximum recorded scores, and Marginal Mean Estimates, all pertinent to students' writing competencies. This research utilised a Two-Way ANOVA using a 2 x 3 factorial design, employing inferential statistics for analysis. This analysis examined the influence of the learning model and students' critical thinking abilities on enhancing their writing skills. Before analysis, all data were checked to confirm adherence to normality and homogeneity standards.

RESULTS AND DISCUSSION

Results

This study examined the differences in improving students' writing skills through various learning models (Project-Based Learning versus Cooperative Learning) and the differing degrees of critical thinking among students classified as high, medium, and low. This study produced three research findings: (1) disparities in writing proficiency between students exposed to distinct learning models (PjBL versus Cooperative), (2) variations in writing proficiency among students classified by high, medium, and low levels of critical thinking, and (3) the impact of the interaction between learning models and students' critical thinking levels on writing proficiency, as demonstrated by the average pre-test and post-test scores. Assessments were conducted prior to and following the intervention to evaluate students' writing abilities. The findings revealed significant differences in writing proficiency between the two student cohorts. Marked discrepancies in critical thinking were seen between the two groups. Significantly, there were substantial disparities among students with high, medium, and low critical thinking ability. This was evident from the discrepancies in the average results reported by the various groups. Thus, Tables 2 and 3 provide an overview of students' writing competencies before and during the implementation of the learning model, including the degrees of critical thinking competency across various groups.

Table 2. Descriptive Statistics of the Control Group Writing Skill

Statistic	Critical Thinking	Pre-test	N	Post-test	N
Mean	High	61.15	79	67.60	25
	Medium	70.56	55	72.84	85
	Low	59.40	20	59.61	36
Standard Deviation	High	15.281	79	27.401	25
	Medium	12.282	55	17.069	85
	Low	15.166	20	26.822	36

The pre-test results for the control group indicated that students demonstrating a high degree of critical thinking attained an average writing skill score of 61.15, with a standard deviation of 15.281. Students categorized as possessing moderate critical thinking skills achieved a mean writing proficiency score of 70.56, accompanied by a standard deviation of 12.282. Students identified as demonstrating underdeveloped critical thinking skills achieved a mean writing proficiency score of 59.40, with a standard deviation of 15.166. Post-test results for the control group indicated that students exhibiting a high degree of critical thinking attained a mean writing skills score of 67.60, with a standard deviation of 27.401. Students demonstrating intermediate critical thinking proficiency attained a mean writing skills score of 72.84, with a standard deviation of 17.069. Students exhibiting deficient critical thinking abilities attained a writing score of 59.61, accompanied by a standard deviation of 26.822. This investigation's findings elucidate the research phenomenon.

Table 3. Descriptive Statistics of the Experimental Group Writing Skill

Statistic	Critical Thinking	Pre-test	N	Post-test	N
Mean	High	72.89	74	85.75	46
	Medium	72.43	47	76.85	44
	Low	71.42	25	73.98	64
Standard Deviation	High	13.164	74	15.730	46
	Medium	13.379	47	21.623	44
	Low	12.769	25	20.887	64

The pre-test findings for the experimental group indicated that students with enhanced critical thinking skills attained an average writing ability score of 72.89, with a standard deviation of 13.164. Students identified as possessing a moderate level of critical thinking ability achieved an average writing skills score of 72.43, with a standard deviation of 13.379. Students identified as lacking adequate critical thinking skills attained an average writing score of 71.42, accompanied by a standard deviation of 12.769. The post-test findings of the experimental group indicated that students exhibiting a high level of critical thinking attained an average score of 85.75 in writing skills, with a standard deviation of 15.730. Students demonstrating intermediate critical thinking proficiency attained an average writing skills score of 76.85, with a standard deviation of 21.623. Conversely, the cohort of pupils exhibiting insufficient critical thinking abilities attained a writing score of 73.98, accompanied with a standard deviation of 20.887. The results of this investigation elucidate this research phenomenon.

