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EXAMINING STUDENTS' PERCEIVED LEARNING: INCORPORATING COLLABORATIVE WRITING INTO A COURSE OF TECHNICAL WRITING

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ABSTRACT

Writing, among the four basic skills of learning a foreign language, is often considered the most challenging. Writing requires not only teachers to read through students' works carefully but also students to spend time improving their works routinely. This study, implemented in the course of Technical Writing, was carried out during the academic years of 2022 and 2023 in Taiwan. Its course design adopted collaborative writing (CW) as the learning framework. Working in groups, the students went through different stages of composing a piece of technical writing. After the CW part was completed, the students moved on to individual writing. Incorporating a multi-drafting process and three writing projects, the course was designed to lead the students to develop the competence for completing different types of technical writing. This study made use of three data collection tools: one survey, students' writing logs, and an interview. The findings have shown CW greatly enhanced the students' confidence in writing, improved their skills in multiple aspects, and elevated their competence levels in revising their works with teacher-provided feedback. Furthermore, CW exerts great scaffolding effects in cultivating student feedback literacy and enables them to apply revision skills to their individual essay revisions.

Key words: collaborative writing, student feedback literacy, feedback for revision, feedback literacy development

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INTRODUCTION

The instruction of foreign languages places an emphasis on training learners to communicate with others effectively. Among the four skills (listening, speaking, reading, and writing), writing is viewed as particularly challenging for many learners. To help students acquire writing skills and raise competency levels, many writing teachers agree that feedback provision is an effort- as well as a time-consuming task. For this reason, how to devise an effective feedback provision process becomes an important issue. Moreover, students need to develop higher feedback literacy so as to benefit from such a process and improve their writing quality. In this generation, self-learning and autonomous learning emphasize stimulating and encouraging students' learning interests, empowering them to take control of their own learning. When these principles are applied to the development of writing competence, assisting students to reflect on the learned concepts and their further applications may pave the way for these learners to discuss language use and create new knowledge, a view in line with the social constructivist theory (Vygotsky, 1978).

Within the framework of English for Specific Purposes (ESP), technical writing is often associated with science, engineering, and business communication and generally regarded as part of English for Occupational Purposes (Dudley-Evans & St John, 1998; Hutchinson & Waters, 1987; K. Hyland, 2006). Emphasizing concision, precision, and functional organization, technical writing takes the form of workplace genres, covering technical reports, feasibility studies, or troubleshooting guides (Markel & Selber, 2018). Recent studies further highlight that ESP writing courses should integrate discipline-specific content and terminology (Tomak & Ataş, 2019), students value workplace-oriented genres like technical reports and work-related documents (Zulfahmi & Kardena, 2024), and ESP writing curricula should align with workplace communication needs and professional writing practices to better prepare students for workplace communication (K. Hyland, 2012; Kharbanda, 2023). Furthermore, for learners to use English for a specific purpose, such as technical writing, both the learning setting and the workplace practice have to be taken into consideration. In a workplace, having the ability to

collaborate with others and complete assigned tasks is deemed as an important quality. In the field of writing instruction, collaborative writing (CW) is designed to have learners work in a pair/group setting, encouraging them to share experiences, generate ideas, negotiate meanings, compose writing, and revise their work. Through this process, students can learn to take responsibility for their work, a basic element for self-regulated and autonomous learning. Previous studies on CW have not examined the effectiveness of this training strategy in the teaching/learning of technical writing. Rus (2015) stressed that specific features related to the technical discourse should be added to the instruction of technical writing. DeSilva et al. (2017) also explained that technical writing built on what learners had learned in other writing courses but focused more on writing for science, technology, and business. With the goals of encouraging students to collaborate with one another (a workplace practice) and examining the students' development of feedback literacy through CW and revision, this study incorporated technical writing as the task type and feedback-for-revision as the training approach. This study hopes to contribute to the field of writing instruction through investigating learners' perceptions towards CW in small groups and the facilitating effects of CW on students' feedback-for-revision tasks.

LITERATURE REVIEW

This study aimed to explore how the students in a Technical Writing course perceived their learning from CW and how CW and revision tasks aided the students' development of feedback literacy in their individual writing (IW) tasks. In order to situate this study, this section reviews three areas of prior research: (1) CW as a learning framework, (2) feedback for revision in writing training, and (3) students' feedback literacy development.

Collaborative Writing as a Learning Framework

CW activities require learners to work in pairs or small groups to produce one jointly-written text (Swain, 2001). In these settings, learners exchange ideas, solve problems, negotiate meanings, and

share authorship and responsibility, with the resulting text characterized by the members' joint ownership (Storch, 2011, 2019). During this process, learners are pushed to apply their learned language skills, enhancing their communication, negotiation, and interpersonal abilities.

Over the past two decades, many studies have pointed out CW's benefits in second language (L2) writing (e.g., Li, 2018). Linguistic gains include learners' improvements in grammar, vocabulary, and overall writing quality (Elabdali, 2021; García Mayo & Zeitler, 2017; Shehadeh, 2011; Storch, 2005). Affective benefits brought by CW can be observed in learners' positive attitudes and increased motivation (Liu & Lan, 2016). Process-related advantages associated with CW cover more language-related episodes (LREs) and higher engagement in content knowledge construction (Elola & Oskoz, 2010; Fernández Dobao, 2012, 2014).

Other studies have viewed CW as a scaffolding activity that shapes learners' perceptions and attitudes. For example, Fernández Dobao and Blum (2013) found that the learners (those in pairs and groups) responded very positively toward the CW experience because CW prompted them to have more active participation, more idea/knowledge sharing, and more language development. Moreover, Chen and Yu (2019a, 2019b) reported changes in students' views of English writing and its purposes. Zhai's (2021) findings indicated that positive collaborative experiences were linked to sustained motivation although some factors, such as time constraints, in-group conflicts, and linguistic challenges, reduced learners' task engagement.

