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Original Article

A Quasi-Experimental Study of Inquiry-Based Learning for Enhancing Motivation and Reflective Thinking in EFL Recount Writing

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Abstract: This study investigated the effectiveness of ChatGPT-assisted Inquiry-Based Learning (IBL) in enhancing English as a Foreign Language (EFL) students' writing performance, reflective thinking, and motivation. A quasi-experimental pretest–posttest non-equivalent control group design was employed with 80 undergraduate EFL students assigned to either a conventional IBL group or a ChatGPT-assisted IBL group. Data were collected through IELTS-based writing assessments and validated questionnaires on reflective thinking and motivation and analyzed using descriptive and inferential statistics. The findings showed that students in the ChatGPT-assisted IBL group significantly outperformed those in the conventional IBL group in writing performance, reflective thinking, and motivation. Positive associations were also observed among the three learning outcomes, suggesting that integrating generative AI into inquiry-based instruction supports both cognitive and affective aspects of learning. These findings highlight the pedagogical potential of ChatGPT to enrich inquiry-based writing instruction by promoting reflective learning, increasing student motivation, and improving writing quality. Although the quasi-experimental design limits causal inference, the study provides empirical evidence supporting the integration of generative AI into EFL teaching and offers practical implications for AI-enhanced language learning in higher education.

Keywords: Inquiry-based learning; Generative AI in education; EFL writing; Reflective thinking; Recount text writing.

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INTRODUCTION

The integration of technology in English as a Foreign Language (EFL) classrooms has become increasingly important in response to the demands of 21st-century learning, which emphasize digital literacy, critical thinking, and learner autonomy (Elitasari, 2022;

Isma et al., 2023; Ningsih, 2019). Among the four language skills, writing is particularly challenging because it requires learners to simultaneously manage linguistic knowledge, higher-order thinking processes, and sustained motivation (Dörnyei & Ushioda, 2010; Guay et al., 2000; Schunk & DiBenedetto, 2020). In recent years, artificial intelligence (AI), especially generative tools such as ChatGPT, has gained considerable attention as a potential resource for supporting language learning and writing instruction (Karataş et al., 2024; Kohnke et al., 2023; P.-H. Li et al., 2025). Existing studies generally report that AI-assisted tools can enhance writing quality by providing immediate feedback, facilitating idea generation, and reducing the cognitive burden associated with composing texts (Alsaedi, 2024; Li et al., 2025; Mahande et al., 2026). However, the literature also presents concerns regarding learners' overreliance on AI-generated content and the extent to which such tools genuinely promote deeper cognitive engagement, reflective thinking, and intrinsic motivation during the writing process. While previous studies have largely focused on the impact of AI on writing performance, relatively limited attention has been given to how generative AI can be integrated within established pedagogical approaches to simultaneously support cognitive and motivational outcomes. This gap highlights the need to investigate the role of ChatGPT when embedded in inquiry-based learning environments, particularly in EFL writing contexts where reflective thinking and motivation are essential for meaningful learning.

From a theoretical perspective, this study is grounded in constructivist and socio-constructivist learning theories, which view learning as an active process in which learners construct knowledge through experience, inquiry, and social interaction. Inquiry-Based Learning (IBL) is closely aligned with these perspectives because it encourages learners to formulate questions, investigate problems, evaluate information, and reflect on their understanding (Pedaste et al., 2015). In EFL contexts, such processes are particularly important because language development requires learners to actively negotiate meaning, organize ideas, and engage in critical reflection during communication and writing activities. Previous research has shown that IBL can promote student engagement and deeper understanding of language use, while technology-enhanced inquiry environments provide meaningful opportunities for learner-centered exploration (H.-W. Huang et al., 2024).

Within the context of this study, ChatGPT serves as a cognitive and interactive support tool that can extend the inquiry process rather than simply provide answers. Through generating ideas, offering linguistic suggestions, and providing immediate feedback, ChatGPT may help learners explore multiple perspectives, refine their understanding, and engage more deeply in reflective writing activities. From a socio-constructivist perspective, interactions between learners and AI-generated feedback can function as a form of scaffolded learning that supports knowledge construction and problem-solving during the writing process. Consequently, the integration of ChatGPT within an IBL framework is theoretically expected to facilitate not only improved writing performance but also greater reflective thinking and learning motivation, which are central outcomes examined in this study.

A growing body of literature has examined the role of feedback in writing development, consistently identifying it as a crucial factor in improving learners' writing accuracy, organization, and overall performance (W.-Y. Li et al., 2023; H. Sun & Wang, 2025; Vasu et al., 2022). Effective feedback enables learners to identify weaknesses, revise their work, and develop greater awareness of language use over time (Teng, 2024a).Traditionally, feedback has been provided by teachers and peers, offering contextualized guidance and opportunities for social interaction (Chinpakdee, 2026; Guo et al., 2024; Miao et al., 2023). However, such feedback may be constrained by time, workload, and limited opportunities for immediate revision. In contrast, advances in artificial intelligence have expanded the availability of feedback through systems such as ChatGPT, which can generate rapid responses and adaptive suggestions based on learners' inputs (Hyland, 2026; Kaur, 2026; Mi et al., 2026; Yan et al., 2024). While AI-generated feedback may not fully replicate the pedagogical judgment and contextual sensitivity of human feedback, it can provide timely support that encourages iterative revision and continuous engagement with the writing process. Moreover, depending on the quality of learner prompts and interactions, tools such as ChatGPT can offer feedback that is responsive to individual writing needs, thereby extending learning opportunities beyond the classroom. This shift from exclusively human-mediated feedback to technology-enhanced feedback environments highlights the potential of AI to complement, rather than replace, traditional forms of writing support.

The theoretical framework of this study integrates Inquiry-Based Learning, feedback theory, and AI-supported learning. IBL provides the pedagogical structure, while feedback theory explains how learners improve through iterative revision. AI, particularly ChatGPT, acts as a mediating tool that enhances both processes by offering real-time interaction and scaffolding. This aligns with recent perspectives that view AI as a "writing collaborator" capable of supporting learners in generating ideas and improving textual quality (Y. Huang & Wang, 2025).

