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ARTICLE

Promoting Student Critical Thinking through Integrated Peer and Teacher Feedback in Online Writing

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The purpose of this study was to investigate the impact on students' critical thinking of integrating peer corrective feedback (PCF) with teacher feedback (TF) in online L2 writing instruction. Specifically, it examined how this integration affected students' focus, logic, and argumentation. 90 second-year undergraduate students from the English Education Department at a large public university in Bengkulu, Indonesia participated in the study. They were divided into three groups, with 30 students each: an anonymous PCF+TF group, a named PCF+TF group, and a TF group. At the beginning and end of the study, all groups completed pre- and post-tests. Data were gathered from writing assignments and semi-structured interviews. The anonymous PCF+TF group scored significantly higher on the post-test for critical thinking in argumentative essay writing compared to the other two groups ($p < 0.05$). Furthermore, both PCF+TF groups showed significant improvements across the three critical thinking aspects— focus, logic, and argumentation—from pre- to post-test ($p < 0.05$). These findings emphasize the pedagogical value of integrating PCF with TF, particularly under anonymous conditions, to enhance critical thinking in second language writing contexts.

Introduction

Critical thinking has been widely recognized as a core component of effective teaching and learning (Adeyemi, 2012; Barjesteh & Niknezhad, 2020; Knight & Robinson, 2021; Zou et al., 2023). It encompasses diagnosing, investigating, and evaluating issues as well as advocating viewpoints (Watson & Glaser, 2012), which taken together enable learners to make reasoned judgments through inductive and inferential reasoning (Freeley & Steinberg, 2009). More specifically, critical thinking involves the

ability to conceptualize, synthesize, and evaluate information gained through experience, observation, or feedback (Nugraheni et al., 2022).

Second language (L2) learners often face challenges in developing and demonstrating critical thinking skills, particularly in expressing arguments, establishing logical relationships among statements, and drawing reasonable conclusions, all of which require particular linguistic conventions and, often, strong writing skills.

As critical thinking in writing develops through cycles of revision and instructional guidance, feedback plays a crucial role in shaping how learners strengthen their reasoning and argumentation. The current study contributes to the literature in several ways: first, it explored how different types of feedback—peer (anonymous and named) and teacher—promoted the development of students' critical thinking. Specifically, peer corrective feedback (PCF) was integrated with teacher feedback (TF) within the same writing cycle, allowing students to revise their drafts based on multiple sources of input. The PCF was further categorized into anonymous and named to examine whether anonymity influenced students' engagement and reflection. Second, while prior studies have used questionnaires to measure L2 students' critical thinking development (e.g., Ekahitanond (2013), Zou et al. (2023)), the current study employed argumentative essay writing as a more authentic and cognitively demanding means of evaluating critical thinking performance.

Literature Review

Critical Thinking

Critical thinking is widely recognized as a disciplined and purposeful process that involves evaluating arguments and making judgments to guide understanding and decision making (Huitt, 1998). According to Facione (2023), its key aspects include interpretation, analysis, evaluation, inference, explanation, and self-regulation. Developing these skills presents significant challenges in modern education, particularly due to the wide range of information sources which students must analyze critically (Klimova, 2013).

In this context, Watson and Glaser (2012) outlined three fundamental aspects of critical thinking: maintaining a reflective attitude when approaching problems, possessing knowledge of rational inquiry methods, and applying these methods effectively. Moreover, Paul and Elder (2008) emphasized that critical thinkers are characterized by self-direction, discipline, and a commitment to overcoming cognitive biases. They further argued that proficient critical thinkers engage in asking insightful questions, systematically analyzing information, reaching well-reasoned conclusions, critically evaluating different systems of thought, and collaborating to solve complex problems.

Beyond defining critical thinking and outlining its key characteristics, critical thinking has been widely discussed in relation to learning processes and educational outcomes. Contemporary literature characterizes critical thinking as an active, skillful process of analyzing and evaluating information to guide belief and action. The Foundation for Critical Thinking (2019) defines it as a form of self-directed, disciplined, monitored, and corrective thinking intended to minimize personal biases and social conformity. Sharma (2024) emphasized the role of critical thinking in fostering awareness and encouraging individuals to question assumptions, thereby facilitating the acceptance of diverse perspectives and enhancing the quality of decision making. Similarly, Young (2023) argued that critical thinking cultivates self-reflection, enabling individuals to identify and challenge cognitive biases that may hinder clear decision making.

Teacher Feedback

Corrective feedback is widely recognized as a key technique in language learning, enabling students to receive explicit or implicit input on their linguistic errors to improve writing proficiency (Scherer et al., 2024). Indeed, recent studies have highlighted the connection between feedback and critical thinking development in L2 writing. Zou et al. (2023) found that collaborative feedback—both peer and teacher—significantly enhanced English as a Foreign Language (EFL) students' critical thinking in argumentative writing.

Teacher feedback, often regarded as the foundation of writing instruction in L2 classrooms, has consistently been shown to enhance learners' writing proficiency (Cui et al., 2022). As the primary and most reliable source of feedback, teacher responses are typically more detailed, accurate, and instructionally informed than those offered by peers (Elfiyanto & Fukazawa, 2020; Saeli & Cheng, 2021). These qualities make teacher feedback particularly valuable for addressing complex issues, such as syntactic accuracy, coherence, and genre-specific conventions.