Last, some meta-analyses and reviews have highlighted the areas requiring more investigation. M. Zhang and Plonsky (2020) reviewed CW studies from 1992 to 2017 and concluded, "61% of CW research in face-to-face settings has focused on dyads, paying limited attention to examining small groups" (p. 13). They also advised that when learners lacked prior CW training, more care should be given to cultivating a sense of shared responsibility among the participants throughout the entire writing process. In addition, these two scholars emphasized that future CW studies should focus on different variables and learners' composing processes, for example, learners' revision

behaviors.

Taken together, the findings from these past studies have established CW as an effective framework for improving students' performance in L2 writing and helping them foster collaborative skills. However, few studies have examined how CW can be applied to the training of technical writing or how CW supports students' development of feedback literacy.

Feedback for Revision in Writing Training

The research on teacher feedback in students' writing has shown that learners consistently value detailed feedback because it supports improvement in their writing (Ferris, 1995; F. Hyland, 1998, 2001; Lee, 2008; Rowe & Wood, 2008; Weaver, 2006). Teacher feedback has been defined as "a constructive judgment of a text: an evaluation that points forward to the student's future writing and the development of his or her writing processes" (Hyland & Hyland, 2019, p. 1). Traditional product-oriented approaches emphasize discourse-level features, such as cohesion, structure, and topic development, often through direct or indirect corrective feedback. In contrast, process-oriented approaches expand feedback to include audience, purpose, and genre structure, encouraging learners to work with feedback clues and take a more active role in the problem-solving process of revision (K. Hyland, 2006; Yu & Liu, 2021).

In the past decade, the discussion of feedback for revision has extended to the development of feedback literacy. Boud and Molloy (2012) defined feedback as "a process whereby learners obtain information about their work in order to appreciate the similarities and differences between the appropriate standards for any given work and the quality of the work itself, in order to generate improved work" (p. 6). More recent research emphasizes that teachers and students share responsibility for making feedback effective. Teachers design environments and provide modeling, while students are expected to seek, generate, and apply feedback productively (Carless & Boud, 2018; Carless & Winstone, 2023; Molloy et al., 2020; Nash & Winstone, 2017; Winstone & Carless, 2019). These perspectives collectively underscore that feedback literacy involves both

opportunity and responsibility. Furthermore, evidence from classroom studies supports this theoretical view. T. Zhang and Mao (2023) showed that carefully designed feedback opportunities in an L2 writing class enhanced students' ability to use feedback to improve their texts, highlighting the importance of structured teacher support in students' feedback literacy development.

Students' Feedback Literacy Development

Building on research that emphasizes the role of feedback in supporting revision, recent work has expanded to include the notion of students' feedback literacy development. Sutton (2012) first framed the concept from the perspective of academic literacies, focusing on how students interpret and act on feedback. Carless and Boud (2018) later defined student feedback literacy as "the understandings, capacities and dispositions needed to make sense of information and use it to enhance work or learning strategies" (p. 1316). Carless and Boud identified four features of student feedback literacy: appreciating the value of feedback, making informed judgments, managing the emotional aspects of receiving feedback, and taking action to improve subsequent work. Building on this model, Molloy et al. (2020) developed a more comprehensive framework that emphasizes students' commitment to feedback as improvement, active engagement in feedback processes, management of emotional responses, and recognition of feedback as a reciprocal process. Together, these frameworks clarify the multiple dimensions of student feedback literacy and provide a basis for designing learning activities that foster its development.

Many studies in writing instruction have shown that collaborative engagement enables learners to discuss errors in their writing, understand feedback through peer support, and revise their writing more effectively (e.g., Hiver et al., 2024; Mohammed & Alharbi, 2022; Saeed & Alharbi, 2023; Storch, 2021; Wigglesworth & Storch, 2012; Z. Zhang, 2022; Z. Zhang & Hyland, 2018, 2022). However, more research examining how learners develop feedback literacy is still needed (Carless & Winstone, 2023; Molloy et al., 2020; Yu & Liu, 2021). To address this gap, the present study focuses on a group of

students learning technical writing in Taiwan, with two research questions:

1. What was this group of Taiwanese students' perceived learning from CW?
2. How did these students' CW revision experience facilitate their IW and feedback literacy development?

STUDY

This section covers four parts: Course Layout, Participants, Data Collection Tools, and Data Analysis. The first part outlines the Technical Writing course, providing details on its design. The second part provides information about the students taking this course and their composition-learning history. The third part introduces the tools employed for data collection, while the last part elaborates on how the collected data were analyzed.

Course Layout

This study investigated students' perceptions of their learning in a Technical Writing course designed to prepare them for workplace communication in line with ESP/EOP principles. Technical writing has been described as writing about specialized knowledge that is "more the territory of experts and specialists" (DeSilva et al., 2017, p. 1). Since many graduates in the department where the study was conducted pursue careers in business, technology, and manufacturing, technical writing is considered essential preparation. This course incorporates three writing projects: an informative paper, a comparison-contrast paper, and a problem-solution paper. These projects are selected for their common workplace applications and arranged to reflect a sequential relationship: presenting information, comparing alternatives, and addressing problems. Such genres are widely used in professional contexts, from the launch of a product or service to its after-sales support.

Recent studies in medical and engineering education also highlight the importance of technical writing training (Chrdileli &

Shulzhenko, 2021; Francis, 2023; Parkinson et al., 2020; Simpson-Smith, 2020; Siu & Afzaal, 2022; Wiederkehr & Rudolf von Rohr, 2020; Wright et al., 2022; Wu et al., 2022), supporting the relevance of these three projects. To train students to collect information, filter details, and produce effective texts, each project was framed as a task (AlGhamdi, 2023; Kadam & Pusawale, 2023) to simulate authentic workplace genres. Specifically, the informative project paralleled documents such as user manuals, process guidelines, or technical briefs (Markel & Selber, 2018); the comparison-contrast project reflected product specifications and feasibility reports (Anderson, 2017); and the problem-solution project corresponded to technical reports, incident reports, or proposals requiring problem analysis and solution development (Huckin & Olsen, 1991).