Table 4. Test of ANOVA 2 ways

Dependent Variable: Writing Skill					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	11523.699a	5	2304.740	4.581	.000
Intercept	1325087.528	1	1325087.528	2633.688	.000
Learning_Models	1972.533	1	1972.533	6.921	.002
Critical_Thinking	5872.157	2	2936.079	5.836	.003
Learning_Models * Critical_Thinking	4948.249	2	2474.125	6.917	.004
Error	147920.221	294	503.130		
Total	1777474.000	300			
Corrected Total	159443.920	299			

a. R Squared = ,072 (Adjusted R Squared = ,056)

The findings from the hypothesis test analysis in Table 4 reveal a statistically significant disparity in the English writing proficiency of students employing the cooperative learning strategy compared to PjBL. The result was derived by juxtaposing the computed F value with the F table value at a 5% significance threshold in a two-way parametric analysis. The computed F value ($F = 6.921$) surpasses the crucial F value from the standard F table (3.87), signifying statistical significance. The acquired significance value (0.002) is beneath the established significance threshold of 0.05. This study employed a two-way analysis of variance to examine the variability among groups. This methodology aligns with the stated study objectives and the criteria for the problem defined by the researcher. Moreover, a high degree of competency in critical thinking profoundly influences pupils' capacity to write in English. The outcomes of the two-way ANOVA parametric test illustrate this by juxtaposing the computed F value with the critical F value from the F table at a significance threshold of

5%. The statistical significance value of 0.003, which is below 0.05, signifies that the computed F value ($F = 5.836$) exceeds the F table value (3.87).

The third conclusion of the study reveals an interaction impact between the learning model (PjBl versus cooperative learning) and the degree of critical thinking on English writing skill. The outcomes of the two-way parametric test involve juxtaposing the computed F value with the F table value at the 5% significance threshold. The computed F value of 6.917 surpasses the essential F value of 3.87 from the standard F table, while the significance value of 0.004 is below the established significance level of 0.05. The educational framework and pupils' critical thinking skills substantially impact their English writing performance. In contrast, the R-squared value of 0.72 signifies that 72% of the variability in students' English writing performance is due to the interplay between the learning model and their critical thinking abilities. The findings of this study are corroborated by the hypothesis analysis, which demonstrates a statistically significant interaction between the learning model and students' critical thinking levels (high, medium, and low). This link profoundly influenced pupils' English writing abilities. Researchers performed further evaluations utilizing a follow-up test or Tukey test. The study demonstrated a statistically significant difference in the writing proficiency of students who engaged in the learning model intervention.

Table 5. Using Tukey Test

Multiple Comparisons						
Dependent Variable: Writing Skills						
Tukey HSD						
(I) Critical Thinking	(J) Critical Thinking	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
High	Moderate	9.95*	3.546	.001	2.95	16.62
	Low	9.97*	3.631	.002	1.02	15.04
Moderate	High	9.95*	3.546	.001	16.62	2.95
	Low	4.75	1.523	.173	1.47	1.47
Low	High	9.97*	3.631	.002	1.02	15.04
	Moderate	4.75	1.523	.173	1.47	1.47

Based on observed means.

The error term is Mean Square (Error) = 70.232.

*. The mean difference is significant at the .05 level.

Table 5 illustrates the connection between the learning model and students' English writing skill, accounting for varying levels of critical thinking (high, medium, and low). The subsequent findings are presented: 1). The interaction coefficient for critical thinking levels between the high and medium proficiency groups is $M = 9.95$. A significance value below 0.05 signifies the rejection of the null hypothesis. The results demonstrate a disparity in English writing quality between pupils exhibiting strong and moderate critical thinking skills. 2). The interaction coefficient for the high and low critical thinking groups is $M = 9.97$. A significance value below 0.05 necessitates the rejection of the null hypothesis (H_0). The study indicates a discrepancy in English writing proficiency between persons exhibiting strong critical thinking skills and those lacking such abilities. 3). The interplay between medium and high levels of critical thinking results in $M = 9.95$, signifying a variation in pupils' writing abilities. Should the significance threshold be below 0.05, the null hypothesis (H_0) is dismissed. This study