Studies also indicate that L2 students generally have positive attitudes toward teacher feedback, perceiving it as reliable and beneficial to their development (Sotlikova, 2023; Taskiran & Goksel, 2022). However, the effectiveness of teacher feedback depends on various factors, including its clarity, level of detail, timeliness, and whether it serves a developmental or evaluative purpose. Moreover, while teacher feedback is often seen as more constructive and credible, it is also time consuming and may not always be sustainable in large or resource-limited classrooms.

Peer Corrective Feedback

To address these challenges, some researchers have emphasized the supportive role of peer feedback, particularly when students are properly trained (Zou et al., 2023). Peer feedback can serve to reduce teacher workload while fostering learner self-direction. While teachers generally provide more comprehensive and more effective feedback, especially in terms of language accuracy and revision guidance (Wihastyanang et al., 2020), peer corrective feedback (PCF) has gained increasing attention for its dual role in fostering language development and promoting learner self-direction.

Research suggests that providing corrective feedback to peers encourages learners to reflect on writing quality and language use, which can deepen their understanding of writing conventions. For example, Illana-Mahiques (2021) argued that giving feedback to peers can be more beneficial than receiving it, as it engages learners in reflective thinking about writing conventions and quality. Similarly, Yan et al. (2024) emphasized that peer feedback helps students become more self-reliant by training them to read critically and write independently. From this perspective, PCF functions as an active learning activity that supports reflective engagement with writing rather than passive error correction.

An increasing number of studies have also linked peer feedback to the development of critical thinking in writing contexts. Peer review tasks require learners to analyze arguments, evaluate evidence, and justify evaluative decisions, thereby promoting higher-order cognitive processing (Kuyyogsuy, 2019; Pham et al., 2020). Van and Duong (2022) demonstrated that peer feedback encourages critical engagement by encouraging students to assess peers' work and suggest feasible revisions. Similarly, Lin et al. (2021) found that peer-review-based learning enhanced students' inclination toward critical thinking. In online writing environments, peer feedback has been shown to encourage critical evaluation and improved argument development (Nurkhamidah et al., 2024). Engagement with multiple perspectives during peer review further contributes to interpretation, inference, and reflective judgment (Filius et al., 2018; Deng & Sitthitikul, 2024).

Anonymous and Named Peer Corrective Feedback

Within peer feedback research, anonymity has been identified as an important factor influencing learners' engagement and the nature of peer comments, particularly in online learning contexts. Several studies have reported that anonymous peer feedback encourages more honest and critical responses by reducing social pressure and interpersonal concerns (Rotsaert et al., 2018; Su, 2023; Zeng & Ravindran, 2025). Similarly, van den Bos and Tan (2019) found that anonymity shifted learners' attention toward content quality rather than social relationships, resulting in more constructive feedback and deeper cognitive engagement.

In contrast, named peer corrective feedback has received comparatively less explicit attention as a distinct research variable. In many studies, non-anonymous peer feedback is treated as the default mode rather than being systematically examined. Existing evidence suggests that named peer feedback may promote learner engagement, but it can also increase anxiety and reluctance to provide critical comments, depending on the instructional context and implementation strategies (Vattøy & Gamlem, 2024). Consequently, the comparative effects of anonymous and named peer feedback on students' cognitive engagement and critical thinking remain unclear.

Advances in educational technology have further shaped how peer feedback is implemented. Technology-mediated peer feedback—ranging from early tools such as email to contemporary online learning platforms—has been shown to enhance language learning effectiveness and interaction (Zou et al., 2023). Studies integrating peer feedback with technological tools have demonstrated that online platforms can support more interactive and engaging learning environments (Li & Hebert, 2024; Luhach, 2025; Sitthiworachart et al., 2023). However, relatively few studies have examined how different peer feedback conditions, such as anonymous and named conditions, influence students' demonstrated critical thinking within technology-supported writing contexts.

Methodological Limitations in Prior Peer Feedback Research

Despite these contributions, existing research on peer corrective feedback reveals several methodological limitations. Many studies have relied primarily on questionnaire-based measures, offering limited insight into how critical thinking is demonstrated through actual written performance. In addition, prior research has often focused on writing accuracy or general engagement rather than higher-order cognitive outcomes. Although anonymity has been examined in online peer feedback contexts, named peer feedback is frequently treated as a baseline condition rather than as a variable requiring systematic comparison. Moreover, few studies have investigated how different peer feedback conditions function when integrated with teacher feedback. As a result, there remains limited understanding of how anonymous or named peer corrective feedback, combined with teacher feedback, influence students' critical thinking in L2 writing.

Contributions of the Study

This study contributed to the literature in several ways. First, it employed argumentative essay writing to assess critical thinking, whereas prior studies often used questionnaires (e.g., Ekahitanond, 2013; Zou et al., 2023). Through essay writing, students are required to directly demonstrate critical thinking in their written arguments—formulating claims, supporting them with logical reasoning, and integrating evidence—rather than only expressing their self-perceived critical thinking abilities. Second, it focused on three aspects of critical thinking—focus, logic, and argumentation—rather than using all six (Hastiari, 2020; Zubaidah et al., 2019) or five aspects (Nejmaoui, 2019; Romadhoni et al.,

2022). Third, it compared three groups (anonymous PCF+TF, named PCF+TF, and TF) in order to explore the effects of anonymous versus named peer feedback combined with teacher feedback on critical thinking, filling a gap left by studies such as Zhang (2024), which examined only peer feedback groups without teacher involvement.