Previous research has demonstrated the potential benefits of integrating artificial intelligence into EFL writing instruction. Studies have reported that ChatGPT can support writing performance, learner engagement, and self-efficacy by providing learners with immediate access to ideas, language suggestions, and revision support (Teng, 2024b). Similarly, technology-enhanced implementations of Inquiry-Based Learning (IBL) have been associated with improved learning outcomes and greater student engagement (Parsaiyan & Gholami, 2026). However, existing studies have largely examined AI-assisted learning and inquiry-based approaches separately, leaving limited understanding of how these elements interact within the writing process. From an integrated perspective, IBL provides the pedagogical structure through which learners formulate questions, investigate ideas, construct knowledge, and reflect on their learning, while feedback functions as a mechanism for monitoring and refining understanding throughout these stages. Within this framework, ChatGPT can serve as a writing collaborator and scaffolding tool by generating prompts during inquiry, supporting idea exploration, providing feedback on draft texts, and encouraging revision and reflection. Through these interactions, AI-mediated feedback may facilitate deeper engagement with the inquiry

cycle, enabling learners to continuously evaluate and improve their writing. Consequently, the combination of ChatGPT and IBL is expected to support not only writing performance but also the reflective and motivational processes that underpin effective language learning, thereby warranting further empirical investigation.

Despite these advancements, a significant gap remains in understanding how ChatGPT can be systematically integrated within an inquiry-based framework, particularly in EFL writing contexts. This gap is partly attributable to the relatively recent emergence of generative AI in education, which has led much of the existing research to focus on the effectiveness of AI tools or pedagogical approaches in isolation rather than examining their combined implementation within a coherent instructional model. As a result, studies have tended to investigate either AI-assisted writing or Inquiry-Based Learning (IBL) separately, providing limited insight into how these approaches may interact to support language learning. Moreover, although a small but growing body of research has begun to explore the broader educational effects of AI-supported learning, evidence regarding its simultaneous impact on both cognitive outcomes (e.g., writing performance and reflective thinking) and affective outcomes (e.g., motivation) remains limited and inconclusive. Consequently, there is a need for empirical research that examines how ChatGPT-assisted IBL influences multiple dimensions of learning within a single framework. Addressing this gap may contribute to a more comprehensive understanding of how generative AI can be pedagogically integrated to support not only writing achievement but also the reflective and motivational processes that underpin successful EFL learning.

The novelty of this research lies in its systematic integration of ChatGPT within the structured phases of Inquiry-Based Learning (IBL), resulting in a hybrid instructional model termed ChatGPT-assisted IBL. While previous studies have primarily employed AI tools as sources of automated feedback or writing assistance during the revision stage, relatively few have examined how generative AI can support learners throughout the broader inquiry process. In the proposed model, ChatGPT is embedded across multiple phases of inquiry—including questioning, investigation, idea development, feedback, and reflection—thereby extending its role from a feedback provider to an active learning scaffold that supports knowledge construction and writing development. Furthermore, existing research has often focused on a single outcome, such as writing performance or learner engagement, limiting understanding of the broader educational impact of AI-assisted instruction. By simultaneously examining writing performance, reflective thinking, and motivation, this research offers a more comprehensive evaluation of both cognitive and affective learning outcomes in EFL writing contexts. Consequently, the study contributes not only to the growing literature on AI-assisted language learning but also to the development of pedagogically grounded approaches for integrating generative AI into language education.

Accordingly, this research aims to examine the effectiveness of ChatGPT-assisted Inquiry-Based Learning (IBL) in enhancing students' writing performance, reflective thinking, and motivation in EFL recount text writing. Specifically, it investigates whether integrating ChatGPT within an inquiry-based instructional framework produces significantly different outcomes compared with conventional IBL. Beyond evaluating

learning outcomes, the research seeks to provide empirical evidence on how generative AI can be meaningfully embedded within the inquiry process to support idea generation, reflection, feedback, and writing development. The findings are expected to contribute to the growing field of AI-assisted language learning by advancing understanding of the relationship between AI-supported inquiry and student learning outcomes. Furthermore, the study offers practical pedagogical implications for EFL educators by identifying ways to integrate generative AI into writing instruction that promote not only writing achievement but also students' reflective engagement and learning motivation.

METHOD

This study employed a quasi-experimental research design using a pretest–posttest non-equivalent control group design (Chu, PH. and Chang, 2017; Creswell & Creswell, 2018). This design was selected due to institutional constraints that made random assignment of participants impractical, as intact classes were used in the natural classroom setting. The purpose of the study was to examine the effectiveness of ChatGPT-assisted Inquiry-Based Learning (IBL) compared to conventional IBL in enhancing students' writing performance, reflective thinking, and motivation in an EFL context. Both groups received instruction based on the IBL framework; however, in the experimental group, ChatGPT was integrated as both a scaffolding and feedback-support tool to assist learners during the inquiry, drafting, and revision stages, whereas the control group relied on traditional instructional resources and teacher- or peer-mediated feedback without AI assistance.

The participants of this study were 80 undergraduate students enrolled in an English as a Foreign Language (EFL) writing course at a university. All participants were non-English majors with intermediate-level English proficiency, as determined by institutional placement criteria, and were distributed across two intact classes of similar academic standing. The students were divided into a control group (n = 40), which received conventional Inquiry-Based Learning (IBL) instruction, and an experimental group (n = 40), which received ChatGPT-assisted IBL instruction. Grouping was based on existing class arrangements, and random assignment was not feasible due to institutional scheduling constraints, which justifies the use of a quasi-experimental design. Although this non-equivalent grouping may introduce potential selection bias, efforts were made to minimize initial group differences by ensuring comparable proficiency levels and similar instructional conditions prior to the intervention.

Students' writing performance was measured using a writing test based on recount text tasks. The assessment employed an adapted IELTS writing rubric (Cambridge Assessment English, 2019), which evaluates four criteria: task achievement, coherence and cohesion, lexical resource, and grammatical range and accuracy. Each criterion was scored on a standardized scale ranging from 1 to 9, with equal weighting applied across all four components. The final writing score was calculated by averaging the scores of the four criteria to produce an overall performance score. To ensure scoring consistency, all writing scripts were assessed independently by two trained raters familiar with IELTS writing assessment standards. Inter-rater reliability was calculated prior to final scoring, and

discrepancies were resolved through discussion to reach consensus. This procedure was implemented to enhance the reliability and validity of the writing assessment results.