This writing course adopted a process-oriented approach, requiring students to engage in a recursive, feedback-for-revision, multi-drafting process. To help students solidify genre knowledge and manage the revision process, CW was incorporated as a scaffolding activity. The course began with genre instruction and guided analyses of the teacher-provided model essays. Next, students worked in groups to compose a piece of technical writing and respond collaboratively to teacher feedback. In the students' submitted work, the teacher provided suggestive-epistemic [1] feedback (Liebold & Schwarz, 2015) on both macro and micro levels. The "suggestive" part gave students clues for revision, while the "epistemic" part encouraged them to reflect more deeply on their writing choices. After completing each CW project, the students moved on to the corresponding IW project, applying what they had learned from collaboration and feedback to complete their own writing and revision tasks.

[1] This type of feedback can be traced back to a 2012 study by Alvarez, Espasa, and Guasch, who described its characteristics without explicitly giving it a formal name. The term suggestive-epistemic feedback was later coined and adopted by Liebold and Schwarz (2015) and Guasch et al. (2019) in reference to the original study.

Participants

This study involved 60 students enrolled across four semesters of the Technical Writing course. Because enrollment was capped at 15 students per semester, the study spanned four consecutive semesters and maintained the same course design and implementation. All participants were foreign language majors who had completed four semesters of English composition during their freshman and sophomore years. Their training focused on paragraph writing (at least 300 words) and essay writing (at least 800 words). The students were expected to have acquired knowledge of basic genres, including narration, description, comparison/contrast, cause/effect, classification, process, and argumentation. Among the 60 students, only seven had prior exposure to feedback-for-revision practices, while the other 53 had received teacher feedback without being required to revise their texts. Therefore, CW was a new practice for all students in the Technical Writing course.

Previous studies (e.g., Shehadeh, 2011; Storch, 2005; Wigglesworth & Storch, 2012) concluded that pairs and triads were more effective for encouraging learner interaction and improving writing performance. Accordingly, the students in this study were organized into groups of three for two main reasons. First, in pairs, the absence of one student often hindered the other's ability to complete the task. Second, triads were expected to facilitate greater interaction, higher task engagement, and a more robust writing and revision process. Moreover, as this study aimed to analyze the students' writing logs and one-on-one interviews, informed consent forms were distributed to the participants in the first session of each semester. The researcher (also the instructor) explained that the students' writing would not be analyzed until the semester ended and that the collected data would be used only for research purposes. All 60 students consented to participate in this study.

Data Collection Tools

As this study aimed to examine students' perceived learning from CW and the effects of CW on their IWs, particularly in relation to feedback-for-revision, three data collection tools were employed: one

CW-learning survey, students' writing logs, and one-on-one interviews. First, the survey was adapted from Farrah's (2015) questionnaire on students' perceptions of collaborative online activities. As this study was conducted in a face-to-face classroom, some items were revised to fit the CW context and new items were added to capture the scaffolding effects of CW on revision. Specifically, the first step was to change the wording from "collaborative online activities" to "collaborative writing." The second step was to modify items 18 and 19 to reflect this study's emphasis on employing CW as a scaffolding activity to strengthen students' composition skills. The last step was to add four items addressing the effects of CW on learners' understanding of teacher-provided feedback and their ability to carry out revisions. Next, the researcher used SPSS 28 to test the reliability and validity of the modified survey. Of the 24 items, three were removed due to their high loading on two factors during factor analysis. The final 21 items displayed a high Cronbach's alpha of .959; the factor analysis revealed four dimensions: Students' Personal Skill Gains from CW, Students' Positive Evaluation of CW, Students' Overall Perceived Benefits of CW, and CW Effects on Students' Individual Writing Improvement. Cronbach's alpha values within these four factors were .930, .915, .868, and .705, respectively. This survey was administered in Week 16 to investigate the students' perceptions of CW.

Second, this study examined the students' course writing logs for their perceptions of the CW/IW practices, with special attention given to how CW impacted the students' genre knowledge acquisition, their collaborative writing process, and the feedback-for-revision experience. Because the students were assigned at least 30 minutes of collaborative work each week in class, they reflected on their learning through logs guided by instructor-provided questions (see Appendix A). Last, a voluntary one-on-one interview was carried out with 35 students. The interview covered six questions (see Appendix B), asking the students how they perceived the CW activities in this course. Three questions were taken from Shehadeh's (2011) research with minor changes in wording. Three more questions were added to examine CW's scaffolding effects in helping the students learn how

to conduct revisions.

Data Analysis

This study generated both quantitative and qualitative findings. First, for the learning survey, SPSS 28 was employed to produce descriptive statistics for these 60 students' responses to the 21-item survey. The purpose was to examine how these students perceived the CW learning experience, particularly their gains in different aspects. The renumbered items and descriptive statistics are presented in Table 1. Additionally, Principal Factor Analysis was conducted for factor extraction and Varimax was used for factor rotation. The four extracted factors explained 78.78% of the total variance in the students' perceived learning from the CW activities (see Table 2). Second, the students' weekly writing logs were analyzed for keywords and expressions reflecting their CW and IW experiences and perceived learning. The researcher and another rater first read through ten randomly selected logs, identified the students' perceptions on the CW/IW processes (with attention to comments on perceived merits or drawbacks), and coded the responses into categories inductively. They tallied the students' responses that reflected different issues in their CW and IW processes. The two raters compared the results for norming purposes, discussed differences, and reached agreement.[2] The inter-rater reliability for this initial coding was $\alpha = .89$ (Krippendorff's). The raters then coded the remaining 50 sets of logs, reaching a final inter-rater reliability of .91. Third, 35 interview transcripts were analyzed for recurring themes related to students' perceptions of CW and their feedback literacy development through

[2] One example is provided to illustrate how the two raters reached a consensus on the categorization of two expressions found in one log entry. In that instance, one student described her CW session negatively, saying, "I am not sure why they (her two groupmates) did this to me." In the same log entry, that student again wrote, "They have always done that." Regarding the uses of "this" and "that," one rater caught the first expression but missed the second one, whereas the other rater caught both. A closer reading performed by both raters indicated that "this" and "that" actually referred to the division of labor in this student's group. The raters discussed these two instances and concluded that both lines referred to the student's experience in the same class session; therefore, they were counted as one response.

revision tasks. To illustrate these themes, representative excerpts were selected to provide deeper insight.