Summary and Research Gap

Although existing research has highlighted the benefits of peer and teacher feedback individually, little is known about how their integration influences higher-order cognitive outcomes such as critical thinking in L2 writing. Most prior studies have focused mainly on writing accuracy, leaving the cognitive aspect of feedback underexplored. In addition, critical thinking has often been measured through questionnaires rather than through authentic written performance, resulting in limited understanding of how students actually demonstrate critical thinking in their writing. To address these gaps, the present study examined how anonymous and named peer corrective feedback, when integrated with teacher feedback, affected students' critical thinking as evidenced in their essay writing.

Accordingly, this study explored the following research questions:

RQ_1: Are there significant differences in students' critical thinking performance among the anonymous PCF+TF, named PCF+TF, and TF groups?

RQ_2: To what extent does the integration of PCF+TF improve students' critical thinking performance in terms of focus, logic, and argumentation?

RQ_3: How do students perceive the impact of PCF on the development of their critical thinking skills?

Methods

Research Design

This study employed a sequential explanatory mixed-methods design (Creswell & Clark, 2018), in which quantitative data collection and analysis were followed by qualitative data collection to help interpret and explain the quantitative findings. An experimental approach was used to address RQ1 and to provide quantitative data for RQ2, while semi-structured interviews were conducted to gather qualitative insights for RQ2 and to answer RQ3. For the experimental component, three existing second-year essay writing classes at a public university in Bengkulu, Indonesia were selected. These classes were randomly assigned to one of three groups: (1) the anonymous PCF+TF group, (2) the named PCF+TF group, and (3) the TF group.

Participants

The study was conducted at a large public university in Bengkulu, Indonesia, selected based on its accessibility and the availability of relevant courses. The English Education Department was chosen because it offered an essay writing course that focused on enhancing students' academic writing skills. Due to the limited number of available classes, a quasi-experimental design was adopted for the quantitative component. Three existing second-year undergraduate classes (totaling 90 students) were selected using simple random sampling and were randomly assigned to one of the three treatment groups, with 30 students in each. To ensure comparability between groups, none of the participants

had prior experience with peer corrective feedback, and all groups were taught by the same teacher, who had eight years of experience teaching English writing to second language learners.

Ethical Approval

The study was conducted in accordance with established ethical standards and received approval from the university's research ethics committee. Written informed consent was obtained from all participants, emphasizing that their participation was entirely voluntary and that their confidentiality would be protected. Participants were also informed of their right to withdraw from the study at any time. These procedures were implemented to protect participants' privacy, promote their well-being, and ensure compliance with ethical research principles.

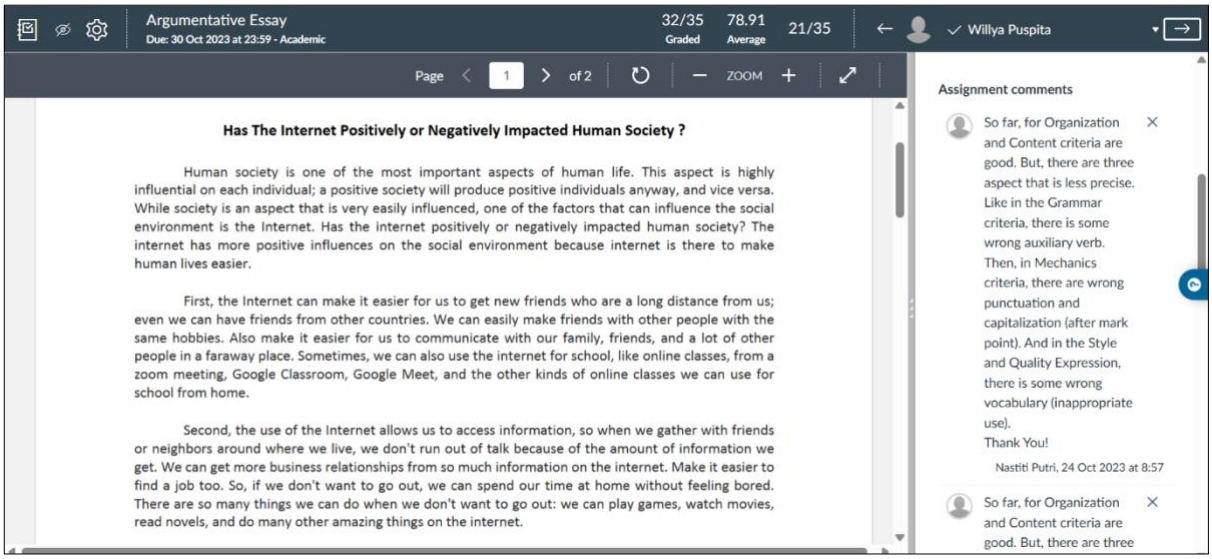
Learning Material

In an essay writing course, students are typically required to write either an argumentative or an expository essay. After completing their essays, they received feedback aligned with the specific intervention assigned to their group.

