



FLIPPED AI-SUPPORTED PROMPT-BASED SCAFFOLDING: AN INNOVATIVE APPROACH TO ENHANCING EFL DESCRIPTIVE WRITING

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ABSTRACT

Aim/Purpose	This study investigates the effectiveness of a flipped AI-supported writing model that integrates structured prompt-based scaffolding to enhance EFL learners' ability to produce descriptive statistical writing.
Background	While artificial intelligence is increasingly used in writing instruction, prior research has largely focused on text generation and automated feedback. Limited attention has been given to AI as a guided learning partner in flipped instructional designs, particularly for genre-specific writing tasks such as static bar chart descriptions.
Methodology	A quasi-experimental one-group pre-test/post-test design was employed with 25 B1–B2 EFL learners at a public university in Oman. The four-week intervention combined AI-assisted pre-class preparation, a teacher-guided “write-with” in-class phase, and AI-supported revision. Writing performance was assessed using parallel tasks evaluated with an IELTS-based rubric, and learner perceptions were collected through a post-intervention questionnaire.
Contribution	This study contributes to AI-mediated writing pedagogy by proposing and empirically testing a flipped, prompt-based scaffolding model for EFL descriptive writing. It contributes to emerging research on prompt-based scaffolding, AI literacy, and technology-integrated writing pedagogy in EFL contexts.
Findings	Results revealed a statistically significant improvement in writing performance following the intervention, with large effect-size gains across all four assessed writing sub-skills (task achievement, coherence and cohesion, lexical resource, and grammatical range and accuracy). Questionnaire findings indicated positive learner perceptions, highlighting increased confidence and improved understanding of responsible AI use.

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Recommendations for Practitioners	Educators should integrate structured AI prompts within flipped learning designs to support pre-class preparation and scaffold in-class writing. Emphasis should be placed on training learners to use AI for guided learning rather than full-text generation.
Recommendations for Researchers	Researchers should consider incorporating structured prompt-based scaffolding when examining AI-supported writing instruction. Future studies should adopt more robust experimental designs, include diverse learner populations, and examine how AI can be integrated as pedagogical support rather than as a text-generation tool.
Impact on Society	The model offers a practical and scalable approach to integrating AI into language classrooms, supporting ethical AI use while enhancing learners' academic writing skills.
Future Research	Future research should examine the effectiveness of the Flipped AI Writing Model using control groups, longer intervention periods, and across different writing genres. Longitudinal studies are also needed to explore the development of AI literacy and self-regulated learning over time.
Keywords	AI literacy, artificial intelligence in education, ChatGPT, descriptive statistical writing, EFL writing instruction, flipped learning, prompt-based scaffolding

INTRODUCTION

The rapid expansion of artificial intelligence (AI) in educational contexts has reshaped pedagogical practices by transforming how learners receive feedback, interact with content, and engage in academic writing tasks. In recent years, AI has increasingly been positioned not as a replacement for human instruction but as a powerful, augmentative tool that supports a collaborative human-AI partnership in learning (Wu, 2024). This shift is particularly relevant in English as a Foreign Language (EFL) settings, where learners often face challenges in writing due to limitations in vocabulary, grammatical accuracy, and coherence. AI tools offer personalized, immediate, and adaptive feedback, making them valuable resources for addressing these challenges (Alzahrani & Alotaibi, 2024; Song & Song, 2023). More broadly, this development reflects a shift toward technology-enhanced learning environments in which AI is increasingly integrated into instructional design to support adaptive and learner-centered pedagogical practices.

Despite this potential, existing research has predominantly examined AI as a generator of complete texts or as an automated feedback system, rather than exploring its role as a structured pedagogical partner that supports the development of writing processes (Kanık, 2025; Xu et al., 2025). Such approaches risk encouraging over-reliance on technology and limiting opportunities for learners to develop authentic writing competence. In contrast, the use of AI as a scaffold to facilitate guided learning through structured prompts remains underexplored, particularly in relation to genre-specific writing tasks such as descriptive statistical writing (Al-Raimi et al., 2024; Ghimire et al., 2024).

Descriptive writing is a foundational academic skill that requires accurate reporting, clear comparison, and concise summarization of information. When the task involves interpreting visual data such as static bar charts, EFL learners often encounter additional challenges. These include identifying key features, selecting relevant comparisons, using appropriate comparative vocabulary, and distinguishing between static and dynamic representations of data (Alzahrani & Alotaibi, 2024). Such difficulties often lead to weak writing performance on academic assessments, where clarity, precision, and coherence are essential (Teng, 2024a; Xu et al., 2025). Mastery of descriptive writing is therefore crucial not only for academic success but also for broader communicative purposes involving the presentation of empirical information.

However, traditional classroom instruction often falls short in supporting the development of these skills. Limited instructional time, large class sizes, and the need to address multiple writing genres restrict opportunities for individualized scaffolding (Huang et al., 2023). Consequently, learners may rely on memorized templates rather than on an understanding of underlying writing principles, or they may depend on AI tools to generate complete texts instead of using them as learning supports (Zhou & Du Preez, 2025). These limitations highlight the need for pedagogical approaches that provide targeted, adaptive support while promoting meaningful engagement and reducing superficial reliance on AI-generated content.

The integration of AI within established learning theories, such as Vygotsky's social constructivism and the Zone of Proximal Development, offers a promising direction for enhancing EFL writing instruction. Within this perspective, AI systems can function as supportive learning partners, providing real-time scaffolding and modelling effective linguistic choices (Song & Song, 2023). Through iterative feedback and opportunities for revision, AI-assisted writing can support the development of metacognitive strategies, enabling learners to internalize complex writing conventions and build greater autonomy in their writing processes (Alpar, 2025; Koka et al., 2023). In addition, AI-supported environments can simulate interactive learning experiences that are often difficult to sustain in traditional classrooms, thereby extending opportunities for practice beyond temporal and spatial constraints (Harunasari, 2023; Wei, 2023).

Despite these pedagogical advantages, a significant gap remains in understanding how AI can be systematically integrated into instructional design to support specific writing sub-skills within structured learning environments. Existing research has rarely examined AI as a scaffold within a flipped learning framework, particularly for genre-specific tasks such as descriptive statistical writing. Instead, most studies have focused on AI for grammar correction, content generation, or general writing improvement (AbdAlgane et al., 2026; Chen et al., 2025). There is limited empirical evidence on how learners can be trained to use AI through structured pedagogical prompts that support skill development rather than outsourcing the writing process (Teng, 2024b). In addition, the role of AI in developing prompt literacy, the ability to design, interpret, and refine effective prompts for learning, remains underexplored, despite its increasing importance in contemporary language education (Hwang et al., 2023).