FINDINGS AND DISCUSSION

This section presents the quantitative and qualitative findings for the two research questions. Because different data collection tools and analyses shed light on both research questions with varying degrees of input, this section is organized according to the two research questions, each supplemented with quantitative and qualitative details.

Students' Perceived Learning from CW

For the first research question, the results are presented in the sequence of those from the learning survey, writing logs, and interviews, respectively. More specifically, the quantitative findings gathered from the learning survey are presented first, followed by the qualitative findings from the students' writing logs and interviews.

Quantitative Findings from the Learning Survey

To begin with, the students' responses to the 21-item survey are presented in Table 1. Four factors were extracted to provide a better understanding of the students' perceived learning from CW. The items under each heading were renumbered based on factor loadings. The statistical details of these four factors (means and standard deviations) are summarized in Table 2.

Based on the descriptive statistics in Table 1, students expressed highly positive views of CW, with all items scoring above 4.5 on a 5-point scale. Strong agreement was reflected in their belief that the time invested in CW was worthwhile (M = 4.95) and that CW improved their writing performance (M = 4.90). Several other items also scored highly, including perceptions that CW facilitated peer exchange (M = 4.87), reduced the burden of interpreting and addressing teacher feedback (M = 4.87), cultivated confidence in revision (M = 4.85), and enabled groups to produce better essays (M = 4.85). In contrast, three items received comparatively lower means: negotiation skills (M =

4.50), planning and editing strategies (M = 4.52), and enjoyment of writing (M = 4.57). Although still positive, these results suggest that students perceived CW as most beneficial for writing improvement, collaboration, and revision but less influential for negotiation, planning, or enjoyment.

Table 1

Descriptive Statistics on Learning Survey

Items	Mean	SD
1. Collaborative writing activities helped me to have a greater sense of responsibility for myself and my group.	4.67	.475
2. Collaborative writing activities enhanced my communication skills.	4.60	.558
3. Collaborative writing activities enhanced my negotiation skills.	4.50	.567
4. Collaborative writing activities enhanced my interpersonal skills.	4.68	.537
5. Collaborative writing activities enabled me to learn new ways to plan and edit my essays.	4.52	.567
6. Collaborative writing activities gave me the chance to express my ideas in the group.	4.70	.497
7. I enjoyed writing more than I did before due to the practice of collaborative writing.	4.57	.563
8. Through the collaborative writing activities, we wrote better essays.	4.85	.360
9. Collaborative writing activities helped me to acquire relevant planning, organizing, and revision skills.	4.85	.360
10. Collaborative writing activities helped me to receive useful feedback from peers.	4.83	.419
11. Collaborative writing activities should be encouraged.	4.85	.404
12. I got more work done when I worked with others.	4.73	.548

Items	Mean	SD
13. Overall, learning through collaborative writing activities is a worthwhile experience.	4.80	.480
14. Working in groups is a waste of time. (reversed)	4.95	.220
15. Collaborative writing activities fostered the exchange of knowledge, information, and experience.	4.87	.343
16. Collaborative writing activities made problem-solving easier.	4.82	.390
17. Collaborative writing activities stimulated my critical-thinking skills.	4.73	.446
18. Through collaborative writing, we became better in using the teacher-provided feedback for revision purposes.	4.80	.403
19. Collaborative writing helped reduce the burden and add the ease in interpreting the teacher-provided feedback for revision.	4.87	.343
20. Collaborative writing for revision made me more confident in revising my own paper.	4.85	.404
21. Collaborative writing activities improved my writing performance.	4.90	.303

Note:

The *N* for the above survey results was 60.
Items 1 to 9 are placed under the heading of "Students' Personal Skill Gains from CW." Items 10 to 14 are placed under the heading of "Students' Positive Evaluation of CW." Items 15 to 19 are placed under the heading of "Students' Overall Perceived Benefits of CW." Items 20 to 21 are placed under the heading of "CW Effects on Students' Individual Writing Improvement."

Factor analysis (Table 2) identified four dimensions of students' perceived learning from CW: Students' Personal Skill Gains from CW, Students' Positive Evaluation of CW, Students' Overall Perceived Benefits of CW, and CW Effects on Students' Individual Writing Improvement. Together, these four factors explained 78.78% of the total variance and each demonstrated strong internal consistency (Cronbach's alpha values ranging from .705 to .930). Among the

factors, CW Effects on Students' Individual Writing Improvement received the highest mean of 4.88, underscoring that students valued CW most for its contribution to strengthening their independent writing. Both Students' Positive Evaluation of CW (M = 4.83) and Students' Overall Perceived Benefits (M = 4.82) also scored highly, indicating that students regarded CW as a beneficial and worthwhile learning activity. In comparison, Students' Personal Skill Gains from CW (M = 4.66) scored somewhat lower, echoing the relatively weaker item-level ratings in Table 1 for students' perceived gains in negotiation, planning, and enjoyment. Taken together, the factor-level findings reinforce the item-level results by showing that these students perceived CW mainly as a framework for improving their revision practices and writing outcomes, while recognizing more modest gains in discrete skills.

Table 2

Descriptive Statistics on the Four Factors

Factors	Mean	SD
1. Students' Personal Skill Gains from CW (items 1 to 9)	4.66	.404
2. Students' Positive Evaluation of CW (items 10 to 14)	4.83	.370
3. Students' Overall Perceived Benefits of CW (items 15 to 19)	4.82	.313
4. CW Effects on Students' Individual Writing Improvement (items 20-21)	4.88	.314

Qualitative Findings from the Students' Writing Logs

In addition to the survey, the students' weekly writing logs provided insight into their reactions to CW. Close reading and coding of the logs yielded four positive categories, one mixed category, and two negative categories (see Table 3). Each category is illustrated with representative comments from students.

