THE IMPACT OF ICT-INTEGRATED COLLABORATIVE WRITING ON EFL STUDENTS' PERFORMANCE: A PROCESS-GENRE APPROACH TO COMPARISON ESSAYS

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Abstract: This quasi-experimental research analyzed how Information and Communication Technology (ICT)-integrated collaborative writing shapes comparison essay performance among 79 Vietnamese learners who were divided into experimental group (EG) and control group (EG) at a public university. Both EG and CG attended a process-genre writing approach with five stages. However, merely the EG were supported with ICT platforms and tools; while the CG attended traditional writing classes. The writing performance assessment evaluated comparison essays before and after the intervention according to their task fulfillment, organization, grammar, vocabulary, and overall writing quality. Before the intervention started, no noteworthy distinctions existed between the participant groups based on all assessment metrics. The analysis after the intervention indicated that while both groups improved the overall scores, the EG demonstrated gains in organizational skills and grammatical accuracy, whereas the CG excelled in task fulfillment. Vocabulary development showed minimal improvement in both groups. The study implies the complementary strengths of traditional and technology-assisted collaborative writing. Further studies should advocate a blended instructional approach to maximize EFL students' writing performance.

Keywords: comparison essays, ICT-integrated collaborative writing, criteria scoring, process-genre writing approach

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TÁC ĐỘNG CỦA VIẾT HỢP TÁC TÍCH HỢP CÔNG NGHỆ LÊN NĂNG LỰC VIẾT CỦA SINH VIÊN TIẾNG ANH: CÁCH TIẾP CẬN QUY TRÌNH - THỂ LOẠI ĐỐI VỚI BÀI LUẬN SO SÁNH

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Tóm tắt: Nghiên cứu bán thực nghiệm này phân tích tác động của viết hợp tác tích hợp công nghệ đối với năng lực viết bài luận so sánh của 79 người học tiếng Anh tại một trường đại học công lập ở Việt Nam. Sinh viên được chia thành nhóm thực nghiệm (EG) và nhóm đối chứng (CG), đều học theo cách tiếp cận viết quy trình - thể loại, nhưng chỉ nhóm EG được hỗ trợ bởi công nghệ. Năng lực viết được đánh giá trước và sau can thiệp dựa trên mức độ hoàn thành nhiệm vụ, tổ chức, ngữ pháp, từ vựng và chất lượng tổng thể. Trước khi can thiệp, không có sự khác biệt đáng kể giữa hai nhóm ở tất cả các tiêu chí đánh giá. Kết quả phân tích sau can thiệp cho thấy mặc dù cả hai nhóm đều cải thiện điểm số tổng thể, nhóm EG đạt tiến bộ hơn về kỹ năng tổ chức bài viết và độ chính xác ngữ pháp, trong khi nhóm CG nổi trội hơn về mức độ hoàn thành nhiệm vụ. Sự phát triển từ vựng ở cả hai nhóm đều ở mức hạn chế. Nghiên cứu gợi ý kết hợp viết truyền thống và viết có hỗ trợ công nghệ để nâng cao hiệu quả dạy viết luận tiếng Anh.

Từ khóa: bài luận so sánh, viết hợp tác tích hợp công nghệ, tiêu chí chấm điểm, cách tiếp cận quy trình - thể loại

1. Introduction

English language education enters a new phase because Information and Communication Technology (ICT) now reshapes traditional teaching methods (Warschauer & Healey, 1998). Group writing aligns well with sociocultural theories of learning, as these theories emphasize the importance of social interaction in the construction of knowledge (Dobao, 2020). Joint writing activities provide students with peer feedback, cognitive resources, and linguistic assistance that are typically unavailable in individual writing (Yeh, 2021). Nevertheless, different collaborative writing methods have some challenges. The first problem is that face-to-face interaction time is limited, which may result in uneven participation among students. The second issue is that it is hard to identify individual contributions (Zheng, 2017). The problems are particularly acute in Vietnamese EFL classrooms, which have high numbers of students and limited time for contact, which additionally impede meaningful engagement between students. The introduction of ICT into a collaborative writing process has offered potential solutions by overcoming physical barriers in the classroom, supporting a dynamic teamwork process, and facilitating targeted feedback (Nguyen & Nguyen, 2022; Warschauer, 2004). Digital platforms and tools such as Learning Management System (LMS), Google Docs, Padlet, and Grammarly, can support various stages of writing, namely planning, drafting, revising, editing, and publishing (Strobl, 2014).

Even though the studies on ICT applications in EFL writing have discussed the

development of overall writing and individual students' writing (Tran & Su, 2025; Thai & Nguyen, 2022), the number of studies about ICT-assisted writing and its use in demonstrating different genres, including comparison essays, is minimal. The available literature is more inclined towards generalized skill enhancement rather than the subtle influence of digital collaboration on genre-based writing assignments. Therefore, further research is needed to investigate the effect of technology-based collaborative strategies on the development of writing skills in comparison essays. Therefore, this study aimed to address these research gaps by examining the impact of ICT-integrated collaborative writing on Vietnamese EFL students' comparison essay performance and tackling the research question: ***"To what extent does ICT-supported collaborative writing impact students' comparison-essay writing performance?"***

2. Literature Review

2.1. Process-Genre Approach and Comparison Essay in EFL Writing

The process-genre approach (PGA) has become one of the most significant pedagogies over the past several years. The strategy combines the process approach with the structural and functional awareness of the genre-based approach to develop comprehensive instructions related to text organization and composition strategies (Peungcharoenkun & Waluyo, 2023). The process approach takes students through the stages that consist of planning, drafting, revising, and editing to encourage active participation in the learning process (Everett, 1992). In contrast, the genre-based approach focuses on the linguistic characteristics and communicative functions of particular types within discourse communities, often by relying on the guidance to familiarize students with the conventions of genres (Hyland, 2007; Matsuda, 2003).

With the complementary nature of these two methods, the PGA combines both programs to enhance writing instruction in EFL settings (Peungcharoenkun & Waluyo, 2023). PGA enables learners to acquire both the competencies to control the writing process and the knowledge to identify; and utilize their appropriate features (Pasand & Haghi, 2013). Badger and White (2000) advocated this integration is a set of writing practices with actual communicative intentions. Such exercises are usually based on model text analysis, group discussion, imitation, independent writing, peer feedback, revision, collaborative drafting, and publication. The given framework can enable students to experiment with genre conventions more practically and cooperate during the writing process. Such a combined approach not only helps students improve their knowledge but also places writing activities in the real context to motivate learners (Guo, 2005). Rusinovci (2024) suggested not using the PGA as a predefined set of instructions or a predetermined framework. Instead, they should be flexible and adjust their approach to the specific classroom setting, including students' level of proficiency, the size, or the available resources. The development of writing skills radically benefits from high student involvement, which makes PGA an encouraging process. Rahimi (2024) showed that PGA succeeded in raising student engagement and writing quality as instructors incorporated motivational instructional strategies.