Addressing this gap is important because it moves beyond viewing AI as a tool for output generation and instead positions it as part of a structured pedagogical system that can support skill development, learner autonomy, and responsible technology use in real classroom contexts. In response, this study investigates a flipped learning model that integrates structured prompt-based scaffolding delivered through AI tools. The model specifically targets the challenges EFL learners face when interpreting and describing static bar charts. Within this design, learners engage with AI-supported instructional prompts during the pre-class phase to develop foundational knowledge of descriptive vocabulary, sentence structures, and comparison strategies. Classroom time is then used for guided writing and application, supported by teacher feedback, followed by AI-assisted revision that reinforces learning through targeted feedback and reflection. This approach positions AI as a learning partner that supports the writing process rather than generating complete responses (Song & Song, 2023; Tseng & Lin, 2024).

By examining the combined effects of flipped learning, prompt-based scaffolding, and AI-supported instruction, this study provides empirical evidence on how AI can be meaningfully integrated into writing pedagogy. It contributes to ongoing discussions on responsible AI use, human-AI collaboration, and the development of authentic writing competence in EFL contexts (Mashhadi et al., 2025; Muslimin et al., 2024). In addition, the study offers practical insights for educators seeking to implement AI in ways that promote critical thinking, reduce over-reliance, and enhance learner engagement.

This study introduces the Flipped AI Writing Model, a three-phase instructional approach in which AI functions as a scaffold for descriptive statistical writing rather than as a text generator. The framework is systematically designed, operationalized, and empirically tested in this study, contributing a practical and replicable model to the field of technology-enhanced writing pedagogy. Two research questions guided the investigation:

- RQ1:** To what extent does the Flipped AI Writing Model improve EFL learners' descriptive writing performance, overall and across the four IELTS Task 1 rubric criteria (task achievement, coherence and cohesion, lexical resource, and grammatical range and accuracy)?
- RQ2:** How do EFL learners perceive the usefulness, clarity, and instructional value of AI-supported prompt-based scaffolding within this flipped learning design?

LITERATURE REVIEW

AI IN EFL WRITING INSTRUCTION

The integration of artificial intelligence in language education has expanded rapidly, reshaping writing instruction through personalized feedback, adaptive modelling, and immediate language support. AI-powered tools such as large language models, automated writing evaluators, and grammar correction systems have become central to contemporary EFL writing pedagogy (Aksakallı & Daşer, 2025; Roe et al., 2025). These technologies provide individualized feedback that is often difficult to achieve in traditional classroom settings, helping to address common learner challenges such as limited vocabulary, syntactic complexity, and issues with coherence (Alzahrani & Alotaibi, 2024; Tseng & Lin, 2024). In addition, AI-generated suggestions can enhance linguistic accuracy, expand lexical resources, and expose learners to more advanced models of academic writing (Shen & Tao, 2025).

Despite these advantages, concerns remain regarding over-reliance on AI tools. When used primarily for text generation, AI systems may undermine learner autonomy, reduce cognitive engagement, and limit opportunities for authentic skill development (Mun, 2024; Yin & Dou, 2025). Research has highlighted that uncritical acceptance of AI-generated output can encourage plagiarism, superficial revision practices, and reduced critical thinking, all of which may negatively affect long-term writing development (Al Herz, 2025; Teng, 2024b). Consequently, scholars increasingly emphasize the need to position AI not as a substitute for human reasoning but as a pedagogical assistant that supports deeper engagement in the writing process (Xu et al., 2025; Zhou & Du Preez, 2025).

This orientation requires deliberate instructional design: learners need to be guided to critically evaluate AI-generated feedback, assess its relevance and accuracy, and integrate it meaningfully into their writing processes (Hao et al., 2024; Strobl et al., 2024). Such engagement is essential for developing AI literacy and ensuring that learners remain active participants in the composition process (McPhee & Jerowsky, 2025). Effective integration, therefore, depends on structured pedagogical approaches that harness AI's analytical capabilities while maintaining human oversight, promoting metacognitive awareness, and supporting iterative learning. This orientation provides a foundation for instructional strategies such as prompt-based scaffolding, which can enhance writing development while preserving learner independence.

FLIPPED LEARNING IN WRITING INSTRUCTION

Flipped learning has emerged as a widely adopted instructional model that shifts foundational learning activities to the pre-class phase, allowing classroom time to be devoted to higher-order analysis and practice (Dung, 2024). In EFL writing contexts, this approach enables learners to engage with instructional materials such as videos, examples, and language models prior to class, thereby freeing in-class time for guided practice, peer interaction, and teacher feedback. Research indicates that flipped learning can enhance writing proficiency, promote learner autonomy, and increase motivation

by allowing students to learn at their own pace and revisit content as needed (Hieu & Thảo, 2024; Yaseen & Alnaakeeb, 2023).

However, flipped learning alone may not fully address the diverse challenges faced by EFL writers. Learners do not always engage effectively with pre-class materials, and instructors may find it difficult to provide individualized scaffolding for varied linguistic and cognitive needs during class (Huang et al., 2023). As a result, students may rely on memorized templates rather than developing an understanding of the underlying principles of writing, particularly when dealing with complex academic genres. The effectiveness of the model is further constrained when learners lack the linguistic foundation necessary to benefit from in-class activities (Zhou & Du Preez, 2025).

Integrating AI into the flipped model offers a potential solution to these limitations. AI tools can support personalized pre-class learning, provide immediate feedback, and present varied examples tailored to individual learner needs (Tseng & Lin, 2024). When combined with flipped pedagogy, AI can help learners develop foundational linguistic knowledge before class, enabling instructors to focus on higher-level writing skills during face-to-face sessions. This integration positions AI as a facilitator of pre-class learning that seamlessly supports in-class application, making it a complementary component of the flipped instructional approach.