Table 3

Tallied Counts for Students' Evaluative Views on CW

Keywords/Expressions	Counts
Idea Generation	490
Experience Sharing	378
Problem-solving Training	364
Clarification through Discussions	293
Division of Labor	224
Spending Extra Time	153
Differences in Communication Styles	104

Idea Generation. Under the category of Idea Generation, a total of 490 comments in the students' writing logs highlighted this feature as the most important perceived strength of CW. The high frequency indicates that the students viewed collaboration as a way to overcome the challenge of starting a project and to expand their perspectives. The writing logs of students 13, 32, and 51 are provided below for illustration.

> I think CW truly manifests the saying, 'Two heads are better than one.' I often find it a challenge to kick-start a project, but my two groupmates totally made up for my weakness. Thanks to their input, I could quickly follow their thinking pattern and map out the possible writing directions. (Student 13)

> In the kick-off discussion for Project 2, we first came up with two topics. I knew one of them quite well because I am into photography and found the comparison of cameras quite an easy task. Another groupmate suggested note-taking applications. Then three of us realized that the second topic actually carried more relevance. Therefore, we reached a joint decision to choose the second topic. (Student 32)

> We decided to write about how to solve the problem of game crashes today for Project 3. One partner mentioned the news she

> saw on TV two days ago. Although another classmate and I did not know anything about that news, that partner was a good storyteller and, from there, we moved on to identifying the stakeholders of that problem and brainstorming the writing points. (Student 51)

Taken together, these reflections suggest that CW not only facilitated idea generation but also helped students make decisions and pool knowledge for approaching writing tasks with greater confidence and clarity.

Experience Sharing. As shown in Table 3, Experience Sharing was the second most frequently observed category in the writing logs, appearing 378 times. Most of the students came to realize that, working as a group, they needed to share their experiences to advance a writing task. For example, Student 26 said, "Today, when my groupmates decided to compare the Android and iOS systems, I shared my experience as both an Android and iOS user. My experiences in using both systems were of value to my group." Similarly, Student 38 felt greatly encouraged when her ideas were adopted by her group in the development of their project.

> Working in a group, I realized I became more 'scrutinizing' and wanted to make sure what I shared would be relevant. In today's discussion, I shared my experience in using the discussed products and my group members acknowledged what I shared should be incorporated into the essay. I like this feeling of being recognized. (Student 38)

Moreover, this sharing practice seemed to solidify a group's working dynamic. In five students' writing logs, this feature emerged as a reason for their positive evaluation of CW. Student 5 said she liked working with her groupmates because everyone in her group was willing to participate in discussions and share ideas. Two other students commented on this feature as follows.

> I did not know my CW partners well when we first came together

> as a group, but I detected a sense of belonging in the discussion today. We were able to listen to one another, share our experiences, and bring about a fruitful discussion. (Student 43)

> We wrapped up the writing for Project 2 today. I felt positive working with my 'partners.' I had not expected to call them partners, for I always viewed writing as an individual project. I now like to share experiences with my groupmates and listen to their ideas. I think we are indeed an 'awesome' group. (Student 48)

These logs collectively indicate that the students valued sharing experiences and recognized the sense of belonging fostered through CW as an important benefit.

Problem-solving Training. Table 3 shows that 364 comments described how students solved problems together in groups. For these students, CW was regarded as a mechanism for fostering problem-solving skills, particularly in three areas: topic selection, essay composition, and feedback for revision. Although these tasks were often challenging, students' reflections indicated that such difficulties strengthened their negotiation and collaborative skills. Excerpts from four students' responses are provided for illustration.

> Every time we tried to finalize the topic for a project, the entire process was like multiple 'discussion-negotiation-rejection-discussion-reformulation' rounds. To select the best topic, we all worked hard to ensure the chosen topic was indeed suitable. It is this shared view that supported us in overcoming a challenge like this. (Student 11)

> When performing CW, I found a writing task was like a tug-of-war. We took turns playing the role of the 'structure scrutinizer' to make sure we got the structure right. This task was difficult because when we were writing the details, we often would lose the higher perspective for examining the entire paper structure. (Student 22)

> I especially like to work with my groupmates in tackling the teacher-provided feedback. My teacher provided feedback in a very detailed manner to challenge us to think further. I am glad I am not alone in addressing those suggestions and questions. Thanks to my groupmates, my revision skills are enhanced because of CW. (Student 58)

> During the CW revisions, the teacher-provided feedback was one major part that triggered our discussions and kept us engaged the most. Our teacher did not provide direct answers regarding how problems should be solved but guided us to think further. For example, she would just provide the first two to three letters in a suggested vocabulary item and we had to work together to figure out the answer. (Student 33)

These reflections point out that CW provided students with valuable practices in negotiation and collaborative problem-solving across different stages of writing and enhanced their ability to process and act on teacher feedback.

Clarification through Discussions/Division of Labor. As shown in Table 3, 293 comments highlighted the role of discussion in clarifying details involved in a writing task. Students often noted that group talk made the focus of a project clearer and helped them coordinate their work more effectively. Meanwhile, 224 comments addressed the division of labor. Yet, the responses were mixed: while 38 students valued role distribution as fair and flexible, 16 expressed concerns about unequal workload. The following two log entries were selected for providing further insight.

> We, as a group, collaborated twice on the first two projects. The problem-solving paper is our third project. I was assigned to look into the history of this incident (the problem) from the perspective of the victim. The other two members had their parts, too. We respected one another's choice, and the negotiation process was never a troublesome one. (Student 37)

> This time, for the comparison/contrast project, I don't know why I was assigned to collect information on both items. I admit I am not familiar with either of them, but that should not be the reason for forcing me to research both of them. (Student 50)

For many participating students, the perception of Division of Labor for a given project seems to hinge on the group's working dynamic. Student 37's group dynamic was very positive, and the group members collaborated with an amiable attitude. However, Student 50, a female, was in a group with two male students who liked to dominate the writing process. The negative feelings toward her groupmates often discouraged her from sharing her thoughts. This student perceived that gender differences hindered the communication in her group, causing her to develop a negative view on group work.