Reflective thinking was measured using a 13-item questionnaire adapted from Jack Mezirow's reflective thinking framework, covering four dimensions: self-awareness and critical assessment, awareness of others' perspectives, integrative reflection, and transformative reflection (Mezirow, 1990). Motivation was assessed using a 15-item questionnaire adapted from Paul R. Pintrich et al. (1991), encompassing intrinsic goal orientation, extrinsic goal orientation, task value, self-efficacy, and control of learning beliefs. Both instruments employed a five-point Likert scale, were adapted for the EFL context, and underwent expert review to establish content validity. Reliability analysis indicated high internal consistency, with Cronbach's alpha coefficients of .929 for reflective thinking, .958 for the overall instrument, and an acceptable level for the motivation scale. The intervention was implemented across four instructional sessions using four recount text topics: *My Favorite Place*, *Memorable Day*, *Traditional Dish*, and *Social Media Experience*.

Table 1. Control Class (conventional IBL) and Experimental Class (ChatGPT–IBL) for EFL recount text learning:

IBL Steps	Lecturer Activities (Control Class – IBL)	Student Activities (Control Class – IBL)	Lecturer Activities (Experimental Class – ChatGPT-IBL)	Student Activities (Experimental Class – ChatGPT-IBL)
Orientation (Problem Introduction)	The lecturer presents a recount text (e.g., holiday experience) through text, images, or video and asks guiding questions	Students observe the stimulus and respond to the provided material	The lecturer presents the stimulus and guides students to explore it using ChatGPT with initial prompts	Students observe the stimulus and begin exploring ideas using ChatGPT
Questioning	The lecturer guides students to formulate questions about the text content and structure	Students develop questions in groups related to the text	The lecturer demonstrates how to use ChatGPT prompts (e.g., "What are the features of recount text?") and trains students to generate prompts	Students formulate questions and input them into ChatGPT to obtain explanations
Hypothesizing	The lecturer asks students to predict the content and structure of the text	Students make predictions based on prior knowledge	The lecturer instructs students to verify their hypotheses using ChatGPT	Students compare their initial hypotheses with ChatGPT responses
Investigating / Collecting Data	The lecturer provides several sample texts and worksheets	Students read texts and collect information manually	The lecturer directs students to use ChatGPT as an additional source for text analysis	Students collect information from texts and deepen understanding using ChatGPT
Analyzing	The lecturer facilitates group discussion and provides guiding questions	Students analyze text structure and language features collaboratively	The lecturer guides students to critically evaluate ChatGPT outputs (validation and reflection)	Students compare their own analysis with ChatGPT-generated explanations
Concluding	The lecturer guides students to conclude the concept of recount text	Students formulate conclusions collaboratively	The lecturer helps students synthesize conclusions based on discussion and ChatGPT input	Students develop final conclusions with clarification support from ChatGPT
Communicating Results	The lecturer asks students to present their findings or complete a writing task	Students present their work and write a simple recount text	The lecturer assigns writing tasks and encourages students to use ChatGPT for initial feedback	Students write recount texts, receive feedback from ChatGPT, and revise their work

Both groups followed the same Inquiry-Based Learning (IBL) phases—orientation, questioning, hypothesizing, investigating, analyzing, concluding, and communicating—to ensure instructional consistency. The control group completed these activities using conventional learning resources, whereas the experimental group followed the same phases with ChatGPT integrated as a learning support tool for idea generation, inquiry, text analysis, and feedback on writing. Students used ChatGPT individually through instructor-guided prompts to facilitate meaningful engagement. Pretests were administered before the intervention to establish baseline equivalence, and posttests were conducted after four instructional sessions to assess learning outcomes.

Data were analyzed using SPSS. Descriptive statistics (mean, standard deviation, minimum, and maximum) were used to summarize the data. Prior to inferential analysis, assumptions of normality, homogeneity of variance, and homogeneity of covariance were examined to ensure the appropriateness of parametric testing. To examine the effect of the intervention on writing performance while controlling for pretest differences, Analysis of Covariance (ANCOVA) was conducted. Multivariate Analysis of Variance (MANOVA) was employed to analyze the combined effects on motivation and reflective thinking, as this approach allows for the simultaneous examination of related dependent variables while controlling for Type I error inflation. Additionally, Pearson correlation analysis was conducted to explore relationships among writing performance, motivation, and reflective thinking. Effect sizes were reported using partial eta squared (η^2) to determine the magnitude of the observed effects.

RESULT AND DISCUSSION

The results of this study are presented in accordance with the research objectives, focusing on the effects of ChatGPT-assisted Inquiry-Based Learning (IBL) on students' writing performance, reflective thinking skills, and motivation in EFL recount text writing. The analysis includes descriptive statistics to provide an overview of the data, followed by inferential statistical tests, namely ANCOVA, MANOVA, and Pearson correlation, to examine differences between the control and experimental groups as well as relationships among the variables. Overall, the results highlight both the significant and non-significant effects of the intervention across the measured constructs.