indicates a disparity in English writing quality between students with moderate and high levels of critical thinking skills. The interaction coefficient for the groups exhibiting medium and low levels of critical thinking is $M = 4.75$. The significance level surpasses 0.05, hence validating the acceptance of H_0 . The findings reveal no distinction in the English writing capability of pupils classified as possessing medium and low levels of critical thinking skills. 5). The correlation of contact between groups with low and strong critical thinking skills is 9.97. A significance level greater than 0.05 results in the rejection of the null hypothesis. The findings reveal a disparity in English writing proficiency between pupils with deficient and robust critical thinking skills. 6). A significance level of 0.05 denotes that the interaction coefficient between the low and medium critical thinking groups is 4.75, leading to the acceptance of the null hypothesis (H_0). The data demonstrate that pupils' English writing performance is stable, irrespective of their critical thinking skills. The subsequent graph approximates the marginal means between the learning model and students' critical thinking abilities concerning their English writing competency. As seen in Figure 1.

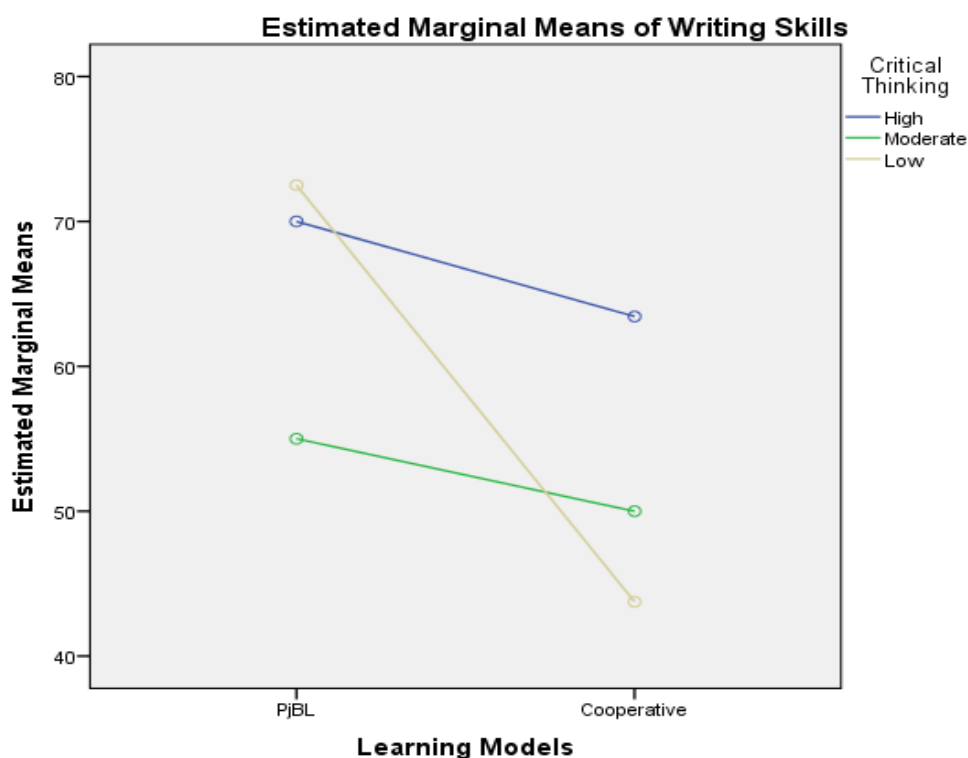


Figure 1. Estimated Marginal Means

Discussion

This research yielded three principal findings: 1) Variations exist in writing proficiency when employing different learning models (PjBL and cooperative). 2) Variations in writing proficiency exist among students with high, medium, and low levels of critical thinking. 3) An interaction exists between learning models (Project-Based Learning and cooperative learning) and the degree of critical thinking in English writing skills. The first findings of this study indicate discrepancies in writing proficiency contingent upon the application of learning models (PjBL and cooperative).

The first findings of this study indicate discrepancies in writing proficiency contingent upon several educational paradigms. The results of this study align with prior research (Aghajani & Adloo, 2018; Andargie et al., 2025; Arochman et al., 2024; Chao et al., 2025; Hakimah, 2023; Khair et al., 2021; Patmasari et al., 2025; Ratu et al., 2025; Susanti et al., 2020; Yusuf et al., 2019) indicating that Project-Based Learning (PjBL) and cooperative learning substantially enhance students' writing abilities. Prior research indicates that both Project-Based Learning (PjBL) and cooperative learning enhance students' writing abilities; thus, this study addresses the integration of PjBL and cooperative learning to further develop these capabilities. This project-based learning initiative seeks to enhance students' academic and linguistic abilities. The use of the PjBL paradigm enables students to engage in project creation and creative thinking while actively participating in the learning process (Chen et al., 2019; Winarni, 2023; Yamin et al., 2020).