Spending Extra Time/Differences in Communication Styles. Table 3 shows that 153 comments reflected students' concerns about spending extra time on CW and 104 comments emphasized differences in communication styles. Together, these two categories pointed to practical challenges in time management and in-group communication. According to the instructor's observation, some groups used class time effectively to make the planned progress, while others did not. For the latter, students were asked to arrange additional meetings, either face-to-face or online. In their logs, some students complained about spending "extra" time on CW but acknowledged that this condition was caused by their groups' inadequate time management in class. For example, Student 12 wrote:

> We spent too much in-class time today arranging the sequence of the information. We had many details, and trying to structure them in the right sequence was hard. Understandably, we had to finish the writing outside of class.

Likewise, Student 47 pointed out that the two girls in his group spent too much time filtering the collected information, causing the delay of their in-class CW.

In addition to time management issues, students reflected on differences in communication styles. Among these 60 participants, only 13 were male. Some logs commented on the different ways male and female students expressed themselves. For instance, Student 40, in a group with two male students, commented twice on the passiveness of her group members. She said, "I know they didn't want to do the CW as homework, but they were passive, not wanting to discuss what should go into different paragraphs. I felt like an ox pulling a very heavy cart." Student 50 reported a similar situation, explaining that the negative group dynamic left her reluctant to participate in topic selection.

> The two male students liked to drift off from the assigned task. When I tried to point out the ineffectiveness, they always said they could get the work done in time, so I should not worry. The way they talked was as if I were not part of the group. Though they did not say any insulting words, I felt put down somehow. (Student 50)

These negative responses focus on several factors: poor time management, overly long in-group negotiation, and different communication styles. Prolonged discussion often undermined groups' ability to manage their time effectively. Moreover, perceived gender differences might have negatively impacted group cohesion. These factors warrant closer attention in a CW classroom.

Qualitative Findings from the Interviews

This study gathered interview responses from 35 students who volunteered to participate. The interviews reinforced the survey and log findings, emphasizing four recurring themes: planning and process, collaboration and ownership, changed views on CW, and confidence building.

Planning and Process. Some students emphasized how CW improved their ability to make plans for writing tasks. Student 30 reflected on her personal growth:

> I did not like writing very much, but through CW, I worked with my groupmates on three different projects and witnessed how they, or we, selected the topics and set the writing plans. That was very helpful for my writing projects later on.

Similarly, Student 55 noted how group planning taught him to stick to a structure and become disciplined in following a plan. In sum, these reflections show that CW supported the students in developing clearer planning strategies and more disciplined approaches to writing tasks.

Collaboration and Ownership. Students also stressed their gains from the collaborative nature of CW and the sense of collective responsibility. Student 7 reflected on her group's experience.

> CW, for our group, truly meant collaboration. Every step, from information collection, to information filtering, to sentence formulation, showed our discussion results. That's why we felt the completed work was ours. When the teacher assigned our work a grade, we felt we collectively earned that grade.

Sharing a similar feeling but adding her own perspective, Student 31 commented that although the work was a joint production, she still felt very proud of the contribution she made in the writing process. Together, the reflections on this feature underscore how CW fostered both a sense of shared ownership and recognition of individual contributions in collaborative work.

Changed Views on CW. Several students described how this technical writing course changed their attitudes toward group writing. Student 18 contrasted past negative experiences with a new appreciation for guided collaboration and stated, "CW was different because we were a team. In my group, all three of us were very good friends. We were similar in attitude and the level of seriousness, so we all benefited from CW." Student 44 echoed this stance, explaining that she had initially considered CW a "time-killing exercise" but soon realized CW allowed her groupmates to teach one another, especially

on essay structure and paragraph composition. She emphasized, "CW enabled us to tackle more complicated concepts and present them in writing. I would not consider doing this alone. CW gave me more courage." From the students' reflections, it can be observed that structured collaborative writing experiences not only countered the students' earlier negative perceptions of group work but also helped them foster a strong sense of appreciation for teamwork and mutual support.

Confidence Building. Last, the students linked CW to greater confidence in writing and revision. Student 26 explained that she gained more confidence in writing because CW gave her "a fuller picture of the assigned writing task," and she could "follow similar preparatory and composing steps to finish my [her] own project." In addition, Student 60 expressed that she "benefited from the organizational nature of CW." Student 17, who began the course with very negative feelings about writing, shared what she gained from CW.

> I did not like writing with others because, very often, my group members were passive and quiet. Then I found myself lost in the writing process. However, this CW experience opened the door for me to see a different way of learning writing and working with others. My groupmates 'guided' one another through this once-difficult process.

Collectively, these reflections indicate that CW not only strengthened students' confidence in handling writing and revision tasks but also helped them approach independent tasks with greater assurance.

Students' Evaluations of Skill Acquisition in Feedback Literacy

For many of the 60 participants, their previous revision experiences had been limited to making surface changes based on teacher comments, a practice more commonly referred to as direct corrective feedback. In contrast, the instructor in this study provided suggestive-epistemic feedback, offering clues and prompting deeper reflection during revisions. The second research question focused on

the students' learning perceptions of revision, particularly whether the CW experiences supported their individual revisions and their transition from CW to IW. Interview responses (Q4 to Q6) revealed further insight into the students' perceptions in these aspects. First, 32 students reported that CW helped them conduct revision tasks individually, while three expressed a neutral stance. Second, all 35 students recognized CW's scaffolding effects on cultivating their confidence in interpreting teacher feedback. Last, 31 students viewed the CW-to-IW transition as highly facilitative for learning technical writing, while four students preferred the entire course structured around CW activities. Taken together, these responses point to two recurring themes: students' growing confidence, particularly in approaching revisions independently, and their perceived scaffolding effect of CW in transitioning them to IW.