Teachers who apply the PGA to comparison essays on helping students develop their skills in drawing critical assessments between multiple subjects. The fundamental concept in these texts involves the analysis of subject similarities and differences, structural organization, and choice of suitable comparative terms (Folse et al., 2015). Despite their varied naming structure, several standard features exist among different terms that describe sub-patterns of the comparison or contrast pattern. Sorenson (1992) established three distinct comparison and contrast sub-patterns, including part-by-part, whole-by-whole, and likenesses-differences. White

and Govern (1994) presented only two sub-patterns termed horizontal and vertical systems, while Oshima and Hogue (2006) called them point-by-point and block organization patterns. The point-by-point or block method applies three significant points to analyze two subjects, so each key point grows into a paragraph topic statement. The second method includes the point-by-point or similarities-differences pattern, which examines two subjects through points of commonality and points of distinction. A writer's choice of starting with similar aspects typically comes before discussing contrasting points, but this sequence may depend on the writer's communication objectives. The block pattern exists in two forms: the whole-by-whole pattern to address a subject until completing the second topic or uses the block or similarities-differences pattern to evaluate similarities first, followed by differences (Smalley & Ruetten, 1990). PGA applications in modern teaching practice feature technological components and define feedback systems. The integration of PGA into online platforms with diverse feedback types results in substantial improvements in writing quality (Peungcharoenkun & Waluyo, 2023).

2.2. Collaborative Writing in EFL Context

Collaborative writing is a group exercise that involves several learners to produce a text through the division of roles, such as planning, writing, revising, and editing. This approach is based on the sociocultural theory of Vygotsky (1978), which emphasizes social interaction in cognitive development and a key factor in language acquisition. By working together, the language serves as a cultural tool to negotiate meaning, mediate thought, and internalize new writing strategies within a supportive teaching environment. Additionally, collaborative writing can be considered a dialogic writing approach in EFL classrooms, involving a type of interactive writing where students exchange ideas, offer feedback to one another, and co-create knowledge. These interactions foster self-consciousness in language use, enhance fluency in writing by facilitating negotiation and reflection of language use (Storch, 2013; Wigglesworth & Storch, 2012). Furthermore, collaborative editing and revising are the core aspects of the collaborative process that enables learners to jointly recognize the mistakes and polish the language (Yu & Lee, 2016), improve grammatical accuracy and vocabulary selection, enhance organization (Dobao, 2012; McDonough et al., 2019; Pham & Usaha, 2016), provide assistance to solve writing problems (Donato, 1994), or enable mutual development (Li & Zhu, 2017; Nguyen, 2017). The repetitive practice increases the level of grammatical correctness and text sophistication (Bikowski & Vithanage, 2016). Students write various drafts using Google Docs as a real-time collaboration tool and Grammarly as an automated feedback tool (Nguyen & Pham, 2025; Nguyen & Pham, 2026). At the same time, peer reviewers provide formal comments on task completion, organization, grammar, and vocabulary, which enables groups to refine their essays collaboratively.

Regardless of these advantages, there are several threats to the success of collaboration. Firstly, unequal participation and inter-personal conflicts are especially significant when collaboration occurs in the EFL context (Le et al., 2018). To overcome these challenges in the present study, the teacher-researcher provided clear group guidelines, peer evaluation criteria, and instructing facilitation. There were also reflective sessions to discuss group dynamics and resolve conflicts. Moreover, the writing process was supported by both synchronous and asynchronous communication via online platforms, such as Padlet and Google Docs. Students joined and provided comments, proposed possible changes, and discussed the material together. Such interactions were recorded through the platform log and observation notes. Therefore, to track the participation of each member, the researchers reviewed the revision histories and platform logs to ensure that all members were actively involved.

2.3. ICT Integration Collaborative Writing: Current Trends

EFL educators extensively utilize ICT tools for collaborative writing because they represent a substantial evolution in educational techniques. Research studies show that multiple developing tendencies define the current ICT-integrated collaborative writing scene.

A significant shift in writing practices is the wide acceptance of cloud-based systems, which enable simultaneous teamwork activities. Google Docs has become the most widely used collaborative tool because it enables students to edit documents simultaneously. According to Yeh (2021), student engagement and writing quality improve through Google Docs collaborative writing because students receive immediate feedback while continuously revising their work. The comment function in Google Docs enables students to deliver purposeful peer support and team-based guidance through direct writing assessments (Yim et al., 2021). The study confirms sociocultural learning views about knowledge development, stressing how social interactions create knowledge (Vygotsky, 1978; Storch, 2013).

Collaborative writing processes now incorporate automated writing evaluation (AWE) tools, with Grammarly. Literature shows that EFL writers find Grammarly highly relevant because it helps them produce more accurate written outputs. Bailey and Lee (2020) demonstrated that Grammarly successfully detects punctuation errors, grammatical mistakes, vocabulary problems, and spelling mistakes within different writing genres. After using Grammarly, EFL students demonstrate better lexical diversity (Dizon & Gayed, 2021). Scientific research teams suggest users approach these tools with careful moderation. According to Koltovskaia (2023), Grammarly functions optimally when integrated with instructor input, although it should not act as a substitute for educator feedback. The vital importance of teacher feedback on appropriateness and style in student papers has been confirmed by Thirakunkovit and Chamcharatsri (2019), while automated tools do not demonstrate sufficient ability in this area.

Renewable ICT tools such as Padlet mark a contemporary development in teaching students' teamwork through technology-enhanced writing. Padlet facilitates idea sharing and peer feedback because its attractive design and innovative features drive student engagement and peer interaction (Do et al., 2023). Nguyen and Trang (2023) reported that students react positively towards Padlet due to its simple platform design features and flexible design choices. Thus, they would be willing to use it again in future classes. Furthermore, Padlet is served as a powerful tool that enhances student writing and knowledge sharing, especially during their preparation tasks (Vo & Nguyen, 2022). It is shown that visual and interactive techniques offer promising potential for developing collaborative writing through interfaces with basic text-based approaches.