DESCRIPTIVE STATISTICAL WRITING: CHALLENGES FOR EFL LEARNERS

Descriptive statistical writing, particularly the interpretation and description of static bar charts, is a core academic skill required in many educational contexts. Effective descriptive writing requires accuracy, precision, comparative analysis, and concise summarization of information (Song & Song, 2023). For EFL learners, however, describing static bar charts presents distinct linguistic and cognitive challenges. Unlike dynamic graphs, which emphasize trends over time, static bar charts require learners to compare categories, identify significant differences, and select key features without relying on temporal progression (Nagao, 2022).

Common difficulties include limited comparative vocabulary, uncertainty in structuring comparison sentences, difficulty identifying salient features, and limited familiarity with the range of sentence patterns needed to report visual data (Alzahrani & Alotaibi, 2024; Fitria, 2024). These challenges often lead to incomplete or inaccurate descriptions, negatively affecting performance in academic writing assessments that prioritize clarity, coherence, and accurate representation of data (Teng, 2024a; Xu et al., 2025). In addition, traditional classroom instruction often lacks sufficient time and resources to support repeated, scaffolded practice with data-driven writing tasks, further constraining learners' development (Robillos & Bustos, 2023).

Despite the importance of descriptive statistical writing, research on pedagogical strategies integrating flipped learning with AI-supported scaffolding to address these challenges remains limited. Existing studies have paid relatively little attention to static bar-chart writing as a distinct genre, particularly in the context of AI tools designed to support learning rather than generate complete texts (Chen et al., 2025; Selim, 2024). This gap highlights the need for empirical research examining how AI can support the development of genre-specific writing skills in EFL contexts.

AI PROMPT LITERACY AND PROMPT-BASED SCAFFOLDING

Prompt-based scaffolding refers to the structured use of targeted prompts to guide learners in developing linguistic, cognitive, and rhetorical skills. This concept is grounded in Vygotsky's Zone of Proximal Development and scaffolding theory, where learners receive graduated support that is gradually withdrawn as proficiency increases (Koka et al., 2023; Walter, 2024). In AI-assisted writing contexts, prompt-based scaffolding involves carefully designed prompts that support learners in analyzing data, generating comparison structures, developing academic vocabulary, and constructing coherent descriptions without producing complete texts on their behalf.

Recent scholarship highlights the growing importance of prompt literacy, defined as the ability to design, interpret, and refine AI prompts to elicit accurate and pedagogically meaningful responses (Hwang et al., 2023; Ognibene et al., 2025). Research suggests that prompt literacy enhances writing self-efficacy, promotes metacognitive engagement, and strengthens learners' ability to evaluate AI-generated suggestions critically (Jin et al., 2025; Kim et al., 2025). Through the development of these skills, learners are better positioned to engage with AI as active collaborators rather than passive recipients of machine-generated output.

Structured prompts also encourage learners to reflect, compare alternatives, and apply linguistic choices independently rather than defaulting to AI-generated output (McPhee & Jerowsky, 2025; Strobl et al., 2024). Such engagement supports the development of AI literacy, fosters higher-order thinking, and enables learners to integrate AI feedback more selectively into their writing processes. In addition, scaffolded interactions with AI have been shown to reduce writing anxiety, improve familiarity with complex tasks, and enhance analytical skills (Khojasteh et al., 2025; Mavridi, 2025).

Despite these developments, empirical research on prompt-based scaffolding for descriptive writing, particularly within flipped learning contexts, remains limited. Much of the existing literature focuses on AI for automated feedback or text generation, with relatively little attention to its potential as an instructional scaffold for genre-specific writing tasks (Dikilitaş et al., 2024; Yu et al., 2024). This gap highlights the need for pedagogical frameworks that integrate AI as a cognitive partner to support purposeful interaction and reduce superficial engagement (Hutson et al., 2024).

The present study addresses this gap by examining a flipped AI instructional model that uses structured prompts to help EFL learners develop proficiency in descriptive statistical writing. The model positions AI as a pedagogical assistant that provides targeted scaffolding while promoting learner autonomy and responsible AI use.

CONCEPTUAL FRAMEWORK: THE FLIPPED AI WRITING MODEL

Building on research in AI-assisted writing, flipped learning, and scaffolded instruction, this study proposes the Flipped AI Writing Model, a pedagogical framework designed to support EFL learners in developing descriptive statistical writing. Unlike existing approaches that primarily rely on AI for text generation or surface-level correction, this model integrates structured prompt-based scaffolding within a flipped learning design. A key feature of the framework is the incorporation of a guided “Write-With” in-class production phase, which represents a distinct instructional contribution to EFL writing pedagogy and addresses a current gap in AI-supported writing research.

During the pre-class phase, learners engage with carefully designed AI prompts that target the sub-skills required to describe static bar charts. These prompts guide students to identify chart types, analyze key features, develop comparative vocabulary, practice syntactic structures, and paraphrase task instructions. Importantly, the prompts are designed to support learning rather than generate complete responses; they provide explanations, examples, sentence frames, controlled practice tasks, and metalinguistic feedback. This phase promotes prompt literacy while introducing genre-specific linguistic resources and maintaining learners' responsibility for content creation.

The in-class phase operationalizes the model's central pedagogical innovation through the “Write-With” approach. Learners bring their pre-class notes and engage in guided, collaborative writing activities. The instructor introduces a static bar chart and facilitates discussion on relevant vocabulary, sentence structures, and organizational patterns. Writing is intentionally paused after each stage of modelling or clarification, allowing students to construct their own drafts using their notes. This structured, interactive process encourages active participation from all learners, including those who may require additional support. Because students rely on their own interpretations, each produces a distinct text while maintaining an accurate representation of data. This phase enhances engagement, discourages template memorization, and supports the development of authentic writing within a scaffolded environment.

In the post-writing phase, AI is reintroduced as a feedback tool. Learners submit their drafts using structured prompts designed to elicit targeted feedback on aspects such as grammatical accuracy, lexical variety, clarity of comparisons, and coherence. Rather than requesting full rewrites, learners are guided to seek explanations, examples, or focused practice related to their errors. They then revise their work by integrating both teacher and AI feedback. This phase promotes self-regulated learning, strengthens AI literacy, and encourages responsible and critical use of AI tools.

Together, these phases form a coherent instructional model that integrates AI as a pedagogical scaffold within a flipped learning environment. The framework assumes that structured interaction with AI during pre-class preparation, combined with guided in-class writing and reflective AI-supported revision, can enhance learners' descriptive writing performance and confidence in using AI as a learning partner. Figure 1 illustrates the cyclical nature of the model, highlighting the interaction between prompt literacy, self-regulation, and AI-mediated scaffolding in supporting writing development. The framework is implemented and empirically examined in this study through a short-term classroom intervention, focusing on its impact on writing performance and learner perceptions.