Students' Growing Confidence. When asked whether CW experiences supported their ability to conduct revisions independently (Q4), 32 students responded affirmatively, while the remaining three expressed a neutral stance. In addition, all 35 students, in their responses to Q5, recognized CW's scaffolding effect in building their confidence to interpret feedback. Their reflections highlighted how CW provided them with opportunities to practice interpreting teacher feedback in a safe and collaborative environment before applying this skill to IW. Many indicated that working in groups allowed them to test ideas and clarify unclear points, a process that gradually strengthened their confidence in handling revision tasks on their own. Furthermore, in their writing logs, the students expressed confidence in revising their work through phrases like "I believe," "I know," "I enjoy," and "I can/could," showing that the students were taking a firmer stance in expressing confidence. The following excerpts illustrate this theme.

> I did not receive much feedback in my previous writing courses, but it did not mean my writing was good. I wanted to know my weaknesses and tackle them one by one. However, I was not sure about my ability in revising my work, so it was perfect for us to gain feedback-for-revision experiences in CW. I learned a lot from

my groupmates. (Student 12)

I have heard a lot about 'process writing' and 'multi-drafting' from the seniors. That's why I chose Technical Writing because it emphasized these features. I appreciated the practice opportunities the teacher arranged for us through CW. In CW, our group worked as a team to revise our work. I could handle the suggestive feedback by myself, but those 'further' questions were hard and my groupmates helped a lot. (Student 22)

The responses collectively suggest that CW not only reduced students' anxiety in interpreting teacher feedback but also strengthened their confidence to carry out revisions independently.

Scaffolding Effect of CW in Transitioning to IW. When asked whether CW facilitated their transition into individual revision tasks (Q6), 31 students expressed that the CW-to-IW course design was highly supportive although four preferred having CW integrated throughout the entire course. Most students explained that CW provided a structured environment for practicing feedback interpretation collaboratively, which made the shift to IW smoother and less intimidating.

Several students emphasized the importance of this preparatory role of CW. For example, one described CW as a necessary stage before tackling independent tasks:

For many of us, this feedback-for-revision process was a whole new experience. That's why I tend to see CW as 'preparation' that gets me ready for my own 'show.' In our group work, we helped one another to understand our teacher's feedback. I was keenly aware that all these revision practices were to prepare me for individual work. (Student 34)

Another student appreciated how CW gave her the chance to practice handling detailed teacher feedback before moving on to the handling of individual revision tasks.

Through CW, we not only composed different projects together

> but also learned to revise our work with the feedback from our teacher. Our teacher's feedback was thorough, covering grammar, word choice, paragraph structure, and essay organization. Naturally, a group was needed for handling such a challenging task. Working with my group, I have learned how to handle revision feedback by myself. (Student 59)

Evidently, most students interviewed highly acknowledged the merits of CW, including cultivating their confidence in revision, deepening their understanding of teacher-provided feedback, and assisting them with individual revision tasks. These reflections jointly illustrate how CW supported the participating students in appreciating the value of feedback, making informed judgments, managing the emotional challenges of revision, and taking action to improve their writing, thereby aligning closely with the four dimensions of feedback literacy identified by Carless and Boud (2018).

LIMITATIONS AND FUTURE DIRECTIONS

This study on how students' perceptions of CW in Technical Writing, focusing on its overall effectiveness and its scaffolding effects on the feedback-for-revision process, has generated positive findings and pointed to some directions for future research. The learning survey results revealed students' self-evaluated growth and their recognition of CW as a valuable learning practice. Moreover, the analyses of writing logs and focused interviews provided more details on students' perceived gains from CW and their development in using feedback for revision (from CW to IW). This section recaps the major findings and observations from these sources and offers suggestions for future studies.

The survey identified four areas in which these students benefited from CW. First, they reported significant gains in organizing the writing process (from planning to revision) through CW, which helped them produce better essays. CW also facilitated the exchange of ideas and encouraged the students to develop a strong sense of responsibility for both themselves and their groups. In addition, the students noted improvements in interpersonal, communication, and

negotiation skills. Second, the students valued CW as an opportunity to receive useful peer feedback and become more efficient writers, concluding that CW should be encouraged in writing courses and that it provided a worthwhile learning experience. These results indicate that CW, as the teaching framework, successfully guided these participating students to work with teacher-provided feedback, to appreciate the feedback process, to make judgments about seeking and using feedback, and to take action in responding to comments. These gains reflected their growth in feedback literacy (Boud & Molloy, 2013; Carless & Boud, 2018; Winstone & Carless, 2019). Third, echoing previous studies (Onrubia & Engel, 2009; Storch, 2005; Suwantarathip & Wichadee, 2014), CW enabled learners to exchange knowledge, information, and experiences, stimulating them to become more critical thinkers. For revision, they worked as teams to address weaknesses in their writing and viewed problem-solving as less threatening in the group setting. Last, the students rated CW highly for its scaffolding role in preparing them to use feedback for revision, emphasizing that CW boosted their confidence in handling revisions independently and improved their writing performance. This growth in confidence also indicated that the students in this study developed competence in managing the emotional demands of processing feedback, another element of student feedback literacy (Carless & Boud, 2018; Molloy et al., 2020).

In addition, the students' writing logs and one-on-one interviews provided more qualitative insights into how they benefited from CW. The log analysis identified four strengths and three potential weaknesses. Most students confirmed that CW supported idea generation, experience sharing, and collaborative problem-solving, which strengthened their communication skills and group problem-solving abilities. Furthermore, the students valued discussions that clarified ideas and guided the division of labor for information collection and writing preparation. However, not all groups managed time effectively. Some struggled with differences in communication styles, which slowed their in-class progress, while others became so engaged in discussion that they lost track of time. In both cases, the students had to complete their CW assignments outside of class, raising concerns about extra workload. Despite these issues, most

students indicated that they were able to manage differences and complete the tasks successfully.