The field of ICT-integrated collaborative writing research has recently shown a growing interest in emotional aspects related to technology-assisted writing collaboration. Research investigations explore how digital devices affect students' emotional reactions when doing writing assignments and measure their levels of anxiety and self-assurance together with their motivational responses. According to Nguyen and Trang (2023), students who receive Padlet peer feedback show higher motivation in EFL email writing tasks, whereas Olives (2019) discovered that Padlet collaborative writing practices strengthen student writing confidence. Im and Lee (2022) demonstrated that Padlet shows no significant effect on writing anxiety reduction among participants, thus pointing to the need for additional research on the complex ICT-affective factor relationships. Researchers now study affective dynamics to establish a comprehensive approach that examines how ICT-integrated collaborative writing influences EFL student learning.

An emerging educational practice investigates how to effectively incorporate various ICT tools to support different stages during collaborative writing. The combination of Google Docs for drafting and Grammarly editing, together with discussion forums for reflection, produces a strengthened collaborative writing environment (Nguyen & Pham, 2025). In addition, Padlet, Google Docs and Grammarly are combined as writing tools, which improves the writing process across several crucial stages better than any single tool. Education practice demonstrates that specific technological features should support various phases within teamwork writing.

The current research mainly explores generic writing development using ICT-based collaborative methods without establishing apparent effects on specific areas of comparison essays, including comparative terminology use, coherence and cohesion, task fulfillment, and grammatical structure. The skills for efficient comparison organization and appropriate vocabulary selection in comparison essays require unique support from digital collaborative approaches (Folse et al., 2015). In particular, writing aspects in comparison essays receive the most potent effects from ICT-assisted collaborative environments within a process-genre structure. Peungcharoenkun and Waluyo (2023) showed that PGA enhances writing quality with technology integration. However, research fails to establish how particular ICT tools affect every PGA stage during comparison essay writing (modeling, joint construction, independent construction). During the modeling stage, interactive digital access to annotated examples of comparison essays can enhance teaching effectiveness, whereas the joint construction phase needs synchronized collaborative systems that show organizational patterns to students. The identified research gap requires attention because of the challenging organizational patterns found within comparison essays.

In comparison essays, the specific organizational sub-patterns (point-by-point or block method) need further study regarding their efficient mastery through ICT-integrated collaborative education methods (Sorenson, 1992; White & McGovern, 1994). Research must determine if digital collaborative platforms enhance student pattern comprehension and application better than traditional learning methods for comparison essays. However, research lacks sufficient investigation about their effect on supporting complex cognitive and organizational needs of process-genre comparison essay writing. The current literature provides insufficient information about how ICT integration should the benefits of cloud-based collaborative writing tools for general writing tasks were examined (Yim et al., 2021); or integration of ICT on cause-effect essays (Nguyen & Pham, 2026) or descriptive ones (Nguyen & Pham, 2025). Hence, research lacks sufficient investigation about their effect on supporting complex cognitive and organizational needs of process-genre approach, specifically comparison essay writing. The current literature provides insufficient information about how ICT integration should be optimized for teaching comparison essay writing instruction.

3. Methodology

3.1. Setting and Participants

A state university in Hanoi was the setting for the research, where two complete EFL writing instruction groups received different teaching methods. Students in the experimental class (EG) employed ICT-integrated collaborative writing techniques, totaling 42 students. The control class (CG) included 37 students who received face-to-face collaborative writing instruction as their regular curriculum. Students enrolled in the same academic course were randomly assigned to either the EG, which received the new teaching method, or the CG, which followed the standard curriculum.

Before the research, EG participants received rudimentary training on digital collaboration platforms to ensure they had the fundamental technological knowledge necessary to participate in the intervention. The number of rural EG students was 38%. These students spent more time on technology, averaging 4.3 hours a day, and this was more than the CG, which spent an average of 3.8 hours a day on technology. This increased familiarity with technology contributed to their ability to adopt ICT-based writing strategies successfully. On the contrary, the CG students participated in conventional (non-digital tool) face-to-face writing sessions. There were 32% rural students in the CG. While CG students used technology slightly less frequently, they were found to be more experienced in learning English; 62% of them had learned the language for more than seven years, compared to 55% in the EG. Nevertheless, the demographic and experience differences, including the use of technologies and previous experience with learning the language, may have some impact on writing performance and the students' willingness to adopt instructional strategies.

Regarding the group sampling, students were randomly assigned to either the EG or the CG to reduce selection bias and ensure comparability across groups. All students were approached before the research to participate voluntarily, and informed consent was obtained from those who accepted participation in the intervention throughout the semester. There was no impact on their grades and position in the course, and students could withdraw at any point without repercussions. To address the potential ethical issues and time constraints, the university's ethics committee approved the study. It made every effort to minimize disruptions by conducting the study activities during regular classes. Students who refused to participate were not disrupted in their regular coursework. All the participants finished Writing 1 and Writing 2 courses, which taught them basic skills for writing sentences and developing paragraphs. The students enrolled in Writing 3 received their initial systematic instruction in essay composition through "*Great Writing 3*", published by National Geographic Learning. This purposeful writing sequence delivered to students improved their potential capacity to tackle the comparison essay assignments throughout this investigation.

The facilities available at this public institution in Hanoi featured superior technological infrastructure beyond what most Vietnamese educational settings possessed because it included dependable Internet access combined with computer laboratories staffed with technical service personnel. The favorable institutional environment enabled researchers to use technology-based methods, but it complicated the application of research outcomes to less well-equipped educational institutions across Vietnam.

3.2. Research Design and Data Collection Instrument

A quasi-experimental research design was implemented to study how students perform in English writing after using collaborative English writing through ICT-mediated learning. Two intact classes were selected randomly as EG (n=42) and CG (n=37), respectively, so the study could evaluate their natural learning conditions. The quasi-experimental design successfully creates causal connections between interventions and outcomes in natural educational settings, thus achieving better external validity. The studied design enabled researchers to evaluate how traditional collaboration methods in writing activities differed from ICT-based approaches. The study evaluated writing performance by keeping instructional content equal between both conditions yet selecting different collaborative platforms. The controlled comparison design demonstrates an important research advantage compared to methods that only use descriptions and correlations alone. The pre-and-post-test design allowed the researchers to study how participant groups progressed and determine their final results to

assess the effects of different instructional approaches.