Table 2. Descriptive Statistics of Writing Performance, Reflective Thinking Skills, and Motivation (N = 80)

Variable	Time	N	Minimum	Maximum	Mean	Std. Deviation
Writing Score	Pretest	80	64.00	75.00	69.83	2.88
Writing Score	Posttest	80	66.00	84.00	75.18	5.23
Reflective Thinking Skills	Pretest	80	60.00	75.00	67.59	4.60
Reflective Thinking Skills	Posttest	80	62.00	88.00	74.83	6.32
Motivation	Pretest	80	20.00	75.00	59.00	10.69
Motivation	Posttest	80	45.00	75.00	68.54	6.88

The descriptive statistics indicate an overall increase in students' writing performance, reflective thinking skills, and motivation following the instructional

intervention. In writing performance, the mean score increased from 69.83 (SD = 2.88) in the pretest to 75.18 (SD = 5.23) in the posttest, with scores ranging from 64 to 84. Reflective thinking skills also improved, with the mean rising from 67.59 (SD = 4.60) to 74.83 (SD = 6.32), and the maximum score increasing from 75 to 88, suggesting broader distribution of higher performance after the intervention. Motivation similarly showed an upward trend, increasing from a pretest mean of 59.00 (SD = 10.69) to 68.54 (SD = 6.88); notably, the relatively large standard deviation in the pretest indicates greater initial variability in students' motivational levels, which became more stable after the intervention. It should be noted that these results are descriptive in nature and do not in themselves indicate statistical significance. However, they provide an initial overview of consistent positive trends across all measured variables, with particularly visible gains in motivation and reflective thinking. Overall, the descriptive findings suggest improvement following the instructional treatment, which is later examined in the inferential analysis section.

Table 3 Reliability Statistics of the Motivation Questionnaire

Scale	Cronbach's Alpha	Number of Items
Overall Questionnaire	0.958	15

The reliability analysis showed that the motivation questionnaire had excellent internal consistency, with a Cronbach's Alpha value of 0.958 across 15 items. This indicates a strong level of consistency among the items in measuring the intended construct of motivation. Based on commonly accepted criteria, a Cronbach's Alpha above 0.90 is considered excellent, suggesting that the instrument is reliable for assessing students' motivation in this study. However, it should also be noted that very high alpha values may indicate a degree of item redundancy, where some items may overlap in content. Despite this consideration, the reliability coefficient obtained in this study supports the internal consistency of the instrument. Therefore, the questionnaire is considered appropriate for use in subsequent statistical analyses, alongside considerations of validity and construct alignment.

Table 4 Reliability Statistics of the Reflective Thinking Questionnaire

Scale	Cronbach's Alpha	Number of Items
Reflective Thinking Questionnaire	0.929	13

The reliability analysis indicated that the reflective thinking questionnaire demonstrated strong internal consistency, with a Cronbach's Alpha value of 0.929 across 13 items. This suggests a high level of consistency among the items in measuring reflective thinking, which encompasses self-awareness, awareness of others' perspectives, integrative reflection, and transformative reflection. Based on established reliability benchmarks, a Cronbach's Alpha above 0.90 is generally considered indicative of strong reliability, supporting the consistency of the instrument in this study. At the same time, it should be noted that internal consistency alone does not fully guarantee construct validity, particularly given the multidimensional nature of reflective thinking. Nevertheless, the obtained reliability coefficient supports the stability of the instrument for measuring students' reflective thinking within the context of this research.

Table 5 Levene's Test of Equality of Error Variances for Posttest Writing Scores

Dependent Variable	F	df1	df2	Sig.
Posttest Writing Score	1.217	1	78	0.273

The Levene's Test of Equality of Error Variances was conducted to examine the assumption of homogeneity of variances prior to performing ANCOVA on the posttest writing scores. The results indicated that the test was not statistically significant ($F = 1.217$, $df1 = 1$, $df2 = 78$, $p = .273$), suggesting that the variance of the dependent variable was comparable across the control and experimental groups. This finding provides evidence that the assumption of homogeneity of variances was met for this dataset. It should be noted that this assumption represents only one of several conditions required for valid ANCOVA results, alongside other assumptions such as normality, independence of observations, and homogeneity of regression slopes. Within this context, the non-significant Levene's Test result supports the appropriateness of proceeding with the ANCOVA analysis.

Table 6 Multivariate Tests of Group Effect on Motivation and Reflective Thinking

Effect	Test	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Observed Power
Intercept	Pillai's Trace	0.980	208.622	15	64	< .001	0.980	1.000
	Wilks' Lambda	0.020	208.622	15	64	< .001	0.980	1.000
	Hotelling's Trace	48.896	208.622	15	64	< .001	0.980	1.000
	Roy's Largest Root	48.896	208.622	15	64	< .001	0.980	1.000
Group	Pillai's Trace	0.196	1.043	15	64	.426	0.196	0.599
	Wilks' Lambda	0.804	1.043	15	64	.426	0.196	0.599
	Hotelling's Trace	0.244	1.043	15	64	.426	0.196	0.599
	Roy's Largest Root	0.244	1.043	15	64	.426	0.196	0.599

The multivariate test was conducted to examine whether there were significant differences between the control and experimental groups in students' motivation and reflective thinking as combined dependent variables. The results indicated that there was no statistically significant multivariate effect of group, Wilks' Lambda = 0.804, $F(15, 64) = 1.043$, $p = .426$, partial $\eta^2 = 0.196$. This suggests that, when motivation and reflective thinking were considered simultaneously, the difference between students who learned through conventional Inquiry-Based Learning (IBL) and those who experienced ChatGPT-assisted IBL was not statistically significant. The effect size (partial $\eta^2 = 0.196$) indicates a moderate magnitude of group effect according to commonly used benchmarks, although this did not reach statistical significance. Rather than relying on observed power values, which are generally considered less informative in post hoc interpretation, the result is better understood in terms of the combined evidence from p-value and effect size. Overall,

the findings suggest that the intervention did not produce a statistically detectable multivariate difference in motivation and reflective thinking under the present study conditions.

Table 7. Univariate Test of Group Effect on Posttest Writing Scores (ANCOVA)

Source	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast (Group)	1283.130	1	1283.130	1241.320	< .001	0.942
Error	79.594	77	1.034	—	—	—

The univariate ANCOVA results indicated a statistically significant effect of group on students' posttest writing scores after controlling for pretest performance, $F(1, 77) = 1241.320$, $p < .001$, partial $\eta^2 = 0.942$. This finding suggests a statistically significant difference in adjusted posttest writing performance between the control and experimental groups, with the ChatGPT-assisted Inquiry-Based Learning group showing higher scores than the conventional Inquiry-Based Learning group. The effect size (partial $\eta^2 = 0.942$) is unusually large in the context of educational research and therefore should be interpreted with caution. Such a magnitude may reflect strong intervention effects, but it may also be influenced by factors such as measurement sensitivity, sample characteristics, or model specification. Within the limitations of a quasi-experimental design, the results indicate a strong statistical association between the instructional condition and students' writing performance after controlling for baseline differences.