The second research conclusion indicates variations in students' writing proficiency aligned with high, medium, and low levels of critical thinking. This research outcome corroborates earlier studies (Indah et al., 2022; Istiara & Lustyantie, 2017; Lustyantie et al., 2022; Murtadho, 2021; Rahmat et al., 2020; Suteja & Setiawan, 2022; Wati et al., 2025) indicating a positive association between critical thinking and students' writing proficiency. The analysis of pre-test, post-test, and follow-up data revealed four student groups exhibiting effective critical thinking, signifying substantial writing proficiency: high vs. medium group, high vs. low group, medium vs. high group, and low vs. high group. This study's findings correspond with prior research indicating a positive association between students' critical thinking abilities and the quality of their writing. Cognition and composition are interrelated. The writing abilities exhibited by learners demonstrate the processes they undergo during critical thinking (Rahmat, 2020).

The interaction between learning models and students' critical thinking skills in English writing proficiency is a recent research discovery. The research findings reveal a significant interaction between learning models and students' critical thinking skills regarding English writing proficiency. Comprehensive studies on English writing proficiency have concentrated on the efficacy of diverse pedagogical frameworks, including Project-Based Learning, Problem-Based Learning, Collaborative Learning, and Genre-Based Approach. Numerous research indicate that student-centered learning methods can markedly enhance the quality of English writing in comparison to traditional models. Nevertheless, the majority of these research have concentrated exclusively on the direct impact of learning models on writing proficiency, neglecting variations in students' cognitive attributes.

Conversely, critical thinking skills have been recognised as a significant element in English writing proficiency. Prior study indicates that children exhibiting elevated critical thinking skills demonstrate superior capabilities in concept organisation, argument development, and language structure utilisation. Nevertheless, these research predominantly investigated the impact of critical thinking in isolation, rather than in conjunction with the application of certain learning paradigms. The research gap exists due to the absence of optimal empirical studies examining the simultaneous interaction between learning models and students' critical thinking levels on English writing proficiency, specifically within the EFL context, utilising an experimental design that facilitates statistical analysis of the interaction.

This research is unusual in its investigation of the interaction effect between learning models and students' critical thinking skills on English writing proficiency, rather than merely assessing the impact of each variable in isolation. This research presents a novel contribution by illustrating that the efficacy of a learning model is not universal but contingent upon students' cognitive attributes. This study introduces methodological innovation using a factorial experimental design (e.g., 2x3), facilitating a comprehensive analysis of the differential effects of learning models on students with varying levels of critical thinking. This methodology offers more robust empirical data compared to earlier descriptive or correlational research..

CONCLUSION

Fundamental Finding : The research results validate three key findings: 1) Disparities in writing proficiency among students exposed to distinct learning models (Project-Based Learning versus Cooperative Learning), (2) variations in writing proficiency among students classified by high, medium, and low critical thinking levels, and (3) the impact of the interaction between learning models and students' critical thinking levels on writing proficiency. **Implication :** These research findings substantiate constructivist theory, which posits that learning is more efficacious when students actively construct knowledge through interaction, problem-solving, and critical reflection. This study affirms that writing proficiency is influenced not only by instructional methods but also by students' cognitive traits. **Limitation :** This research possesses multiple limitations. The primary constraints are the brief timeframe and restricted financial resources. The study exclusively targeted Madrasah Aliyah (Islamic Senior High School), excluding all other school levels. Moreover, the disproportionate allocation of students among groups and the concise data analysis were noteworthy. **Future Research :** Future research should repeat this study with bigger, more varied populations and varying educational levels. The "Further Research" section recommends investigating specific blended learning models in greater depth, highlighting areas where future studies could examine their effectiveness, implementation strategies, and impact on student learning outcomes writing skill.

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