The Flipped-AI Writing Framework: A Three-Phase AI-Supported Instructional Model

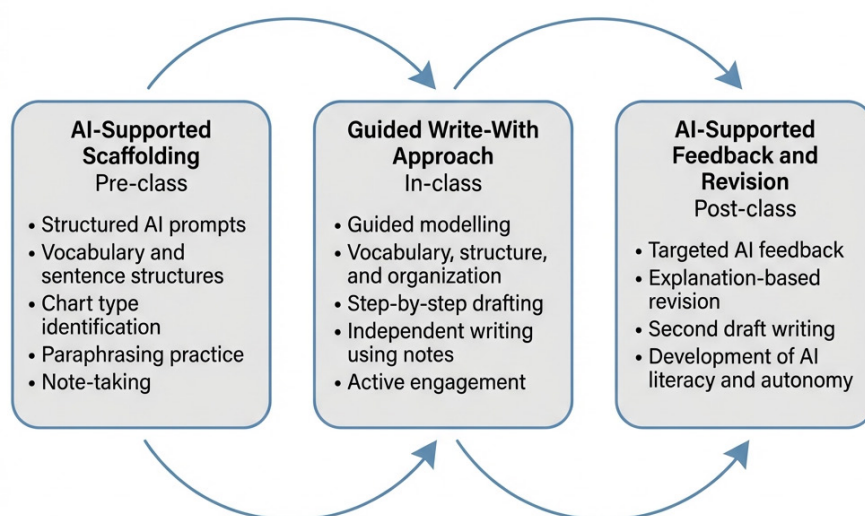


Figure 1. Flipped AI writing model

METHODOLOGY

RESEARCH DESIGN

This study employed a quasi-experimental one-group pre-test/post-test design to examine the effectiveness of the Flipped AI Writing Model on EFL learners' descriptive writing performance. A one-group design was selected due to practical and institutional constraints, as the intervention was integrated into an existing writing course, making random assignment and the inclusion of a control group infeasible.

Participants completed parallel pre-test and post-test tasks that required them to describe a static bar chart. These assessments were administered before and after a four-week instructional intervention. The intervention incorporates three phases: AI-supported pre-class scaffolding, a guided in-class

“Write-With” drafting approach, and AI-supported post-writing revision. This design enabled measurement of changes in writing performance following structured exposure to the instructional model.

CONTEXT AND PARTICIPANTS

The study was conducted at a public university in Oman and involved 25 EFL learners aged between 20 and 22. The participants were enrolled in the GE3 writing module of a preparatory program and were assigned to the class through standard institutional scheduling procedures. Based on institutional placement criteria, their English proficiency levels were estimated to be within the B1–B2 range according to the Common European Framework of Reference for Languages (CEFR).

The class was treated as an intact group, and the intervention was implemented as part of regular coursework. Participation in the study did not affect students’ course grades, and all data were anonymized before analysis. Ethical approval for the study was obtained from the relevant institutional body.

INSTRUCTIONAL TREATMENT

The instructional intervention was conducted over a four-week period and followed the Flipped AI Writing Model, which consisted of three interconnected phases: pre-class AI-supported scaffolding; in-class guided writing; and post-writing AI-supported revision. All participants used the free version of ChatGPT as the AI tool throughout the intervention.

In the pre-class phase, students engaged with structured, researcher-designed prompts delivered through instructional handouts. These prompts were intended to prepare learners for descriptive writing tasks involving static bar charts by targeting key sub-skills, including chart type identification, extraction of key features, development of comparative vocabulary, construction of sentence patterns, paraphrasing of task statements, and organization of ideas. The prompts were explicitly designed to support learning rather than generate complete responses. Instead of producing full essays, the AI provided explanations, example sentences, sentence frames, and short practice tasks. Students were instructed to interact with the AI by requesting explanations, examples, and guided practice, and to record key notes from these interactions for use in subsequent classroom activities.

The in-class phase operationalized a guided “Write-With” approach. Students brought their pre-class notes and applied them to a new static bar chart task introduced by the instructor. The teacher facilitated step-by-step modelling of relevant vocabulary, sentence structures, and paragraph organization. After each stage of modelling or clarification, writing was intentionally paused to allow students to draft the corresponding sections of their response using their prepared notes. This structured and interactive process encouraged active participation from all learners, including those requiring additional support. As students relied on their own notes and interpretations, each produced a unique text while maintaining an accurate representation of data. This phase supported incremental development of writing, reduced reliance on memorized templates, and promoted authentic language production.

In the post-writing phase, AI was reintroduced as a feedback tool to support revision. Students submitted their drafts to ChatGPT using structured prompts designed to elicit targeted feedback on grammatical accuracy, lexical choice, clarity of comparisons, and overall coherence. They were explicitly instructed not to request full rewrites but to seek explanations, examples, and focused corrections related to specific issues in their writing. Students were also encouraged to ask follow-up questions to deepen their understanding of the feedback received. Based on both teacher input and AI-generated feedback, students revised their drafts and produced a second version. This phase aimed to foster self-regulated learning, strengthen AI literacy, and promote critical engagement with AI-generated suggestions.

To ensure transparency and reproducibility, the AI prompts used in this study were systematically designed and delivered to students as structured instructional handouts. These handouts guided learners

through specific sub-skills, including chart identification, vocabulary development, sentence construction, paraphrasing, and paragraph organization. For example, one vocabulary-development prompt instructed students to “list 15 words or phrases used ONLY for describing static bar charts...Do NOT create worksheets, tables, or exercises – only explanations,” illustrating how prompts were deliberately constrained to elicit explanatory, non-generative AI responses rather than complete text. All prompts were explicitly designed to support learning processes rather than generate complete written responses. Students were instructed to use AI to explain concepts, provide examples, and support understanding, while avoiding full-text generation. Representative examples of the prompts used in the intervention are provided in Appendix A & B. This structured approach ensured consistency in AI use across participants. It positioned AI as a guided learning tool rather than a content generator.

Together, these three phases created a balanced integration of AI support and teacher guidance, enabling learners to actively engage in the writing process while benefiting from structured scaffolding and targeted feedback.