The interview results further showed how CW prepared the students for IW revisions. Many participants explained that the progression from CW to IW allowed them to experience how their learning in one context, with group members and shared tasks, positively influenced their performance in another context, where they worked independently on similar tasks. In other words, the feedback-for-revision practices developed through CW prepared the students for their own writing projects. This observation reflects what Perkins and Salomon (1992) described as "near transfer," or the application of learning "between very similar contexts" (p. 4). James (2010) likewise suggested examining the learning that occurs in a given instructional setting to better identify the impact that "particular instructional settings have on transfer" (p. 199). Later, James (2014), in his review of 41 studies on transfer in EAP contexts, concluded that instruction could bring about transfer and involve various kinds of learning. Building on these insights, future studies could investigate more closely how CW supports learners' development in vocabulary knowledge, grammar awareness, and writing strategies.

For the limitations of this study, two areas could be improved. First, this study reported the students' perceptions of CW learning. Learner perception is highly subjective although such perception does have a huge impact on whether a learner will continue investing time and effort in a target activity like writing (Chen & Yu, 2019a, 2019b; Fernández Dobao & Blum, 2013). As learner perception cannot be overlooked, what can be improved is to add other details to the study of CW effects, for example, examining the group communication process. In this regard, examining a group's LREs can be suggested because, according to Swain and Lapkin (1998), such detailed dialog analyses can provide further insight into students' language learning processes, helping writing instructors know "how students talk about the language they are producing, question their language use, or correct themselves or others" (p. 326). Second, this study was conducted over a span of four semesters due to the course cap. In a study like this, although the researcher tried hard to keep all parameters the same, some variations might still exist. For future

studies in the same vein, researchers can consider structuring such a study in one class, reducing possible variations in instruction.

Furthermore, future studies examining the effectiveness of the CW-IW design in technical writing courses or other writing courses should consider several contextual factors and limitations. First, when a course is conducted within a single semester, instructors should assess students' workload and time management skills both before and during CW tasks. Monitoring collaboration is also important for ensuring equitable workload distribution in groups. To address uneven workload, recent studies suggest assigning explicit roles to group members (Donelan & Kear, 2024), providing detailed peer-evaluation guidelines to enhance individual accountability (Donelan & Kear, 2024; Wei & Liu, 2024), and increasing intergroup awareness by making individual contributions visible (Peng et al., 2022). Second, group size is a crucial factor in the success of CW tasks. In institutions with larger writing classes or in the context of online writing courses, group sizes may inevitably increase. Consequently, instructors should anticipate potential challenges, including social loafing (Wigglesworth & Storch, 2012), difficulties with communication and coordination, and issues related to task design and interaction patterns (Mei et al., 2025). Third, students' learning gains in CW tasks may be mediated by factors such as L2 proficiency (Storch & Aldosari, 2013), task mode and modality (Wang, 2015), and group size and formation methods (Fernández Dobao, 2012, 2014; Mozaffari, 2017).

Different group sizes also bring distinct advantages and limitations. Pairs promote focused interaction, clearer accountability, more LREs, higher grammatical accuracy, and tighter collaboration (Storch, 2005, 2013; Swain & Lapkin, 1998; Wigglesworth & Storch, 2009). Despite the increasing demands of coordination, small groups of three to four members provide more opportunities for idea generation (Fernández Dobao, 2012), encourage greater content development (Storch, 2013), promote multiple perspectives (Storch, 2013), and benefit individual writing proficiency (Fan et al., 2025). By contrast, large groups (e.g., five learners) enhance learners' critical thinking performance but face more in-group conflicts (Fan et al., 2025). Last, future studies may examine how CW affects learners with different English proficiency levels, including ESL learners in

English-speaking countries. Specifically, attention can be given to how learners with high and low English proficiency benefit from this teaching/learning approach. Also, learner traits such as introversion/extroversion (Winarti et al., 2021) and gender differences in interaction merit attention. By broadening the research scope, future studies can provide deeper insight into how CW benefits learners of writing. In short, while the findings of this study are encouraging, their transferability to larger classes, online settings, or different learner populations requires careful adaptation and further investigation.

For Taiwanese students learning English writing, this study has generated encouraging results in helping learners improve organizational abilities, enhance communication skills, elevate confidence in writing and revision, and become more proficient writers. Both process writing and feedback-for-revision require considerable effort, but the findings from this study confirm that such effort and time investment are worthwhile. At the same time, the results point to future directions for practice and research, suggesting that these approaches offer a promising pathway for continued development in both technical writing pedagogy and student feedback literacy development.

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APPENDIX

Appendix A

To guide the students' log-writing activity, the following questions were provided. The first three were adapted from Shehadeh's (2011) interview questions with some minor changes in wording. The fourth question was an open-ended one, allowing the students to reflect on their learning each week.

Questions:

1. How do you find the collaborative writing activity this week? Please elaborate on any positive, negative, helpful, and unhelpful experiences.
2. In the CW activity this week, what was the most interesting part or the part you liked most?
3. In the CW activity this week, what was the most difficult part? Why?
4. In the CW activity this week, was there anything you especially wanted to comment on? (This is an open-ended question, and you can write on any anecdote that happened this week.)

Appendix B

Interview Questions

The one-on-one interview in this study focuses on the following questions. The first three questions were taken from Shehadeh's (2011) interview questions with some minor changes in wording. Three more questions were added to explore the students' learning perceptions about CW's effects on revision as well as their writing experience from CW to IW.

1. What's your view of the collaborative writing activity? How did you find the experience overall?
2. What was your view and perception of collaborative writing before this course experience? Did your view(s) change after the experience?
3. Did the CW activity have any effect (positive or negative) on your confidence in your writing ability? Please specify.
4. Did your feedback-for-revision experience from CW have any effect (positive or negative) on your confidence level in conducting revision individually? Please explain.
5. Compared to the beginning of the semester, do you feel more confident in revising your writing with the teacher-provided feedback? Please explain.
6. Was the learning transition from CW to IW smooth and conducive for your learning of Technical Writing? Please explain.

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