Online Learning Platform

Canvas, a digital learning management system, was used to facilitate the PCF+TF activities in this study, allowing both students and teachers to collaborate and share course content efficiently (Canvas, 2023). The platform supported the submission of essays and enabled the collection of peer and teacher feedback, all of which were stored and monitored for analysis. One of Canvas's key features is its peer review system, which allows instructors to assign peer feedback tasks either anonymously or with names visible, simply by adjusting the settings (Boston College, 2022). This system uses the same comprehensive online annotation tools available in SpeedGrader, making the feedback process smooth and accessible (Boston College, 2022). Additionally, instructors can track completed peer reviews and view individual feedback directly from the Peer Review section of each assignment (Boston College, 2022). A visual example of the peer review display in Canvas is provided in Figure 1.

Figure 1
Peer Review Display in Canvas



Experimental Steps

This study was conducted over seven weeks (see Figure 2). A total of 90 second-year undergraduate students were randomly assigned to one of three groups: (1) Anonymous PCF+TF, (2) Named PCF+TF, and (3) TF. At the beginning of the study (Week 1), all students took a pre-test to assess their initial essay writing performance. During the study, all three groups participated in the learning activity, but only the Anonymous and Named PCF+TF groups used the PCF activities. Students in these two groups were informed that they would provide corrective feedback on three essays from their peers and receive feedback from three peers on their own essay. Additionally, the teacher provided feedback on all essays in the three groups. These PCF+TF activities can be seen in Figure 3. In Week 2, the teacher provided instruction on essay writing. Subsequently, students were given one week to write an initial draft on a specified topic.

Before engaging in the PCF activities, students in the Anonymous and Named PCF+TF groups received guidance on how to provide constructive comments on their peers' essays. The teacher demonstrated examples of clear and specific feedback, emphasizing how comments should address content, organization, and language use rather than only surface errors. Students were encouraged to suggest improvements to promote critical reflection and mutual learning.

The PCF activities were conducted twice during the study. In Cycle 1 (Week 3) and Cycle 2 (Week 5), students in the PCF groups provided feedback on three peers' essays and received feedback from three peers on their own essays. Each cycle was followed by a revision phase (Weeks 4 and 6), allowing students to revise their drafts based on the feedback received. Teacher feedback was provided only in Cycle 2, ensuring that all groups received similar opportunities for revision and improvement in the final stage. It should be noted that the rubric for assessing critical thinking performance was used by the experienced raters to evaluate students' essays and not by the students when giving feedback.

Teacher feedback was provided to the TF group during Weeks 3 and 5. In Week 3, students in the PCF groups participated in Cycle 1, during which they provided corrective feedback on peer

essays for the first time. In the following week (Week 4), students in both the PCF and TF groups revised their drafts to produce the first revision. In Week 5, students in the PCF groups participated in the PCF+TF activities during Cycle 2. During this cycle, both peers and the teacher provided corrective feedback on the students' essays. In Week 6, students in both the PCF and TF groups produced a final revision, which served as their final essay submission. Afterwards, all students completed a post-test on essay writing. In the final week (Week 7), 20 students from the PCF groups (10 from each) voluntarily participated in semi-structured individual interviews conducted in Indonesian. Each interview lasted approximately 20 minutes and focused on the students' experiences with the PCF+TF activities.