INSTRUMENTS

Writing performance was assessed using two parallel tasks: a pre-test and a post-test, each requiring students to produce a 150-word description of a static bar chart of comparable complexity. To minimize practice effects, different charts were used in the pre- and post-tests while maintaining similar task demands. Student responses were evaluated using an IELTS Task 1–based analytic rubric that assessed four criteria: task achievement, coherence and cohesion, lexical resource, and grammatical range and accuracy. In addition to the composite score, scores for each of the four criteria were analyzed separately to examine whether gains were consistent across sub-skills.

To enhance scoring reliability, two trained raters independently scored all scripts using the shared rubric, following prior calibration on sample responses. Inter-rater reliability was assessed using a two-way random-effects, absolute-agreement intraclass correlation coefficient, ICC(2,1), calculated on the raters’ independent scores across all 50 rated scripts (25 pre-test, 25 post-test). Reliability was excellent, ICC = .96, 95% CI [.53, .99], $p < .001$ (Koo & Li, 2016). The two raters showed a small but statistically significant mean-level difference (Marker 2 scoring on average 1.8 points higher than Marker 1, $p < .001$) despite near-perfect agreement in their relative ranking of scripts ($r = .99$); any such discrepancies were resolved through discussion to reach a final agreed score used in all analyses.

To examine learners’ perceptions of the Flipped AI Writing Model, a post-intervention questionnaire was administered. The questionnaire consisted of 12 Likert-scale items measuring perceived usefulness, clarity of instruction, confidence in writing, and understanding of responsible AI use; internal consistency reliability was calculated using Cronbach’s alpha. In addition, two optional open-ended questions were included to allow students to elaborate on what helped them most and what challenges they encountered, and responses were analyzed thematically. Together, these instruments provided quantitative and qualitative insight into student learning and engagement.

PROCEDURE

The study was conducted over a four-week period within the regular course schedule. In Week 1, students completed the pre-test and received an orientation on the responsible and purposeful use of AI as a learning tool. This orientation emphasized the use of AI for guided learning rather than full text generation.

During Weeks 1 to 3, the instructional intervention was implemented through repeated cycles of the Flipped AI Writing Model. Students engaged in AI-supported preparation tasks before class, participated in guided writing activities during class, and revised their work using AI-supported feedback after class. These cycles allowed for progressive development of writing skills through structured scaffolding and iterative practice.

In Week 4, students completed the post-test under conditions similar to those of the pre-test, followed by administration of the perception questionnaire. All components of the intervention were integrated into the existing course timetable, ensuring that data collection occurred within a naturalistic classroom environment without disrupting regular instructional practices.

PROMPT ENGINEERING PROCEDURES

The AI prompts used in the pre-class and post-writing phases were developed through a structured pedagogical design to ensure that students engaged in learning processes rather than relying on AI for full-text generation. All prompts followed a controlled format that provided explanations, example sentences, sentence frames, and guided practice tasks, while explicitly restricting the generation of complete paragraphs or full essays.

Each prompt was aligned with a specific sub-skill required for describing static bar charts, including identifying key features, recalling comparative vocabulary, constructing syntactic patterns, paraphrasing task statements, and organizing information into logical groups. Students were instructed to interact with the AI by requesting clarifications, additional examples, and short practice tasks, rather than soliciting complete written responses.

During the post-writing phase, prompts were designed to elicit targeted feedback on grammatical accuracy, lexical choice, coherence, and clarity of comparisons. Students were trained to evaluate AI-generated feedback critically, compare it with teacher guidance, and make independent decisions when revising their drafts. This process aimed to promote reflective learning, strengthen AI literacy, and support the development of self-regulated writing practices.

All prompts were implemented using the free version of ChatGPT to ensure accessibility and reproducibility. Representative examples of the prompts used in the study are provided in Appendix A & Appendix B.

DATA ANALYSIS

Data analysis involved both quantitative and qualitative procedures. Writing performance data from the pre-test and post-test were analyzed using descriptive statistics, including means and standard deviations, to examine overall performance trends. Gain scores were calculated to determine the extent of improvement across participants. A paired-samples t-test was conducted to assess whether the differences between pre-test and post-test scores were statistically significant, and the normality of the difference scores was assessed using the Shapiro–Wilk test. In addition, effect size (Cohen’s *d*) was calculated to evaluate the magnitude of the observed changes. The same procedure was repeated for each of the four IELTS rubric criteria separately to examine whether gains were consistent across task achievement, coherence and cohesion, lexical resource, and grammatical range and accuracy.

Responses from the post-intervention questionnaire were analyzed using descriptive statistics, including item-level means and standard deviations, to identify patterns in students’ perceptions of the instructional model; internal consistency was assessed using Cronbach’s alpha. Responses to the two optional open-ended items were read repeatedly and grouped into recurring themes using inductive thematic coding, with illustrative excerpts retained to represent each theme.

RESULTS

PRE- AND POST-TEST DESCRIPTIVE STATISTICS

To examine changes in students’ descriptive writing performance following the Flipped AI Writing Model, a paired-samples t-test was conducted to compare pre-test and post-test scores on a static bar-chart writing task. Descriptive statistics indicated a substantial increase in performance from the pre-test ($M = 10.60$, $SD = 3.86$) to the post-test ($M = 22.04$, $SD = 6.94$). The mean gain score was 11.44 ($SD = 7.39$), reflecting considerable improvement across participants (Table 1).

Table 1. Pre-test, post-test, and gain scores (N = 25)

Measure	Pre-test	Post-test	Mean gain	<i>t</i> (24)	<i>p</i>	Cohen's <i>d</i>
Mean (SD)	10.60(3.86)	22.04(6.94)	11.44 (7.39)	7.74	< .001	1.55

Note. *N* = 25. A paired sample *t*-test showed a statistically significant improvement from pre-test to post-test ($p < .001$).

The paired-samples *t*-test showed that the difference between pre-test and post-test scores was statistically significant, $t(24) = 7.74$, $p < .001$. The effect size, calculated using Cohen's *d*, was 1.55, indicating a large effect according to established benchmarks. A Shapiro–Wilk test indicated that the gain scores did not deviate significantly from a normal distribution ($W = 0.94$, $p = .137$), supporting the appropriateness of the paired-samples *t*-test for these data. Given the one-group pre-test/post-test design and the absence of a control group, this result should be interpreted as a substantial improvement following the intervention rather than definitive evidence that the intervention alone caused the change.