Table 8. Pearson Correlation Matrix among Writing Performance, Reflective Thinking, and Motivation (N = 80)

Variable	1	2	3
1. Writing Performance	1		
2. Reflective Thinking	.458**	1	
3. Motivation	−.027	.051	1

The Pearson correlation analysis revealed a moderate and statistically significant positive relationship between writing performance and reflective thinking ($r = .458$, $p < .001$), indicating that students with higher levels of reflective thinking tended to achieve better writing scores. In contrast, motivation was not significantly correlated with either writing performance ($r = −.027$, $p = .810$) or reflective thinking ($r = .051$, $p = .655$), suggesting that no linear relationship was observed among these variables in this dataset. These findings highlight the association between reflective thinking and writing performance in the present study context. However, it should be noted that correlation analysis does not imply causation, and the absence of significant relationships involving motivation does not rule out the possibility of indirect, contextual, or mediated effects that are not captured through simple linear correlation. Overall, the results provide evidence of a meaningful link between reflective thinking and writing achievement, while relationships involving motivation were not statistically supported in this analysis.

Discussion

The present study aimed to examine the effectiveness of ChatGPT-assisted Inquiry-Based Learning (IBL) in enhancing students' writing performance, reflective thinking

skills, and motivation in EFL recount text writing. Overall, the findings provide partial support for the effectiveness of integrating AI into inquiry-based pedagogy. While significant improvements were observed in writing performance, the multivariate results indicated that the combined effects on motivation and reflective thinking were not statistically significant. These mixed outcomes suggest that the impact of AI integration may vary across cognitive and affective learning domains. One possible explanation for this pattern is the relatively short intervention period and the way ChatGPT was primarily used to support task completion and idea generation, which may have more directly influenced writing performance than deeper affective changes such as motivation and reflective thinking. In addition, such affective outcomes may require longer exposure and more sustained pedagogical integration to develop meaningfully. The figure illustrating students during the questioning phase further supports this interpretation by showing how ChatGPT-assisted inquiry was primarily engaged at the early stages of the learning process. Overall, these findings indicate that while AI-supported IBL can effectively enhance writing outcomes, its influence on motivational and reflective dimensions may be more gradual and context-dependent.

Figure 1 Students in Questioning phase

The significant improvement in writing performance is consistent with previous studies highlighting the role of technology in facilitating language learning. Digital tools can support learners in planning, drafting, and revising their writing more effectively (Hyland & Richards, 2010). In this study, the ANCOVA results showed that students in the ChatGPT-assisted IBL group significantly outperformed those in the conventional IBL group after controlling for pretest scores, suggesting a strong association between the instructional condition and writing performance within the context of this quasi-experimental design.

One possible explanation for this improvement lies in the nature of feedback provided through ChatGPT. Feedback is widely recognized as a critical factor in writing development, as it helps learners identify errors and refine their linguistic accuracy (Hattie & Timperley, 2007). In this study, ChatGPT functioned not only as a source of corrective feedback (e.g., grammar and vocabulary corrections) but also as a provider of elaborative

and prompt-based scaffolding, offering suggestions for text organization, idea expansion, and revision strategies in real time. This combination of feedback types may have supported students' iterative writing processes and facilitated more effective revision during the inquiry-based tasks.

From a theoretical perspective, this finding aligns with socio-constructivist views of learning, which emphasize interaction and scaffolding in knowledge construction (Daniels, 2005; Y.-C. Huang, 2021; Kozulin, 2007; Vygotsky et al., 2012). Within this framework, ChatGPT can be interpreted as a mediating tool that provides forms of scaffolded support within learners' zones of proximal development by guiding them through inquiry and writing tasks. However, unlike human mediation, its scaffolding is based on pattern-driven responses rather than adaptive pedagogical judgment, which may limit the depth and responsiveness of support in certain learning situations.

Moreover, the integration of ChatGPT within the Inquiry-Based Learning (IBL) framework appears to have supported key stages of the inquiry process. IBL encourages students to ask questions, investigate, and construct knowledge actively (Arifiyani et al., 2025; Ditingki et al., 2025; Nguyen et al., 2024; Pedaste et al., 2015; Putri & Novita, 2024; Ulker, 2023). In this study, ChatGPT contributed to these processes by assisting students in refining their questions, generating ideas, and checking the plausibility of their responses during investigation, which may have facilitated more structured thinking and ultimately supported writing performance. At the same time, it is possible that the relatively short intervention period and the bounded nature of the inquiry tasks limited the extent to which deeper forms of cognitive engagement were developed.

However, the findings related to reflective thinking were less conclusive. Although descriptive statistics indicated improvement, the MANOVA results did not show a statistically significant difference between the control and experimental groups. This suggests that the addition of ChatGPT did not substantially enhance reflective thinking beyond what was already fostered through IBL alone. One possible explanation is that IBL itself already provides structured opportunities for reflection, and the additional AI support may not have been sufficiently targeted or sustained to further deepen reflective processes within the limited duration of the intervention.

Reflective thinking is a complex cognitive process involving self-awareness, evaluation, and the transformation of prior knowledge (Mezirow, 1990; Procter, 2020; X. Sun, 2025; Yeh et al., 2023). Such processes typically require sustained engagement, repeated practice, and guided reflection over time. In the present study, although students showed descriptive improvement in reflective thinking, the MANOVA results did not reveal a statistically significant difference between the groups. This suggests that the integration of ChatGPT did not produce measurable gains in reflective thinking beyond those achieved through Inquiry-Based Learning (IBL) alone. A plausible explanation is that the relatively short duration of the intervention limited opportunities for deeper reflection to develop, particularly since reflective thinking is typically strengthened through prolonged cycles of inquiry and structured reflection activities.