Figure 2
Experimental Steps

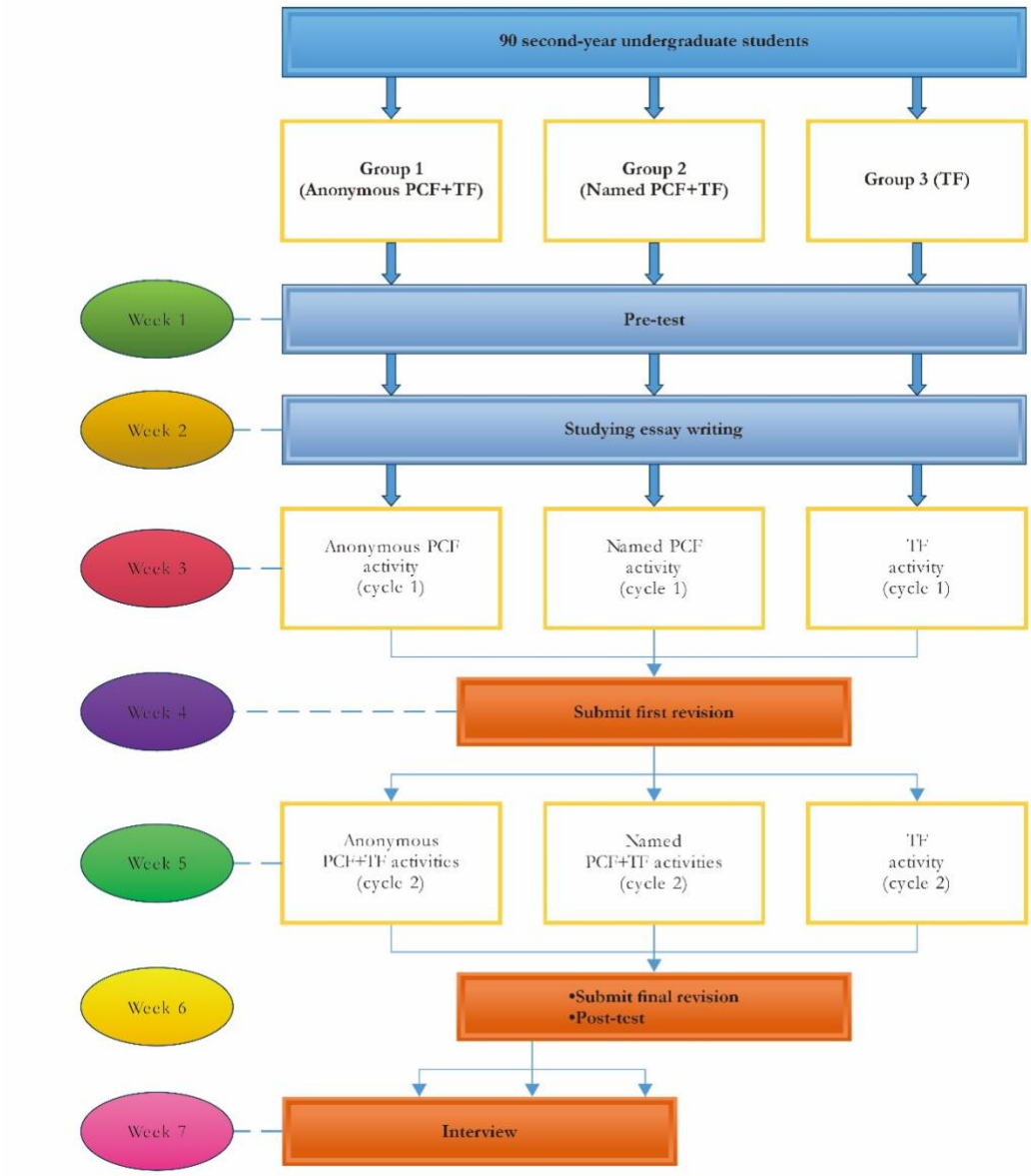
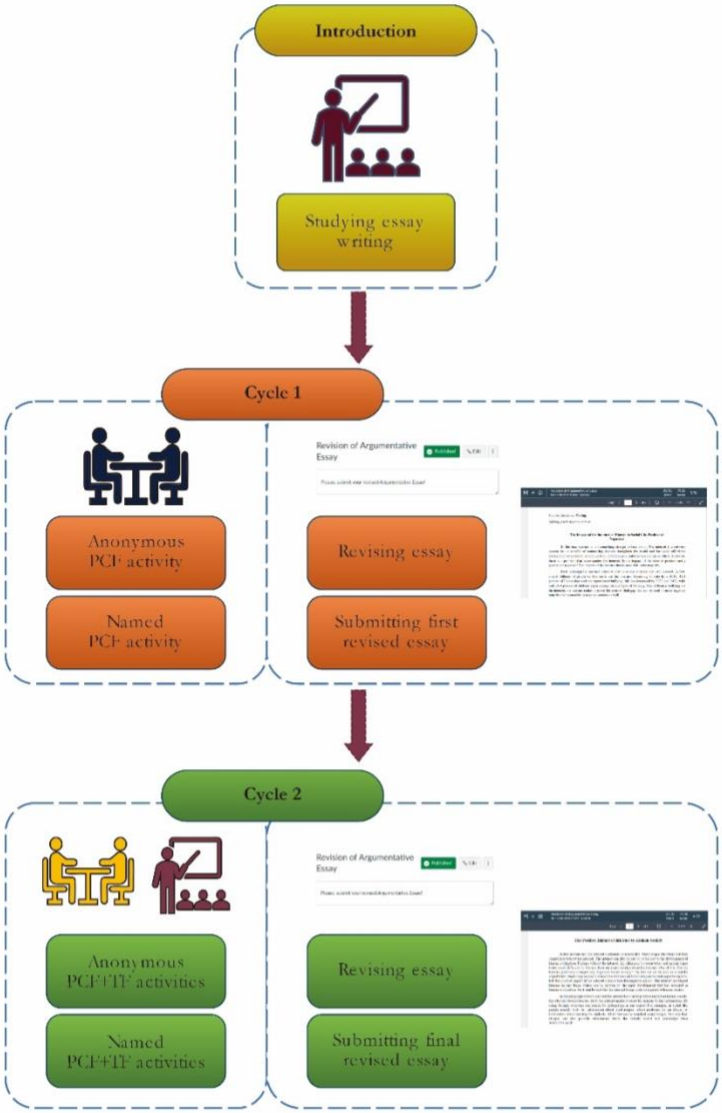


Figure 3
PCF+TF Activities on Canvas



Instruments

The primary aim of this study was to investigate the impact of PCF integrated with TF on students' critical thinking. Selecting appropriate research instruments is essential for ensuring the quality and accuracy of data collection (Wihastyanang et al., 2020). Accordingly, two research instruments were employed in this study: writing assignments and semi-structured interviews.