Overall, these findings indicate that the intervention period was associated with improvements in students' descriptive writing. To examine whether these gains were consistent across specific writing sub-skills rather than driven by a single component of the rubric, paired-samples *t*-tests were also conducted separately for each of the four IELTS criteria; results are presented in Table 2.

Table 2. Pre-test, post-test, and gain scores by IELTS rubric criterion (N = 25)

Criterion	Pre-test	Post-test	Mean gain	<i>t</i> (24)	<i>p</i>	Cohen's <i>d</i>
Task achievement	3.32 (1.35)	5.84 (1.80)	2.52 (2.04)	6.17	< .001	1.23
Coherence and cohesion	2.76 (1.23)	5.76 (1.83)	3.00 (2.04)	7.35	< .001	1.47
Lexical resource	2.32 (0.80)	5.24 (1.67)	2.92 (1.73)	8.44	< .001	1.69
Grammar (range and accuracy)	2.20 (0.71)	5.20 (1.73)	3.00 (1.78)	8.43	< .001	1.69

Note. *N* = 25 for all criteria. TA = Task Achievement; CC = Coherence and Cohesion; LR = Lexical Resource; GR = Grammatical Range and Accuracy. All paired *t*-tests were significant at $p < .001$. Shapiro–Wilk tests indicated approximately normal gain-score distributions for TA, CC, and GR (all p s > .08); the Lexical Resource gain scores deviated somewhat from normality ($p = .013$), so this result is interpreted with some caution.

As shown in Table 2, statistically significant gains with large effect sizes were observed for all four rubric criteria, indicating that improvement was not confined to a single sub-skill but was broadly distributed across task achievement, coherence and cohesion, lexical resource, and grammar.

QUESTIONNAIRE FINDINGS

Learners' perceptions of the Flipped AI Writing Model were examined using a 12-item post-intervention Likert-scale questionnaire, with responses ranging from 1 (strongly disagree) to 5 (strongly agree) (Table 3). The scale demonstrated excellent internal consistency (Cronbach's $\alpha = .92$). Overall, students reported positive attitudes toward the instructional approach, with a mean score of 3.60 across all items, indicating moderate to strong agreement with the perceived benefits of the intervention.

Item-level analysis revealed that the highest-rated statement was Q2, "I learned new words and phrases for making comparisons in writing" ($M = 3.88$, $SD = 0.83$), reflecting the effectiveness of the AI-supported prompts in developing lexical resources. Similarly, Q9 ($M = 3.80$, $SD = 0.91$) and Q1 ($M = 3.72$, $SD = 1.28$) suggest that learners found the prompts useful for understanding how to organize and describe data in static bar charts.

The lowest-rated item, although still above the neutral midpoint, was Q10, "I can now write body paragraphs more logically after learning with AI" ($M = 3.24$, $SD = 0.97$). This indicates that while

learners perceived improvement, the development of paragraph organization may require more sustained instructional support beyond the intervention period.

Table 3. Students' perceptions of the flipped AI writing model (N = 25)

Item	Questionnaire statement	Mean	SD
Q1	The AI prompts helped me understand how to describe static bar charts.	3.72	1.28
Q2	I learned new words and phrases for making comparisons in writing.	3.88	0.83
Q3	The AI feedback after writing helped me identify and correct my mistakes.	3.64	1.08
Q4	Using AI before class made me more confident to write on my own in class.	3.48	1.01
Q5	I understand better how to use AI for learning, not for copying full essays.	3.48	1.30
Q6	I would like to use AI tools in similar ways for other writing topics.	3.64	1.11
Q7	The AI instructions were clear and easy to follow.	3.60	1.23
Q8	It was easy to use AI to find the information I needed for writing.	3.60	1.32
Q9	AI helped me understand how to group and organize data in bar charts.	3.80	0.91
Q10	I can now write body paragraphs more logically after learning with AI.	3.24	0.97
Q11	The teacher's explanation helped me use AI more effectively.	3.52	1.19
Q12	Combining AI learning at home with class practice helped me improve faster.	3.60	0.96

Standard deviations across items ranged from 0.83 to 1.32, indicating moderate variability in responses without substantial disagreement. Overall, the findings suggest that students perceived the Flipped AI Writing Model as useful, clear, and supportive of their writing development, complementing the observed improvements in performance outcomes.

QUALITATIVE FINDINGS FROM OPEN-ENDED RESPONSES

Of the 25 participants, 23 responded to the two optional open-ended items asking what helped them most and what challenges they faced. Response length varied considerably: several students gave single-word or minimal answers (e.g., “no,” “nothing”), which limited the depth of thematic analysis for those cases, while others provided more elaborated reflections. Responses were read repeatedly and grouped into recurring themes using inductive coding.

Regarding what helped most, the most frequently cited benefit was vocabulary and comparative language support, with roughly one-third of respondents specifically mentioning learning new words or phrases for comparison. A smaller number of students highlighted the clarity of AI explanations and feedback on grammar and sentence structure. One student summarized this benefit: “Using AI helped me most by giving quick feedback on my grammar and sentence structure. It also gave me better vocabulary choices and helped me organize my ideas more clearly.”

Regarding challenges, most students reported few or no notable difficulties. Where challenges were mentioned, two related concerns emerged. First, a small number of students noted uncertainty about the accuracy of AI feedback and a risk of over-reliance; as one student put it, “I had to learn how to use AI in a smart way and not depend on it too much.” Second, a few students indicated they still preferred the teacher's explanations for sentence-level work, with one noting that “how to formulate sentences using the teacher's method is easier than AI.” Occasional mentions of difficulty with unfamiliar vocabulary were also noted.

Taken together, these themes are broadly consistent with the questionnaire findings: students valued the AI prompts primarily as a source of vocabulary and language-level support, while expressing an awareness of over-reliance that aligns with the study's emphasis on responsible AI use. Given the brevity of many responses, these qualitative findings should be read as indicative rather than exhaustive.

DISCUSSION

The purpose of this study was to examine the effectiveness of the Flipped AI Writing Model, which used structured, pedagogical, prompt-based scaffolding to support EFL learners in writing static bar chart descriptions. The findings show that writing performance improved substantially over the course of the intervention and that learners perceived the model positively, offering insights into the pedagogical potential of structured, prompt-based AI support.