The data were primarily collected using standardized writing assessments, which follows a traditional methodological framework. This highlights the advantages of standardized tests in measuring educational outcomes (Creswell & Guetterman, 2019). Despite the inherent collaborative nature of writing, which standardized tests may not well represent, the researchers opted to use standardized writing tests to provide an objective and consistent measurement of writing performance outcomes on an individual basis. The comparison of key writing criteria, including task fulfillment, organization, grammar, and vocabulary, before and after the intervention is effectively achieved by using standardized tests, which also made it possible to assess the effects of ICT-supported collaboration on the written products of students. The researchers acknowledged that standardized measures did not directly assess the group process or interaction that occurred in group writing. Future studies may consider supplementing product-based measures with qualitative data, such as records of working sessions or student commentaries, as a method of gaining deeper insight into the processes of ICT-mediated collaboration.

Testing twice before and again following the intervention phase through parallel writing measurements served to establish a powerful performance assessment system for both classes. The VSTEP (Vietnamese Standardized Test of English Proficiency) mock tests published by Ho Chi Minh City University of Education Publishing House served as the source for these assessments. To maintain the validity of the writing assessments and the security of the test materials, the study has used different yet similar essay prompts to conduct the pre- and post-intervention writing assessments. Both prompts required students to compose a comparison essay, ensuring consistency with the writing activity and the cognitive abilities being tested. The pre-test required students to compare the similar and different features of six chosen media to convey information, specifically comics, books, radio, television, film, and theatre. This challenge stimulated the critical thinking and analysis of various alternatives. Conversely, the post-test referred to a more personal and real-life topic, in which the students were requested to compare the similarities and disparities of living in a house and an apartment. Both prompts required writing at least 250 words within 40-minute testing conditions. The requirements were also matched in terms of complexity and scope to ensure they were made neither easier nor harder. The correspondence in prompts contributed to a minimal amount of practice effects and helped avoid bias in assessing the writing performance of students.

The study used the VSTEP writing assessment rubric with four evaluation criteria that evaluate Task Fulfillment, Organization, Grammar, and Vocabulary for both the pre- and post-test. The VSTEP writing scale was developed and utilized by the Testing Center at the University of Languages and International Studies (ULIS), Vietnam National University, Hanoi. Therefore, it serves as a standardized and reliable tool for assessing English proficiency among Vietnamese learners. The researchers attended and certified the formal training program at the Testing Center at the university. In addition, the researchers' institution has been consistently using the VSTEP writing criteria to assess and evaluate English-major students' writing abilities. Hence, the rubric can be accessed appropriately. In accordance with this authority, the full rubric is not disclosed to respect proprietary and confidentiality restrictions. Only the main evaluation criteria were reported to provide transparency.

This systematic assessment system provided profound evaluation capabilities to assess student writing progress across multiple linguistic and rhetorical aspects. The rubric evaluates writing using four main parameters, i.e., Task Fulfillment, Organization, Vocabulary, and Grammar. The most common scoring scale is the 0-10 scale, which is the original and detailed

rubric used for evaluating writing tasks. The writing task 2, in other words, "writing essays", is evaluated using four main criteria, namely Task Fulfillment, Organization, Grammar, and Vocabulary. Examiners assign scores on smaller sub-scales for each criterion, and these scores typically range from 0 to 5. The researchers used a 10-band rating scale based on the VSTEP Rating Scale for Writing Task 2, which has elaborate descriptors for four broad criteria: Task Fulfilment, Organization, Vocabulary, and Grammar. The bands reflect different degrees of performance, ranging from 0 (no attempt or irrelevant response) to 10 (excellent performance). The scale offers sensitive differentiation, comprising 11 scales (ranging from 0 to 10), allowing examiners to assign scores that detail the quality and accuracy of the writing. As an example, a 10 score would mean that the candidate develops major points to the full extent in a relevant manner, has a rich vocabulary and uses it accurately and flexibly, and their ideas are well-arranged in logical order with proper paragraph structures and extremely infrequent grammatical mistakes. On the other hand, decreasing bands are associated with growing levels of difficulty in fulfilling the task requirements, and problems such as unclear communicative intent, inadequate vocabulary, poor organization, and significant grammatical errors can be mentioned.

Besides the 0-10 scale, VSTEP also has a level of proficiency scale between 3 and 5. This scale is not used to score separate writing criteria, as detailed in this rubric, but rather to assess overall writing ability and classify it based on these CEFR levels. The proficiency levels are related to writing scores: between approximately 3.5 and 5.0, Level 3 (B1); between approximately 5.5 and 6.5, Level 4 (B2); and 7.0 or above, Level 5 (C1). This scale is primarily used for the issuance of certificates and reporting of final results, rather than detailed assessments. Owing to the objectives that evaluate how ICT-supported collaborative writing impacted students' overall scores of comparison essays, as well as specific writing dimensions including: Task fulfillment, Organization, Vocabulary, and Grammar, the 0-10 scale was utilized to make the assessment and evaluation. The following discussion focused on specific writing criteria applied in the current study to assess students' specific writing aspects in their comparison essays.

- Task Fulfillment assesses the response of students to the essay prompt. The banding range for task fulfillment allows the evaluators to measure how fully a candidate responds to the task requirement. At the top (9-10), students meet all the requirements of the tasks, successfully meeting all the communicative needs with an even and proper tone, and deliver developed main points with pertinent supporting information. On the other hand, the lower bands indicate a progressively weaker performance on the writing task. For example, essays related to band 2 fail to address significant parts of the tasks with very few or irrelevant ideas. Also, there is little or even no clear communicative purpose.
- The organization evaluates the rational set-up and consistency of thoughts. High-band essays (9-10) are logically presented, with an extensive use of cohesive devices that are flexibly employed, and paragraphing is used correctly. However, essays in Band 2 are poorly organized, often lacking coherence or being fragmented. It is an important criterion used to evaluate students' skills in organizing their comparison essays clearly and coherently.
- Vocabulary is concerned with lexical range, specificity, and suitability. Essays with high scores in the high bands are characterized by a rich vocabulary, including rare lexis applied accurately and freely, as well as a good command of style and collocation. In the event of errors, they are also minimal and non-intrusive. On the contrary, band 2 essays exhibit minimal variety in words and phrases, and their most

frequent mistakes are those that alter the meaning. Consequently, it highlights the vocabulary issues of less proficient students when it comes to making subtle comparisons.

- Grammar measures the richness and correctness of the sentence structures. High-band students use complex and straightforward structures flexibly and with a great variety, committing a very low number of minor errors. In contrast, band 2 essays are highly dependent on memorized structures; often, they contain simple mistakes that distort the meaning and hinder communication. Hence, the standard assesses students' grammatical aptitude in creating clear and complex comparative sentences.