To address RQ1 (differences in critical thinking between the anonymous PCF+TF, named PCF+TF, and TF groups) and RQ2 (the extent to which the integration of PCF+TF improved students' critical thinking in terms of focus, logic, and argumentation), students completed writing

assignments at three stages: pre-, during, and post-intervention. Only the pre-test and post-test assignments were evaluated using an adapted critical thinking rubric. To gain deeper insight into students' experiences and perceptions of the feedback process, semi-structured interviews were conducted. The resulting interview transcripts provided qualitative data to support RQ2 and directly address RQ3, which explored students' perceptions of the impact of PCF on their critical thinking. A detailed explanation of each instrument is provided below.

Writing Assignments

At the beginning and end of the study, students completed a pre-test and a post-test on essay writing, both on the same topic: Should undergraduate students in an EFL environment learn English? During the intervention, as part of the learning process, they wrote an essay on a different topic: Has the internet positively or negatively impacted human society? This essay underwent two rounds of revision, resulting in three versions: the initial draft, the first revision, and the final revision.

To ensure the credibility of the writing topics, both were sourced from IELTS Writing Task 2 prompts (British Council, 2024). In this study, the critical thinking scoring rubric developed by Finken and Ennis (1993), known as the Illinois Critical Thinking Essay Test (ICTE), was used as an international standard to assess students' critical thinking. This rubric has been widely applied in previous research (e.g., Zubaidah et al., 2019; Nejmaoui, 2019; Hastiari, 2020; Romadhoni et al., 2022). The rubric consists of six aspects: (a) focus, (b) supporting reasons, (c) reasoning, (d) organization, (e) conventions, and (f) integration. The first three aspects are directly related to critical thinking, while the fourth and fifth relate to writing proficiency, and the sixth addresses the integration of all previous aspects. Therefore, only the first three aspects—focus, supporting reasons, and reasoning (labeled as focus, logic, and argumentation in this study)—were used to assess students' critical thinking.

- Focus evaluates the writer's ability to identify, state, and maintain the main idea throughout the essay. It shows how well the writer understands the topic or issue being discussed and stays on topic without losing focus. Essays that maintain a coherent perspective and consistently answer the main question score higher than those that show ambiguity, inconsistency, or topic drift.
- Logic assesses the coherence, relevance, and strength of the arguments presented to support the writer's claim. It evaluates how effectively the writer provides rational argumentation and solid evidence instead of relying on unjustified opinions.
- Argumentation evaluates the writer's ability to use logical reasoning to connect ideas and evidence. It includes the capacity to integrate arguments, address counterarguments, and demonstrate depth of reasoning when constructing a logical argument.

These three aspects are conceptually related: a clear focus is essential for well-developed logic, which is necessary for strong argumentation. When combined, they provide a valid and comprehensive assessment of students' critical thinking abilities, as they encompass key elements of critical thinking in writing such as depth of argument development, quality of reasoning, and clarity of perspective.

To ensure the reliability of the assessment, two experienced raters—each with over 15 years of expertise in evaluating critical thinking and familiarity with the rubric—independently rated the same set of student essays. Interrater reliability was assessed using the Intraclass Correlation Coefficient (ICC) which yielded a value of 0.90, indicating a high degree of consistency between the raters' evaluations.

Semi-Structured Interviews

The interview questions for students in the PCF groups are presented in Table 1. All interviews were conducted in Indonesian, recorded, and transcribed verbatim. The transcripts were then translated into English and reviewed by a professional language expert to ensure translation accuracy and faithfulness to the original meaning. Thematic analysis was applied using Braun and Clarke's (2006) six-phase approach for identifying, analyzing, and interpreting patterns (themes) within the data. This systematic approach supported the generation of meaningful insights into students' experiences with PCF and critical thinking development.

Table 1
Interview Questions for PCF Groups

No.	Questions
1.	What do you think of the PCF activity regarding your critical thinking process?
2.	What do you think of the PCF+TF activities regarding your critical thinking process?
3.	a) In what way could anonymous PCF help you improve your critical thinking? **(only for the anonymous PCF+TF group)** b) In what way could named PCF help you improve your critical thinking? **(only for the named PCF+TF group)**
4.	From your experience, what were the advantages and disadvantages of the PCF+TF activities for your critical thinking process?
5.	Did the PCF+TF activities improve your overall critical thinking skills and proficiency in three particular aspects, including focus, logic, and argumentation? Why or why not?

Data Analysis

To address RQ1, a one-way ANOVA was used to examine differences in critical thinking skills among the three groups following the intervention. This method was selected because it allows for the comparison of mean scores across more than two independent groups. Prior to conducting the analysis, the assumptions of normality and homogeneity of variances were tested using the Shapiro-Wilk test and Levene's test, respectively, and both assumptions were met. Since the ANOVA indicated significant group differences, a Scheffe post hoc test was employed to identify which specific group comparisons were statistically significant. Scheffe's method was chosen because it offers strong control over Type I error when making multiple comparisons. Its conservative nature aligns with the study's aim to ensure rigorous and cautious interpretation of between-group differences. All quantitative analyses were conducted using SPSS (version 26), ensuring accuracy and transparency in the statistical procedures.