The substantial improvement from the pre-test to the post-test suggests that the intervention period was associated with meaningful gains in students' descriptive writing skills. Consistent with RQ1, these gains were not confined to a single dimension of writing: statistically significant improvements with large effect sizes were observed across all four IELTS rubric criteria – task achievement, coherence and cohesion, lexical resource, and grammatical range and accuracy (Table 2) – indicating that the model was associated with broad-based rather than narrowly localized improvement. The large overall effect size ($d = 1.55$) is consistent with the possibility that AI-supported pre-class learning, combined with guided in-class drafting, helped students build the lexical and syntactic resources needed for accurate statistical description. This aligns with previous research indicating that AI tools can support vocabulary development, syntactic accuracy, and overall writing fluency when used as guided scaffolds rather than automated writing systems (Alzahrani & Alotaibi, 2024; Tseng & Lin, 2024).

The flipped design also provided opportunities for richer in-class interaction, allowing the instructor to focus on clarifying misconceptions, probing understanding, and reinforcing rhetorical features of descriptive writing, an approach supported by studies on flipped learning that highlight the value of dedicating class time to higher-order writing processes (Dung, 2024). Because this study used a one-group pre-test/post-test design without a control group, these gains cannot be attributed to the intervention with certainty; maturation, increased familiarity with the task format, or general exposure to the course during the same four-week period cannot be ruled out as contributing factors. The consistency of gains across all four independently scored criteria nonetheless offers some support for a genuine instructional effect, and this pattern would benefit from replication using a controlled design.

Students' questionnaire responses further reinforce the effectiveness of the approach. High mean scores on items relating to vocabulary development (Q2), understanding of descriptive techniques (Q1), and responsible AI use (Q5) indicate that the structured prompts enhanced learners' metacognitive awareness of how to learn with AI rather than depend on it. This finding aligns with recent scholarship advocating for AI as a pedagogical collaborator that improves critical thinking and the use of writing strategies, rather than as a tool for producing complete texts (Kanik, 2025; Xu et al., 2025). The high ratings for clarity of AI instructions and ease of use (Q7–Q8) demonstrate that students were able to navigate the AI tools effectively when provided with guided prompts aligned with learning objectives. The open-ended responses converged with this pattern: when asked what helped most, students most frequently cited vocabulary and comparative-language support, echoing the highest-rated questionnaire item (Q2), while several students also spontaneously noted an awareness of the risk of over-reliance on AI, suggesting that the intervention's emphasis on responsible AI use resonated with learners beyond the closed-ended items.

The lowest mean score (Q10) for the logical structuring of body paragraphs highlights an area for further development. While students improved overall, structuring body paragraphs for descriptive statistical writing, particularly grouping data and organizing comparisons, is a cognitively demanding

skill that may require more explicit, extended scaffolding. This aligns with research indicating that EFL learners often struggle with coherence and rhetorical organization when interpreting charts and graphs, even as their vocabulary and grammar improve (Nagao, 2022; Teng, 2024a). Thus, while the Flipped AI Writing Model supported foundational skills, more targeted instruction may be necessary for advanced discourse organization.

Overall, the findings contribute to emerging research on AI literacy and prompt engineering in EFL instruction. By training students to interact critically and purposefully with an AI system, the model encouraged learners to internalize analytical processes rather than rely on the tool for text generation. This supports recent arguments that prompt-based AI scaffolding can strengthen metacognitive engagement, improve self-regulation, and foster deeper learning (Jin et al., 2025; Walter, 2024). It also addresses concerns about over-reliance on AI by positioning the technology as an interactive tutor that guides learning rather than replacing cognitive effort.

Importantly, the study highlights the potential for short-term, targeted AI interventions to yield meaningful improvements in writing performance, even within highly structured academic genres such as descriptive statistical writing. This is particularly relevant in EFL higher education contexts where class time is limited and individualized feedback is challenging. The Flipped AI Writing Model, therefore, represents a sustainable, ethically aligned approach to integrating AI into writing instruction, one that supports skill development without encouraging academic dishonesty or rote memorization of templates.

A key contribution of this study is the introduction of the Flipped AI Writing Model, a novel pedagogical framework that integrates structured, prompt-based scaffolding with a flipped learning cycle. Unlike previous research that typically positions AI as a generator of full texts or as an automated feedback tool, this model conceptualizes AI as a guided learning partner that prepares students before class, supports interactive drafting during class, and facilitates reflective revision after class. This structured three-phase design fills a clear gap in existing literature by demonstrating how AI can be embedded within a pedagogical sequence that promotes prompt literacy, self-regulation, and responsible AI use. The model, therefore, extends current understandings of AI integration in writing instruction and offers an innovative, replicable approach for supporting genre-specific writing skills, particularly the underexplored domain of descriptive statistical writing.

CONCLUSION

This study examined the Flipped AI Writing Model, grounded in structured prompt-based scaffolding, and its association with EFL learners' descriptive writing performance. The results showed a statistically significant improvement in students' ability to describe static bar charts, with large effect sizes accurately observed both overall and across all four IELTS rubric criteria, alongside positive learner perceptions. Because the study used a one-group pre-test/post-test design without a control group, these findings should be read as evidence that the intervention period was associated with meaningful gains rather than as definitive proof that the Flipped AI Writing Model alone caused them. With that caveat, the findings are consistent with the view that guided, prompt-based use of AI can support learners' vocabulary range, syntactic flexibility, and confidence in academic writing.

The intervention also highlights the value of leveraging AI for pre-class preparation, which enables more focused and interactive in-class engagement and supports higher-quality writing production. Overall, the study provides empirical evidence that AI-supported flipped learning can serve as an effective pedagogical approach for developing genre-specific writing skills in EFL contexts.

PEDAGOGICAL IMPLICATIONS

The findings highlight several pedagogical implications for integrating AI into writing instruction. First, structured AI prompts can effectively guide learners in developing foundational skills such as

paraphrasing, comparative vocabulary, and sentence construction during the pre-class phase. This enables teachers to use classroom time for deeper analysis, collaborative drafting, and individualized guidance. Second, the model supports the development of AI literacy by training learners to engage critically with AI, use it for targeted learning, and avoid overreliance on full-text generation.

Third, the approach is practical and scalable in EFL contexts where large class sizes and limited instructional time restrict opportunities for individualized feedback. Teachers can incorporate pre-designed AI prompt materials to support the development of essential writing strategies and use in-class activities to reinforce organization, coherence, and accuracy. Overall, the model offers a feasible and ethically grounded approach to AI-enhanced writing instruction that can be adapted to a range of academic writing genres beyond static bar-chart descriptions.