The standardized evaluation scale enabled assessment officials to conduct a whole assessment and designated analysis of distinct writing elements. The detailed assessment technique demonstrated exceptional value in detecting how ICT-integrated collaborative writing affected distinctive areas of writing ability at different points during the assessment. Measuring writing skills with standardized rubrics before and after treatments resulted in performance reliability because every evaluator used the identical assessment tool.

3.3. The Procedure of the Study

The EG experienced a systematic five-step writing process that incorporated ICT tools. The ICT-supported intervention could enable students to think at a higher-order level and acquire skills for critical comparison. Conversely, CG was taught in a traditional way of writing instruction with five-step systematic framework, but without the incorporation of ICT tools. The entire process took eight weeks, which was sufficient time to ensure that the students in the EG successfully handled the digital writing process and demonstrated quantifiable gains in their writing skills compared to the baseline. It is a clear difference between the EG and CG processes to investigate the effect of the ICT-enhanced writing treatment. Figure 1 illustrates different stages conducted with ICT support during the intervention.

Figure 1

The Writing Process Conducted with ICT Support during the Intervention
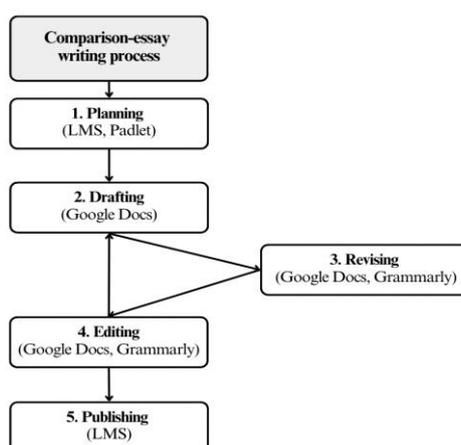
Each writing group typically contained from 4 to 6 students in the intervention. The group size could enable effective interaction between peers while maintaining manageable group collaboration. They had almost three primary drafts of an essay: the initial version, the second one after the revising process (called the edited version), and the final one for publication stage. During the process, ICT platforms were utilized to monitor collaboration

continuously, which enabled instructors to observe the level of participation of each student in the collaborative writing process. There was also a peer evaluation, where writing criteria were given at every stage to promote the responsibility and a shared workload. Hence, the possibility of students' unequal contributions within each group could be reduced.

Firstly, the writing process started with organized planning activities through the Learning Management System (LMS) and Padlet. The teacher initially posted the corresponding learning content, including lecture notes and articles, on the LMS so that every student has access and can read them autonomously prior to brainstorming. It ensured that all learners had easy and consistent access to essential content before beginning the writing tasks. Moreover, in this stage, the participants used Padlet as a virtual collaborative space where they could actively share and organize their ideas related to the comparison-essay writing tasks. In particular, students could comment, like, or expand on each other's posts asynchronously or in real-time sessions. Consequently, the participants could build upon each other's contributions in such a collaborative learning environment. As the teacher, the researcher facilitated this collaboration by supplying clear instructions on how to use Padlet effectively and guide students on how to engage with their peers' ideas. The researcher monitored the Padlet board regularly throughout the planning stages and checked the students' participation visible on that platform. Hence, quieter students were encouraged and reminded to contribute to the planning process; or the focus of the lesson could be maintained in case there were some off-topic posts.

In the second stage, students used Google Docs to compose their comparison essays during the drafting stage. Due to the platform's real-time editing mode, students could collaborate with their peers to build statements and topic sentences that specified comparison points and supported detailed development. Students could produce more substantial analytical reviews in their comparative essays since the Google Docs platform allowed them to share real-life examples and counterexamples when examining shopping methods and modern conveniences.

In the third stage, a revision combination used Google Docs comments alongside Grammarly's automatic suggestions. Participants went through organized peer review tasks, which evaluated how students structured their content and transitions while assessing element distribution. Reviewers paid particular attention to fair descriptions of the compared elements during their assessments.

In the fourth stage, the editing process involved student use of Grammarly coupled with Google Docs to enhance their comparison essays through sentence-level revision. Language enhancement tools from Grammarly identified transition issues that remain crucial for comparison essays, which need a direct indication of relational elements. With Grammarly's vocabulary suggestions, students evolved their comparative language selection to replace imprecise phrases with descriptions of significant similarities and distinctions.

In the final stage, students published their comparison essays in the LMS for class members to access. Student reflection activities comprise a critical component of the publication stage, which examines how the use of ICT affected their methods of conducting comparative writing. LMS functions as the official platform for students to submit their essay versions and for teachers to distribute overall feedback and grades. The exclusive use of LMS for uploading and downloading learning materials along with for publishing different essay drafts is due to the platform's institutional role, as the official system for course management. They require teachers to open classes within the system. Hence, they can share information and materials systematically. It can be understood that the compliance with the university policies is ensured and LMS is a reliable record of student submissions and teacher evaluations.

3.4. Data Analysis

The study used SPSS 27.0 to analyze the quantitative data to examine the impact of the ICT-supported comparison-essay writing process on students' performance. Firstly, to answer the research question, independent t-tests were used to compare the baseline scores of the EG and CG in terms of overall essay scores and specific dimensions. Subsequently, paired-sample t-tests were conducted within both groups to determine the differences in writing performance between the pre- and post-intervention periods. The tests were used to evaluate gains in total scores and specific writing dimensions as well.

4. Findings and Discussions

4.1. The Effects of the ICT-Integrated Intervention on EG and CG's Writing Comparison-Essay Performance

In the first place, Table 1 indicates that task fulfillment scores improved significantly for participants in both the EG and CG, yet the experimental scores registered a lesser increase. The EG achieved a moderate improvement measured (M = 0.2500, SD = 0.5972, p = .010), whereas the control class demonstrated significantly more significant enhancement (M = 0.5676, SD = 0.6988, p < .001). Students participating in traditional or ICT-integrated collaborative writing developed more potent abilities to fulfill comparison essay requirements. McDonough et al. (2019) supported that collaborative writing helped enhance content development within Thai EFL contexts. The EG class displayed enhancement beyond what Yeh (2021) established regarding Google Docs' effectiveness in collaborative writing. The research dissonance becomes understandable because Koltovskaia (2023) pointed out that digital tools achieved maximum efficiency through instructor-assisted implementation rather than operating independently. The EG students showed average progress in their assignment completion through ICT implementation, so future studies are needed to maximize the use of digital tools when writing comparison essays.