For RQ2, a paired samples t-test was conducted to compare pre- and post-test scores within the PCF groups across three critical thinking aspects: focus, logic, and argumentation. This test was appropriate for examining within-group changes over time. The assumption of normality for the difference scores was checked using the Shapiro-Wilk test and found to be satisfied. In addition to the quantitative analysis, student interviews provided insights into their experiences with the PCF activities and their perceptions of differences between the anonymous and named PCF conditions.

With regard to RQ3, interview data were also used to explore students' perceptions of how the PCF activities contributed to the development of their critical thinking skills. Thematic analysis was applied, following Braun and Clarke's (2006) six-phase approach. To enhance rigor, credibility, and transparency, two researchers independently coded the data. Coding decisions and emerging themes were then reviewed and discussed with the third author until full agreement was reached. This

collaborative process helped ensure inter-rater reliability and minimize individual bias, strengthening the trustworthiness of the findings.

Findings

RQ 1: Are there significant differences in students' critical thinking performance among the anonymous PCF+TF, named PCF+TF, and TF groups?

The aim of this study was to determine whether integrating PCF with TF positively affected students' critical thinking skills. To explore this, differences in pre-test and post-test scores among the anonymous PCF+TF, named PCF+TF, and TF groups were analyzed using One-Way ANOVA.

Normality Tests

According to the Shapiro-Wilk test results presented in Table 2, all significance values for both the pre-test (p = 0.778, p = 0.064, and p = 0.053) and the post-test (p = 0.072, p = 0.177, and p = 0.171) exceeded the alpha level of 0.05, suggesting that the data followed a normal distribution.

Table 2
Normality Tests for Pre-test and Post-test Scores

	Groups	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Pre-test	Anonymous PCF+TF	0.084	30	0.200	0.978	30	0.778
	Named PCF+TF	0.139	30	0.143	0.934	30	0.064
	Traditional classroom	0.108	30	0.200	0.931	30	0.053
Post-test	Anonymous PCF+TF	0.152	30	0.074	0.936	30	0.072
	Named PCF+TF	0.114	30	0.200	0.951	30	0.177
	Traditional classroom	0.108	30	0.200	0.950	30	0.171

Homogeneity Tests of Variance

As shown in Table 3, the significance values from Levene's test for both the pre-test (p = 0.112) and the post-test (p = 0.342) were greater than the alpha level of 0.05, indicating that the assumption of homogeneity of variance was satisfied.

Table 3
Homogeneity Tests of Variance for Pre-test and Post-test Scores

	Levene's Test			
	Levene Statistic	df1	df2	Sig.
Pre-test	2.247	2	87	0.112
Post-test	1.085	2	87	0.342

One-Way ANOVA

Tables 4 and 5 present the results of a one-way ANOVA and Scheffe post hoc test comparing the critical thinking performance of students in three groups: anonymous PCF+TF, named PCF+TF, and traditional classroom (TF). As shown in Table 4, no statistically significant difference was found among the three groups in the pre-test scores ($p = 0.689$), indicating comparable baseline levels of critical thinking. However, the post-test results revealed a statistically significant difference ($p < 0.001$), with the anonymous PCF+TF group (M = 72.50, SD = 8.61) outperforming both the named PCF+TF group (M = 64.81, SD = 9.64) and the TF group (M = 57.02, SD = 7.80).

Further analysis using the Scheffe post hoc test (Table 5) showed that the anonymous PCF+TF group scored significantly higher than the named PCF+TF group ($p = 0.004$), and both intervention groups performed significantly better than the TF group ($p < 0.001$ and $p = 0.004$, respectively). These findings suggest that the integration of PCF and TF—particularly in the anonymous feedback condition—had a significant positive effect on students' critical thinking development.

Table 4
Descriptive Analysis of the Pre-test and Post-test of the Three Groups

Groups	Pre-test		Post-test	
	M	**SD**	**M**	**SD**
Anonymous PCF+TF	51.40	9.39	72.50	8.61
Named PCF+TF	50.32	13.86	64.81	9.64
Traditional classroom	49.02	7.80	57.02	7.80
F	0.375		23.678	
p	0.689		<0.001	

Table 5
Scheffe Post Hoc Test on Critical Thinking Skills

(I) Groups	(J) Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Anonymous PCF+TF	Named PCF+TF	7.69	2.25	0.004	0.68	14.70
	Traditional classroom	15.48	2.25	< 0.001	8.47	22.50
Named PCF+TF	Anonymous PCF+TF	-7.69	2.25	0.004	-14.70	-0.68
	Traditional classroom	7.79	2.25	0.004	0.78	14.81
Traditional classroom	Anonymous PCF+TF	-15.48	2.25	< 0.001	-22.50	-8.47
	Named PCF+TF	-7.79	2.25	0.004	-14.81	-0.78

RQ 2: To what extent does the integration of PCF+TF improve students' critical thinking performance in terms of focus, logic, and argumentation?

This part of the study aimed to determine whether integrating PCF with TF had a significant impact on students' critical thinking, specifically in the aspects of focus, logic, and argumentation. To address this, paired samples *t*-tests were conducted to compare pre-test and post-test scores between the anonymous and named PCF+TF groups.