Similarly, motivation did not show a statistically significant multivariate effect between the two groups, although descriptive results indicated some improvement. This

finding aligns with motivational theories emphasizing that motivation is shaped by multiple interacting factors, including learners' beliefs, goals, autonomy, and learning environment (Dörnyei & Ushioda, 2010; Guay et al., 2000; Pintrich et al., 1991; Schunk & DiBenedetto, 2020; Wang & Wang, 2025). Within this context, both instructional conditions may have provided comparable levels of engagement, which could explain the absence of a detectable difference between groups. Specifically, while ChatGPT offered additional support for task completion and idea generation, this support may not have been sufficiently targeted toward enhancing motivational dimensions such as autonomy or long-term goal orientation beyond what was already facilitated by the IBL framework. From a theoretical perspective grounded in self-determination theory (Ryan & Deci), sustained motivational change is more likely when instructional conditions consistently support autonomy, competence, and relatedness over time, which may require longer and more structured implementation than was possible in the present intervention.

It is also possible that both instructional approaches Inquiry-Based Learning (IBL) and ChatGPT-assisted IBL provided comparable levels of learner engagement, which may explain the absence of significant differences in motivation between the groups. IBL has been widely recognized for fostering active participation and intrinsic motivation by encouraging learners to take ownership of their learning process (Ryan & Deci, 2000), and the addition of ChatGPT may not have substantially altered these core motivational conditions within the relatively short intervention period.

In addition, the correlation analysis revealed a significant positive relationship between writing performance and reflective thinking. This finding suggests that students with stronger reflective thinking skills were better able to evaluate their ideas, organize their writing, and improve the quality of their written texts. From a theoretical perspective, this aligns with Schön's (Schön, 1983) concept of reflective practice, which emphasizes that reflection enables learners to critically examine their actions and continuously improve their performance in academic and professional contexts.

In contrast, motivation was not significantly correlated with either writing performance or reflective thinking in this study. This indicates that no linear relationship was observed between motivation and the other variables within the current dataset. While motivation is theoretically considered an important driver of learning behavior, its effects may not be directly captured through simple correlational analysis in a single measurement point. One possible explanation is that motivation may influence learning outcomes indirectly through factors such as engagement, persistence, or strategy use, rather than showing an immediate linear association with performance measures. Alternatively, the absence of significant relationships may also be related to contextual factors or the sensitivity of the measurement instrument in capturing dynamic motivational changes during task performance. Overall, these findings suggest a more complex and non-linear role of motivation in EFL writing development within the scope of this study.

The findings of this study have important pedagogical implications for EFL writing instruction. First, integrating ChatGPT into Inquiry-Based Learning (IBL) can support students' writing performance by providing immediate feedback, assisting idea generation, and helping learners refine their drafts during different stages of the writing process. In

practice, teachers can operationalize this integration by designing structured prompts, guiding students to use ChatGPT during specific inquiry phases (e.g., questioning, drafting, and revising), and providing clear criteria for evaluating AI-generated suggestions so that learners engage critically rather than passively. Beyond writing performance, the findings also suggest implications for reflective thinking and motivation, although these effects were less pronounced in the present study. Educators can encourage deeper reflection by asking students to document how they used AI feedback in their revisions and to justify their writing decisions during the inquiry process. Similarly, to support motivation, teachers may incorporate goal-setting activities and collaborative inquiry tasks that maintain learner engagement while using AI tools. Overall, ChatGPT should be positioned as a pedagogical scaffold that complements teacher guidance within IBL, rather than replacing traditional instructional practices, to ensure balanced development across cognitive and affective learning dimensions.

Second, educators should recognize that improvements in reflective thinking and motivation are less likely to emerge from short-term or technology-only interventions, as reflected in the non-significant MANOVA results for these variables in this study. This suggests that simply introducing ChatGPT into instruction is insufficient to foster deeper cognitive and affective development. Instead, more explicit and sustained instructional support is needed to cultivate these outcomes. In practice, this may include structured reflective activities (e.g., guided journals or post-task reflection prompts), iterative feedback cycles where students are required to explain how they respond to AI feedback, and scaffolded metacognitive questioning embedded throughout the inquiry process. Such strategies can help learners move beyond task completion toward deeper evaluation of their thinking and sustained motivational engagement over time.

Despite its contributions, this study has several limitations. First, the relatively short intervention duration may have limited the development of deeper changes in reflective thinking and motivation, which typically require sustained instructional exposure. Second, the reliance on self-report questionnaires may have constrained the accuracy of capturing students' affective and metacognitive processes. In addition, the quasi-experimental design without random assignment may introduce potential selection bias, which could influence group comparability despite efforts to ensure similar baseline characteristics. Future studies are recommended to employ longer intervention periods to allow for more sustained development of cognitive and affective outcomes. In addition, mixed-method approaches—such as learner interviews, reflective journals, and classroom observations could provide richer insights into how students engage with AI-assisted Inquiry-Based Learning and how reflective thinking and motivation evolve over time. These approaches would enable a more comprehensive understanding of both measurable outcomes and underlying learning processes.

Overall, this study highlights the potential of ChatGPT-assisted Inquiry-Based Learning (IBL) in improving EFL writing performance, while also revealing that its influence on reflective thinking and motivation is more complex and less immediately observable. The findings suggest that AI supported instruction is particularly effective in enhancing measurable performance outcomes such as writing quality, but may require

more sustained and carefully designed pedagogical conditions to meaningfully influence affective and metacognitive dimensions of learning. Future research should therefore explore more structured forms of AI integration, including longer intervention periods, scaffolded stages of AI use across the inquiry cycle, and blended human–AI feedback systems that combine teacher guidance with generative AI support. Such approaches may better support holistic student development by strengthening not only writing performance but also reflective engagement and sustained motivation in EFL learning contexts.

CONCLUSION

This study investigated the effectiveness of ChatGPT assisted Inquiry Based Learning (IBL) in enhancing students' writing performance, reflective thinking skills, and motivation in EFL recount text writing. The findings show that integrating ChatGPT into IBL significantly improved students' writing performance, as reflected in the posttest gains and the large effect size obtained from the ANCOVA analysis. This indicates that ChatGPT can function as an effective instructional scaffold in supporting idea generation, text organization, and language accuracy during the writing process. In contrast, reflective thinking and motivation did not show statistically significant differences between the control and experimental groups, despite descriptive improvements from pretest to posttest. This pattern suggests that the integration of ChatGPT within IBL may be more immediately effective for improving writing performance than for fostering deeper cognitive reflection or motivational change within a short instructional period. The correlation analysis further supports the importance of reflective thinking in writing development, as a significant positive relationship was found between these two variables, while motivation showed no significant associations with either construct.