Table 1

Paired Sample T-Test of Specific Scoring Criteria and Overall Performance of the EG and CG Before and After the Intervention

		Paired Samples Test							
		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	EG_Pos_TR_Com - EC_Pre_TR_Com	0,2500	0,5972	0,0922	0,0639	0,4361	2,713	41	0,010
Pair 2	EG_Pos_CC_Com - EC_Pre_CC_Com	1,1905	0,7805	0,1204	0,9473	1,4337	9,885	41	0,000
Pair 3	EG_Pos_GR_Com - EC_Pre_GR_Com	0,1310	0,3672	0,0567	0,0165	0,2454	2,311	41	0,026
Pair 4	EG_Pos_LC_Com - EC_Pre_LC_Com	0,0333	0,1223	0,0189	-0,0048	0,0714	1,766	41	0,085
Pair 5	EG_Pos_Ave_Com - EC_Pre_Ave_Com	0,3952	0,2489	0,0384	0,3177	0,4728	10,293	41	0,000
Pair 6	CG_Pos_TR_Com - CC_Pre_TR_Com	0,5676	0,6988	0,1149	0,3346	0,8006	4,940	36	0,000
Pair 7	CG_Pos_CC_Com - CC_Pre_CC_Com	0,1216	0,4473	0,0735	-0,0275	0,2708	1,654	36	0,107
Pair 8	CG_Pos_GR_Com - CC_Pre_GR_Com	0,0811	0,3008	0,0494	-0,0192	0,1814	1,640	36	0,110
Pair 9	CG_Pos_LC_Com - CC_Pre_LC_Com	0,0000	0,1179	0,0194	-0,0393	0,0393	0,000	36	1,000
Pair 10	CG_Pos_Ave_Com - CC_Pre_Ave_Com	0,1919	0,2499	0,0411	0,1086	0,2752	4,671	36	0,000

* Note: EG_Post_TR_Com = The post-test Task fulfillment scores in comparison essay of the experimental group; EG_Pre_TR_Com = The pre-test Task fulfillment scores in comparison essay of the experimental group; EG_Post_CC_Com = The post-test Organization scores in comparison essay of the experimental group; EG_Pre_CC_Com = The pre-test Organization scores in comparison essay of the experimental group; EG_Post_GR_Com = The post-test Grammar scores in comparison essay of the experimental group; EG_Pre_GR_Com = The pre-test Grammar scores in comparison essay of the experimental group; EG_Post_LC_Com = The post-test Vocabulary scores in comparison essay of the experimental group;

EG_Pre_LC_Com = The pre-test Vocabulary scores in comparison essay of the experimental group; CG_Post_TR_Com = The post-test Task fulfillment scores in comparison essay of the control group; CG_Pre_TR_Com = The pre-test Task fulfillment scores in comparison essay of the control group; CG_Post_CC_Com = The post-test Organization scores in comparison essay of the control group; CG_Pre_CC_Com = The pre-test Organization scores in comparison essay of the control group; CG_Post_GR_Com = The post-test Grammar scores in comparison essay of the control group; CG_Pre_GR_Com = The pre-test Grammar scores in comparison essay of the control group; CG_Post_LC_Com = The post-test Vocabulary scores in comparison essay of the control group; CG_Pre_LC_Com = The pre-test Vocabulary scores in comparison essay of the control group

In the second place, there are significant differences in EG and CG organizational development outcomes. Organization scores rose significantly in the EG (M = 1.1905, SD = 0.7805) compared to only modest growth in the CG (M = 0.1216, SD = 0.4473). Both results achieved statistical significance with $p < .001$ and $p = .107$, respectively. Research findings demonstrated that ICT-integrated collaborative writing exceeded other methods when developing organizational abilities for comparison essays. Pham and Usaha (2016) pointed out that collaborative writing mainly enhanced text organization, which is directly validated by this result. Besides, Peungcharoenkun and Waluyo (2023) concerning technology-enhanced PGA matched the present findings. Technological collaborative platforms produced substantial organizational improvements by allowing users to easily view and modify the two main comparison essay structures (point-by-point or block) following Oshima and Hogue (2006). The ICT environment led students to excel at implementing systematic structures required for comparison essays while confirming the importance of sub-patterns in these sub-patterns within comparison writings (Sorenson, 1992).

In the third place, data for grammar improvements revealed similar findings as organization where the EG demonstrated meaningful progress (M = 0.1310, SD = 0.3672, $p = .026$) than the CG (M = 0.0811, SD = 0.3008, $p = .110$). The modest improvement recorded by the EG supported the idea that using ICT in collaborative writing created advantages for grammatical accuracy. Nguyen and Pham (2025) verified that collaborative writing in ICT-supported environment practices helped Vietnamese EFL learners reach better grammatical accuracy. Bikowski and Vithanage (2016) identified collaborative editing and revision activities that enabled participants to identify and fix errors. Accordingly, the EG made progress in grammar, thanks to Grammarly (Bailey & Lee, 2020). The modest effect size indicates that ICT-based collaborative writing for grammar development might need either an extended intervention length or direct grammatical teaching along with teacher feedback for maximal impact (Vo & Nguyen, 2022).

In terms of the fourth scoring criteria, vocabulary development witnessed the least progress among all measured criteria because the EG had a minimal but non-significant increase (M = 0.0333, SD = 0.1223, $p = .085$), yet the CG remained unchanged (M = 0.0000, SD = 0.1179, $p = 1.000$). Both traditional and ICT-integrated collaborative approaches failed to significantly improve vocabulary development for comparison essays during this research period. The outcomes from Dizon and Gayed (2021) about how Grammarly enhanced lexical diversity in slight opposition to these results. Wigglesworth and Storch (2012) advocated that the lack of vocabulary during the collaborating process may result in this writing format of mainly improving organizational and content aspects rather than vocabulary development. Thorough instruction on comparative vocabulary, including comparative terms and transitional phrases, is needed independently of collaborative writing.

Regarding overall writing performance, the outcomes revealed substantial gains for all students, but the EG delivered much better results than the CG by achieving (M = 0.3952, SD = 0.2489, $p < .001$) versus (M = 0.1919, SD = 0.2499, $p < .001$). The EC participants achieved

approximately twice the improvement in overall comparison scores compared to the CG because of the ICT-integrated collaborative writing environment. Nguyen and Pham (2025) found strong support regarding multi-dimensional online collaborative writing environments. The EG participants demonstrated higher overall achievement in their writing, which matches Nguyen and Nguyen (2022) about how multiple ICT tools could improve writing performance in essential stages. The substantial improvement in overall scores is mainly because of organizational gains, which validated Badger and White's (2000) PGA principles regarding how contextual social interactions helped students develop awareness of genres and better writing quality. Rahimi (2024) demonstrated that technologies that applying PGA led to better student involvement and writing performance when teaching includes motivational instructional methods. Students experienced higher benefits with collaborative writing through information and communication technology because it enhanced essay organization but produced moderate progress in accomplishing writing tasks and grammatical correctness. According to the sociocultural theory (Vygotsky, 1978), the study proved that digital tools helped students collaborate to improve their writing, primarily through better organizing complex comparison essay structures.