LIMITATIONS AND FUTURE RESEARCH

Despite its positive outcomes, the study has several limitations. First, the sample size was relatively small and limited to a single intact GE3 class. In addition, the absence of a control group limits causal generalization. Second, the intervention focused exclusively on static bar-chart descriptions; other IELTS Task 1 genres, such as tables, processes, and line graphs, may require different forms of scaffolding. Third, the intervention was relatively short (four weeks), and longer implementations may reveal different patterns of development, particularly regarding coherence and rhetorical organization. Fourth, while gain scores for the composite measure and three of the four rubric criteria were approximately normally distributed, the Lexical Resource gain scores showed some deviation from normality (Shapiro–Wilk $p = .013$), so results for that criterion should be interpreted with some caution.

Fifth, the study measured only immediate post-test gains; including delayed post-tests would provide valuable insights into long-term retention and transfer of learning. Future research could explore the application of AI-supported flipped models across a wider range of writing genres, examine their long-term impact on writing autonomy, and investigate how varying levels of AI scaffolding influence learners at different proficiency levels. While this study analyzed responses to two optional open-ended questionnaire items, many responses were brief; future work incorporating richer qualitative data sources, such as learner interviews or classroom observations, may provide deeper insights into how learners engage with AI during the writing process.

ETHICAL CONSIDERATIONS AND AUTHOR DECLARATIONS

This study was conducted in accordance with institutional guidelines for research involving human participants. Ethical approval was obtained from the relevant institutional authority before data collection. Participation was voluntary, and informed consent was obtained from all participants. Students were informed that their responses would be used for research purposes only and would not affect their course grades. All data were anonymized to ensure confidentiality and privacy.

The author confirms that this manuscript is original, has not been published previously, and is not under consideration for publication elsewhere. All sources have been appropriately cited, and no copyrighted material has been used without proper acknowledgment. The manuscript contains no plagiarized material and complies with academic integrity standards.

AI tools were used strictly for instructional support within the study. Students were guided to use AI responsibly for learning purposes, and no AI-generated content was submitted as part of assessed work. AI tools were used solely for language refinement (e.g., grammar and clarity). All intellectual content and interpretations are the author's own.

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APPENDIX A

Flipped AI Preparation Handout 1

Topic: Learning to Describe Static Bar Charts (IELTS Task 1)

Purpose

Tomorrow in writing class, we will begin learning how to write IELTS Task 1 reports on static bar charts. Use the prompts below with ChatGPT to learn key points about bar-chart writing. These prompts are designed to teach you only the necessary explanations, not to give full essays or worksheets.

Use These Prompts Exactly as Given

- 1. Identifying Static Charts:** Explain clearly what a static bar chart is in IELTS Task 1. Compare it with a dynamic chart in one short sentence only. Do NOT give any examples, questions, or writing tasks. Your answer should be limited to explanation only.
- 2. Vocabulary for Bar Charts:** List 15 words or phrases used ONLY for describing static bar charts (no words for changes over time). Give one short example sentence for each word. Do NOT include vocabulary for trends, years, increases, or decreases. Do NOT create worksheets, tables, or exercises only explanations.
- 3. Complex Sentence Structures:** Write 8 example sentences comparing categories in a static bar chart using: while, whereas, although, compared to, in contrast to. Do NOT write about changes over time or line graphs. Do NOT make it a worksheet; give sentences only.
- 4. Paraphrasing the Question Statement:** Show 10 ways to paraphrase IELTS Task 1 bar-chart question statements without changing meaning. Use academic vocabulary such as illustrates, compares, presents, displays. Do NOT paraphrase for line graphs or process diagrams. Do NOT give model essays, only sentence-level paraphrases.
- 5. Writing an Overview:** Explain what an overview paragraph should include in IELTS Task 1 static bar charts. Give exactly 3 short sample overview sentences without numbers. Do NOT include any data, percentages, or full reports. Keep your answer short and purely explanatory, no dynamic charts or writing tasks.

Important Reminder

Use AI to learn, not to write. Copy each prompt exactly as it is written above. Do not add extra questions or ask for full essays.

APPENDIX B

Flipped AI Handout 2

Topic: Writing Body Paragraphs for Static Bar Charts (IELTS Task 1)

Purpose

In this session, you will learn how to write body paragraphs for IELTS Task 1 static bar charts. You will learn how to group and organize data, select key features, and structure ideas logically. Use the prompts below exactly as written in ChatGPT. Do NOT ask for full essays or sample paragraphs. The goal is to learn the reasoning process, not to generate complete writing.

- 1. Understanding the Body Paragraphs:** Explain clearly what the body paragraphs in IELTS Task 1 (static bar chart) should include. Describe how many body paragraphs are usually written and what each paragraph focuses on. Do NOT give a full essay or example paragraphs; only explain the purpose and function of body paragraphs.
- 2. Grouping the Data:** Explain how to group data in a static bar chart for IELTS Task 1. Describe how to decide which bars or categories can go together in one paragraph. Give 3 different logical ways to group the data (for example, by similarity, by difference, or by category). Do NOT provide any complete writing; explain the decision process only.
- 3. Selecting Key Features:** Explain how to identify and select the key features in a static bar chart for IELTS Task 1. Describe which details are important to include and which can be ignored. Give general examples such as “the highest value,” “categories that are close in number,” or “a clear contrast.” Do NOT give a sample essay or full paragraph.
- 4. Organizing Ideas within a Paragraph:** Explain the ideal structure of one body paragraph in a static bar chart description. Tell me how to start the paragraph, how to compare categories, and how to end it. Do NOT write a paragraph for me; only show the logical order of ideas.
- 5. Avoiding Common Mistakes:** What are the common mistakes students make when writing body paragraphs for static bar charts, and how can they avoid them? Include mistakes about repetition, writing all data, and missing comparisons. Do NOT give any examples or sample essays.
- 6. Evaluating a Paragraph (Optional):** Give me 5 questions I can ask myself after writing my body paragraphs to check if they are well-organized, focused, and accurate. Do NOT give any model answers.

Reflection After Using AI

After completing these prompts, write short notes in your notebook on the following: How many paragraphs should be written and why? Which grouping method makes the most sense to you? What mistakes should you avoid when writing your own body paragraphs?

AUTHOR



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