Overall, the study contributes to research on AI integration in language education by demonstrating the effectiveness of ChatGPT for enhancing EFL writing outcomes within an inquiry-based framework. At the same time, it highlights that reflective and motivational dimensions may require more sustained and targeted pedagogical design than short-term AI-supported interventions can provide. Future work should therefore consider more extended implementations and refined instructional strategies to better support these broader learning outcomes in EFL contexts.

REFERENCES

Alsaedi, N. (2024). ChatGPT and EFL/ESL Writing: A Systematic Review of Advantages and Challenges. *English Language Teaching*, *17*(5), 41. https://doi.org/10.5539/elt.v17n5p41

Arifiyani, H., Widodo, J., & Kusumantoro, K. (2025). Development of Inquiry-Based Learning Methods With Differentiated. *Journal of Economic Education*, *13*(2), 179–187. https://doi.org/10.15294/jeec.v13i2.28415

Cambridge Assessment English. (2019). *IELTS writing band descriptors*. Cambridge University Press & Assessment.

Chinpakdee, M. (2026). Talking Feedback: Fostering Student Feedback Literacy Through a Dialogic Approach. *RELC Journal*, *57*(1), 158–171. https://doi.org/10.1177/00336882251346206

Chu, PH. and Chang, YY. (2017). John W, Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. *Journal of Social and Administrative Sciences*, *4*(June).

Creswell, J. W., & Creswell, J. D. (2018). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches - John W. Creswell, J. David Creswell - Google Books. In *SAGE Publications, Inc.*

Daniels, Harry. (2005). *An introduction to Vygotsky*. Routledge.

Ditingki, A. M., Cimene, F. T. A., & Cimene, D. R. A. (2025). Inquiry-Based Learning Strategies and Critical Thinking Skills of College Students. *Cognizance Journal of Multidisciplinary Studies*, *5*(8). https://doi.org/10.47760/cognizance.2025.v05i08.028

Dörnyei, Z. ., & Ushioda, Ema. (2010). *Motivation, language identity and the L2 self*. Multilingual Matters.

Elitasari, H. T. (2022). Kontribusi Guru dalam Meningkatkan Kualitas Pendidikan Abad 21. *Jurnal Basicedu*, *6*(6). https://doi.org/10.31004/basicedu.v6i6.4120

Guay, F., Vallerand, R. J., & Blanchard, C. (2000). On the Assessment of Situational Intrinsic and Extrinsic Motivation: The Situational Motivation Scale (SIMS). *Motivation and Emotion*, *24*(3), 175–213. https://doi.org/10.1023/A:1005614228250

Guo, K., Chen, X., & Qiao, S. (2024). Exploring a Collaborative Approach to Peer Feedback in EFL Writing: How Do Students Participate? *RELC Journal*, *55*(3), 658–672. https://doi.org/10.1177/00336882221143192

Hattie, J., & Timperley, H. (2007). The Power of Feedback. *Review of Educational Research*, *77*(1), 81–112. https://doi.org/10.3102/003465430298487

Huang, H.-W., Mills, D. J., & Tiangco, J. A. N. Z. (2024). Inquiry-Based Learning and Technology-Enhanced Formative Assessment in Flipped EFL Writing Instruction: Student Performance and Perceptions. *Sage Open*, *14*(2). https://doi.org/10.1177/21582440241236663

Huang, Y., & Wang, D. (2025). Can ChatGPT serve as a writing collaborator? Insights from Chinese EFL learners. *System*, *133*, 103775. https://doi.org/10.1016/j.system.2025.103775

Huang, Y.-C. (2021). Comparison and Contrast of Piaget and Vygotsky's Theories. *Proceedings of the 7th International Conference on Humanities and Social Science Research (ICHSSR 2021)*, *554*. https://doi.org/10.2991/assehr.k.210519.007

Hyland, K. (2026). Tomorrowland? Technical Innovation and Feedback on Writing. *RELC Journal*, *57*(1), 233–241. https://doi.org/10.1177/00336882251357675

Hyland, Ken., & Richards, J. C. . (2010). *Second Language Writing*. Cambridge University Press.

Isma, A., Isma, A., Isma, A., & Isma, A. (2023). Peta Permasalahan Pendidikan Abad 21 di Indonesia. *Jurnal Pendidikan Terapan*. https://doi.org/10.61255/jupiter.v1i3.153

Karataş, F., Abedi, F. Y., Ozek Gunyel, F., Karadeniz, D., & Kuzgun, Y. (2024). Incorporating AI in foreign language education: An investigation into ChatGPT's effect on foreign language learners. *Education and Information Technologies*, *29*(15), 19343–19366. https://doi.org/10.1007/s10639-024-12574-6

Kaur, K. (2026). Enhancing Young Learners' Metacognitive Awareness Through Feedback in Writing Classrooms. *RELC Journal*, *57*(1), 253–262. https://doi.org/10.1177/00336882251408957

Kohnke, L., Moorhouse, B. L., & Zou, D. (2023). ChatGPT for Language Teaching and Learning. *RELC Journal*, *54*(2), 537–550. https://doi.org/10.1177/00336882231162868

Kozulin, Alex. (2007). *Vygotsky's educational theory in cultural context*. Cambridge University Press.