4.2. The Comparisons of the EG and CG Students' Writing Comparison-Essay Performance Before and After the Intervention

Firstly, Table 2 of the independent sample t-test demonstrates that the EG and CG showed no statistically significant variances regarding writing criteria prior to the intervention implementation.

Table 2

Independent Sample T-Test of the EG and CG Students' Assessment Criteria and Overall Scores of Comparison-Essay Writing Performance Before and After the Intervention

		Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Pre_TR_Com	Equal variances assumed	0,000	0,994	-0,643	77	0,522	-0,1281	0,1991	-0,5244	0,2683
	Equal variances not assumed			-0,645	76,288	0,521	-0,1281	0,1986	-0,5237	0,2676
Pre_CC_Com	Equal variances assumed	1,352	0,249	0,120	77	0,905	0,0151	0,1264	-0,2367	0,2669
	Equal variances not assumed			0,119	72,026	0,906	0,0151	0,1276	-0,2391	0,2694
Pre_GR_Com	Equal variances assumed	0,556	0,458	0,295	77	0,769	0,0576	0,1955	-0,3316	0,4468
	Equal variances not assumed			0,295	76,465	0,768	0,0576	0,1949	-0,3306	0,4457
Pre_LC_Com	Equal variances assumed	0,053	0,819	-1,493	77	0,140	-0,2149	0,1440	-0,5016	0,0718
	Equal variances not assumed			-1,488	74,699	0,141	-0,2149	0,1444	-0,5026	0,0728
Pre_Ave_Com	Equal variances assumed	1,453	0,232	-0,667	77	0,506	-0,0685	0,1026	-0,2727	0,1358
	Equal variances not assumed			-0,672	76,975	0,503	-0,0685	0,1019	-0,2713	0,1344
Post_TR_Com	Equal variances assumed	3,537	0,064	-2,494	77	0,015	-0,4456	0,1786	-0,8014	-0,0899
	Equal variances not assumed			-2,534	75,920	0,013	-0,4456	0,1759	-0,7959	-0,0953
Post_CC_Com	Equal variances assumed	5,215	0,025	6,814	77	0,000	1,0840	0,1591	0,7672	1,4007
	Equal variances not assumed			6,908	76,427	0,000	1,0840	0,1569	0,7715	1,3965
Post_GR_Com	Equal variances assumed	0,201	0,655	0,557	77	0,579	0,1075	0,1929	-0,2766	0,4915
	Equal variances not assumed			0,554	73,675	0,581	0,1075	0,1939	-0,2790	0,4939
Post_LC_Com	Equal variances assumed	0,210	0,648	-1,268	77	0,209	-0,1816	0,1432	-0,4668	0,1036
	Equal variances not assumed			-1,268	75,881	0,209	-0,1816	0,1432	-0,4668	0,1036
Post_Ave_Com	Equal variances assumed	0,178	0,674	1,396	77	0,167	0,1349	0,0966	-0,0575	0,3272
	Equal variances not assumed			1,399	76,181	0,166	0,1349	0,0964	-0,0572	0,3269

* Note: Pre_TR_Com = The Task fulfillment scores of the pre-test; Post_TR_Com = The Task fulfillment scores of the post-test; Pre_CC_Com = The Organization scores of the pre-test; Post_CC_Com = The Organization scores of the post-test; Pre_GR_Com = The Grammar scores of the pre-test; Post_GR_Com = The Grammar scores of the post-test; Pre_LC_Com = The Vocabulary scores of the pre-test; Post_LC_Com = The Vocabulary scores of the post-test; Pre_Ave_Com = The overall scores of the pre-test; Post_Ave_Com = The Overall scores of the post-test

All writing criteria evaluations scored non-significant differences between EG and CG students. Task fulfillment ($t(77) = -0.643$, $p = .522$), organization ($t(77) = 0.120$, $p = .905$),

grammar ($t(77) = 0.295$, $p = .769$), vocabulary ($t(77) = -1.493$, $p = .140$), and average scores ($t(77) = -0.667$, $p = .506$) demonstrated no statistical variation. The identical writing abilities between groups at the starting point yielded an appropriate benchmark to measure how the intervention affected them. According to Storch (2013), collaborative writing benefits developed due to instruction rather than pre-existing variations between participants and the study groups matched on performance aspects at the beginning. The initial performance equivalency served as a vital condition for examining ICT integration effects (Yim et al., 2021), since it enhanced the validity of technology-induced collaborative writing effects. Similar pre-intervention writing ability levels allowed the researchers to interpret post-intervention changes with assurance because they excluded background ability disparities from impacting results. It is important to note that despite no initial significant differences, the effect sizes were small. It indicated that there were limited practical differences between groups at baseline. Hence, it might reinforce the appropriateness of comparing the post-intervention outcomes.

Secondly, the research found that the CG achieved superior performance in task completion after the intervention (M = -0.4456, $t(77) = -2.494$, $p = .015$) than the EG. The surprising result shows that standardized collaborative writing methods might provide better advantages when teaching students to fulfill comparison essay requirements. The results in this study differ from Im and Lee (2022) because they demonstrated that online collaborative writing improved students' content development outcomes. Le et al. (2018) supported the notion that digital teamwork occasionally created disturbances that interrupt fundamental writing duties. Students in the CG achieved better task fulfillment probably because face-to-face communication supported interactions to develop students' writing awareness. Students benefited more from traditional classroom collaboration since they received immediate feedback about their essay content compliance with assignments (White & McGovern, 1994). However, the data suggested that factors like students' technological familiarity might have influenced the results. Thus, ICT integration in collaborative settings might challenge students' ability in accomplishing the task fulfillment.

Thirdly, about organization dimension, after the intervention, both groups received different test scores, but organization scores revealed that the EG achieved higher results than the CG (M = 1.0840, $t(77) = 6.814$, $p < .001$). The finding aligns with and builds upon previous research. That the positive organization outcomes observed in the EG supported findings in Bikowski and Vithanage (2016). Moreover, the good organizational element matched Li and Zhu (2017) who found that digital platforms helped users view and modify text structure formats. Oshima and Hogue (2006) further emphasized that digital environments simplify the planning and revising stages of comparison essays through structured organizational methods. However, it is important to recognize that meanwhile the organizational gains were significant, these improvements may primarily reflect the supportive features of ICT tools for text structuring rather than direct improvement of writing ability.

The analysis showed no meaningful distinction in grammar ($t(77) = 0.557$, $p = .579$) and vocabulary levels ($t(77) = -1.268$, $p = .209$) between the two groups after the intervention. These research findings highlighted equivalent effects between traditional collaborative methods and those incorporating ICT in developing comparison essay grammatical accuracy and lexical content. The research findings matching Wigglesworth and Storch (2009) indicated that grammar outcomes during collaborative writing tasks demonstrated similar effects when using various collaborative modes. Thirakunkovit and Chamcharatsri's (2019) meta-analysis confirmed that technology-enhanced feedback created results that matched traditional feedback methods about particular linguistic features. The analytical methods produced similar outcomes

in the tested linguistic features, which indicated that both techniques needed additional training on specialized vocabulary and grammatical structures for comparison essay writing (Smalley & Ruetten, 1990). Given the lack of significant differences and small effect sizes in grammar and vocabulary, it seemed that neither ICT-aided intervention nor conventional approach provided sufficient support for these features. As a consequence, it is necessary to organize a targeted instructional intervention beyond collaborative ICT-support approach.

Concerning the overall score, the EG obtained better organizational scores, yet the overall post-intervention performance revealed no significant difference throughout both groups ($t(77) =$ 1.396, $p = .167$). The superior organizational capabilities of the EG matched with the CG's outstanding task accomplishment, thus leading no significant difference in overall writing quality. Matsuda's (2003) analysis of writing development complexity becomes evident through these results because different instructional methods supported individual writing aspects differently. The research results showed equilibrium between the groups, which supports Yu and Lee's (2016) discovery of complementary mutual advantages between different interactive feedback systems. Additionally, this finding is consistent with Guo (2005) recommendation for integrative teaching methods, which used both traditional and technology-based approaches, because it illustrated the benefits and the lack of global significance in different performance areas. This balance suggested that the combination of both traditional and ICT-supported collaboration might be optimal to address the potentiality of writing intervention.

The evaluation demonstrates that integrating ICT into writing sessions and conventional collaborative techniques drives different strengths in comparison essay development. The EG achieved superior organization compared to the CG, but the CG completed their task fulfillment at a better rate. This indicates that optimal writing instruction should adopt components from each methodology. Possibly, the experimental participants were influenced by their varying levels of technological familiarity during the intervention. Rusinovci (2024) validated the action research testing process-genre teaching techniques to develop various writing abilities. The findings also emphasized the need to integrate technology into existing writing instructions, rather than as a substitute, which shared the similar suggestion by Peungcharoenkun and Waluyo (2023). They argued that technology is intended to complement conventional pedagogical approaches. The results offered empirical confirmation of the collective scaffolding model proposed by Donato (1994), as both digital and face-to-face scaffolding enable effective scaffolding. However, the two scaffolding models affect various aspects of writing performance. Hyland (2007) proposed an integrated teaching methodology that involves the integration of ICT-based exercises with traditional group work. Such a combination may maximize the accomplishment of tasks and the growth of writing skills. Nguyen (2017) is also in favor of the combined instructional techniques, stating that these techniques help learners adopt both approaches and enhance their writing skills. Moreover, the present research supports the findings of Pasand and Haghi (2013), who advised adopting flexible instruction with both approaches. In sum, these convergent results highlighted the importance of multifaceted pedagogy instruction in encouragings academic writing.

5. Conclusion

The research focused on evaluating how ICT-based collaborative writing influenced students' writing performance, particularly in comparison essays. The study shows specific patterns regarding how technology incorporation affects different characteristics of writing progression. The ICT approach excelled at teaching the EG students organizational skills, but the

CG performed best at task fulfillment abilities. However, it is cautious that the effect sizes for some improvement were modest. It revealed that ICT's advantages may be domain-specific. Results regarding the balanced performance from testing indicate that both ICT-supported and traditional teaching approaches significantly benefited the development of comparison essay writing skills. The research findings enhanced the comprehension of how technology changed group composing practices in particular writing domains. The investigation shows that ICT technology improved writing performance by enhancing organizational structure in comparison essay. These findings indicated that technology promoted some writing aspects. However, it did not show superiority in every area, thus validating a well-rounded perspective on ICT usage in writing. This outcome suggested that factors like students' habit with technology might play critical roles in mediating the effectiveness of ICT tools. Accordingly, the strategic integration of both digital and traditional collaborative approaches in writing pedagogy would become viable because of their mutual strengths. The study findings validated the sociocultural theoretical approaches that ICT tools play a vital role in enabling writing development within collaborative settings. Different writing criteria responded better to digital tools than to traditional collaborative methods. Hence, it indicated that technological mediation features enhanced particular aspects of writing improvement. Technology integration should involve matching instructional tools to clear educational targets instead of assuming equipment will automatically bring widespread positive results. Furthermore, the practical significance of ICT benefits should be considered with statistics to guarantee the expectations for educators and learners.

Nevertheless, some limitations still exist. Firstly, the eight-week duration might have been insufficient to reveal the complete outcomes of ICT-integrated collaborative writing on long-term written composition development, especially regarding vocabulary progress and grammatical refinement. Future research needs to use extended longitudinal study periods across multiple semesters to show enduring results from different collaborative approaches to writing development. Secondly, the study restricted its examination to comparison essays, thus decreasing the transferability of its results to different academic genres. Future studies must study whether writing genres with diverse organizational requirements and linguistic elements produce analogous effectiveness convergence rates. Moreover, the research failed to consider the effect of differences in participants' technological skills and collaborative behavior preferences, which might have impacted the results obtained from ICT integration. Given these factors, future investigations should systematically assess students' digital literacy levels and their interaction as potential moderators of ICT impact. Additional research must explore self-confidence in technology usage and collaboration tendencies since they could act as variables that affect the link between information and communication technologies integration and writing progress. Writing instructors should use adaptable teaching methods that select digital and non-digital collaborative activities according to appropriate learning targets. In addition, organizational development, in comparison to essays, benefits from ICT-integrated educational activities, but students need traditional face-to-face sessions to fulfill their assigned tasks effectively. Future educational content planning should determine the proper ordering and combination of these interactive methods to build whole writing abilities among all critical domains.

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