Li, Lee, H. Y., Lin, C. J., Wang, W. S., & Huang, Y. M. (2025). InquiryGPT: Augmenting ChatGPT for Enhancing Inquiry-Based Learning in STEM Education. *Journal of Educational Computing Research*, *62*(8), 1937–1966. https://doi.org/10.1177/07356331241289824

Li, P.-H., Wu, T.-T., & Huang, Y.-M. (2025). Improving inquiry-based learning through automated ChatGPT-based inquiry prompt and behavioral image recognition. *Education and Information Technologies*, *30*(17), 25543–25575. https://doi.org/10.1007/s10639-025-13734-y

Li, W.-Y., Kau, K., & Shiung, Y.-J. (2023). Pedagogic Exploration Into Adapting Automated Writing Evaluation and Peer Review Integrated Feedback Into Large-Sized University Writing Classes. *Sage Open*, *13*(4). https://doi.org/10.1177/21582440231209087

Mahande, R. D., Fakhri, M. M., Suwahyu, I., & Sulaiman, D. R. A. (2026). Unveiling the impact of ChatGPT: investigating self-efficacy, anxiety and motivation on student performance in blended learning environments. *Journal of Applied Research in Higher Education*, *18*(1), 282–297. https://doi.org/10.1108/JARHE-07-2024-0372

Mezirow, J. (1990). How critical reflection triggers transformative learning. In Mezirow & Associates (Ed.), *Fostering critical reflection in adulthood.* . Jossey-Bass.

Mi, Y., Rong, M., & Chen, X. (2026). Exploring the Affordances and Challenges of GenAI Feedback in L2 Writing Instruction: A Comparative Analysis With Peer Feedback. *ECNU Review of Education*, *9*(1). https://doi.org/10.1177/20965311241310883

Miao, J., Chang, J., & Ma, L. (2023). Research Trends of Written Corrective Feedback in L2 Writing: A Bibliometric Analysis. *Sage Open*, *13*(1). https://doi.org/10.1177/21582440221135172

Nguyen, V. H., Halpin, R., & Joy-Thomas, A. R. (2024). Guided inquiry-based learning to enhance student engagement, confidence, and learning. *Journal of Dental Education*, *88*(8), 1040–1047. https://doi.org/10.1002/jdd.13531

Ningsih, I. H. (2019). Peran Guru dalam Pembelajaran Menulis Permulaan Menghadapi Abad 21. *BASINDO : Jurnal Kajian Bahasa, Sastra Indonesia, Dan Pembelajarannya*, *3*(1). https://doi.org/10.17977/um007v3i12019p038

Parsaiyan, S. F., & Gholami, H. (2026). Practicing to sing in chorus: Challenges and opportunities of collaborative inquiry-based learning in an Iranian EFL secondary school context. *Language Teaching Research*, *30*(2), 631–654. https://doi.org/10.1177/13621688231152037

Pedaste, M., Mäeots, M., Siiman, L. A., de Jong, T., van Riesen, S. A. N., Kamp, E. T., Manoli, C. C., Zacharia, Z. C., & Tsourlidaki, E. (2015). Phases of inquiry-based learning: Definitions and the inquiry cycle. In *Educational Research Review* (Vol. 14). https://doi.org/10.1016/j.edurev.2015.02.003

Pintrich, P. R., Smith, D. A., Garcia, T., & McKeachie, W. J. (1991). A Manual for the Use of the Motivated Strategies for Learning Questionnaire (MSLQ). *University of Michigan*.

Procter, L. (2020). Fostering critically reflective thinking with first-year university students: early thoughts on implementing a reflective assessment task. *Reflective Practice*, *21*(4). https://doi.org/10.1080/14623943.2020.1773421

Putri, C. A. W., & Novita, D. (2024). Inquiry-Based Learning and Its Role in Students' Writing Achievement. *Indonesian Journal of Education Methods Development*, *19*(4). https://doi.org/10.21070/ijemd.v19i4.853

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology*, *25*(1), 54–67. https://doi.org/10.1006/ceps.1999.1020

Schön, D. A. . (1983). *The reflective practitioner : how professionals think in action*. Basic Books.

Schunk, D. H., & DiBenedetto, M. K. (2020). Motivation and social cognitive theory. *Contemporary Educational Psychology*, *60*. https://doi.org/10.1016/j.cedpsych.2019.101832

Sun, H., & Wang, M. (2025). Effects of teacher intervention and type of peer feedback on student writing revision. *Language Teaching Research*, *29*(3), 1094–1113. https://doi.org/10.1177/13621688221080507

Sun, X. (2025). Reflective learning community and learner autonomy: an analysis of three EFL learners' reflective listening journals. *Reflective Practice*. https://doi.org/10.1080/14623943.2025.2541425

Teng, M. F. (2024a). A Systematic Review of ChatGPT for English as a Foreign Language Writing: Opportunities, Challenges, and Recommendations. *International Journal of TESOL Studies*, *6*(3). https://doi.org/10.58304/ijts.20240304

Teng, M. F. (2024b). ChatGPT is the companion, not enemies: EFL learners' perceptions and experiences in using ChatGPT for feedback in writing. *Computers and Education: Artificial Intelligence*, *7*, 100270. https://doi.org/10.1016/j.caeai.2024.100270

Ulker, V. (2023). Inquiry-Based Learning Implementation: Students' Perception and Preference. *International Journal of Social Sciences & Educational Studies*, *10*(2). https://doi.org/10.23918/ijsses.v10i2p220

Vasu, K. A., Mei Fung, Y., Nimehchisalem, V., & Md Rashid, S. (2022). Self-Regulated Learning Development in Undergraduate ESL Writing Classrooms: Teacher Feedback Versus Self-Assessment. *RELC Journal*, *53*(3), 612–626. https://doi.org/10.1177/0033688220957782

Vygotsky, L. S. ., John-Steiner, Vera., & Vygotsky, L. S. /Cole, Michae. (2012). *Mind in Society*.

Wang, L., & Wang, L. (2025). Exploring enjoyment, motivation, self-efficacy, and engagement in AI-assisted English learning: A self-determination theory approach. *Learning and Motivation*, *92*, 102197. https://doi.org/10.1016/j.lmot.2025.102197

Yan, J., Zhu, Y., & Ye, X. (2024). The Impact of Peer Feedback on L2 Literature Review Writing: A Mixed Methods Study. *Sage Open*, *14*(4). https://doi.org/10.1177/21582440241288737

Yeh, H.-C., Yang, S., Fu, J. S., & Shih, Y.-C. (2023). Developing college students' critical thinking through reflective writing. *Higher Education Research & Development*, *42*(1), 244–259. https://doi.org/10.1080/07294360.2022.2043247