Normality Tests

According to the Shapiro-Wilk test results presented in Table 6, all significance values for both the pre-test and post-test scores across the focus, logic, and argumentation aspects were greater than 0.05. This indicates that the data were normally distributed. For instance, the Shapiro-Wilk *p*-values for the Focus–Anonymous PCF+TF group were 0.347 (pre-test) and 0.080 (post-test), both exceeding the significance level.

Table 6
Normality Tests for Pre-test and Post-test Scores

Aspects	Groups		Kolmogorov Smirnov[a]			Shapiro-Wilk		
			Statistic	df	Sig.	Statistic	df	Sig.
Focus	Anonymous PCF+TF	Pre-test	0.107	30	0.200	0.962	30	0.347
		Post-test	0.130	30	0.200	0.938	30	0.080
	Named PCF+TF	Pre-test	0.083	30	0.200	0.983	30	0.899
		Post-test	0.100	30	0.200	0.972	30	0.582
Logic	Anonymous PCF+TF	Pre-test	0.099	30	0.200	0.973	30	0.636
		Post-test	0.100	30	0.200	0.966	30	0.441
	Named PCF+TF	Pre-test	0.089	30	0.200	0.964	30	0.390
		Post-test	0.140	30	0.136	0.953	30	0.203
Argumentation	Anonymous PCF+TF	Pre-test	0.055	30	0.200	0.985	30	0.941
		Post-test	0.124	30	0.200	0.958	30	0.281
	Named PCF+TF	Pre-test	0.083	30	0.200	0.983	30	0.889
		Post-test	0.140	30	0.137	0.939	30	0.084

Paired Samples T-Tests

The impacts of the anonymous and named PCF+TF groups on critical thinking aspects are illustrated in Figure 4. Paired samples t-tests revealed statistically significant improvements ($p < 0.001$) from pre- to post-test in both groups across all three aspects: focus, logic, and argumentation, as shown in Table 7. Substantial gains were observed in both groups. In the anonymous PCF+TF group, mean scores increased from 27.62–28.57 to 40.95–46.47, while the named PCF+TF group showed increases from 25.90–27.42 to 36.03–40.67. Descriptively, the anonymous PCF+TF group obtained higher post-test scores across all three aspects compared to the named PCF+TF group.

Figure 4
Mean Scores of Each Critical Thinking Aspect in the Anonymous and Named PCF+TF Groups

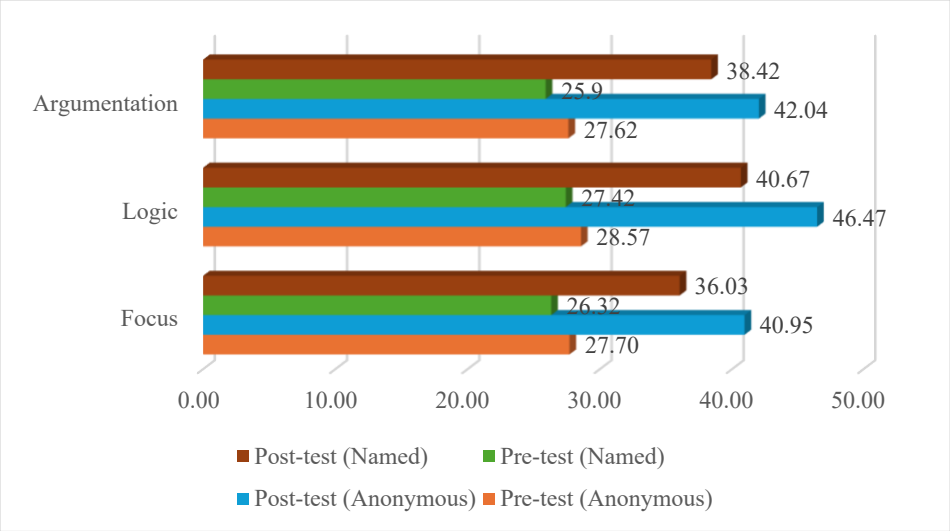


Table 7
Paired Samples t-Tests on Each Critical Thinking Aspect in the Anonymous and Named PCF+TF Groups

Groups		Focus			Logic			Argumentation		
		$\bar{X} \pm S$	t	*p*	$\bar{X} \pm S$	t	*p*	$\bar{X} \pm S$	t	*p*
Anonymous PCF+TF	Pre-test	27.70 ± 3.91	-5.730	< 0.001	28.57 ± 4.06	-39.215	< 0.001	27.62 ± 3.45	-6.905	< 0.001
	Post-test	**40.95** ± 12.05			**46.47** ± 4.32			**42.04** ± 11.18		
Named PCF+TF	Pre-test	26.32 ± 4.13	-6.783	< 0.001	27.42 ± 4.09	-8.681	< 0.001	25.90 ± 4.20	-5.250	< 0.001
	Post-test	**36.03** ± 6.86			**40.67** ± 7.82			**38.42** ± 12.19		

Qualitative interview data provided further insights into the observed quantitative differences. A participant from the anonymous PCF+TF group shared, "I like to be in the anonymous group because I think I can practice my critical thinking by giving honest and critical comments on my peers' essays." (Student A). In contrast, a student from the named group remarked, "Being in the named group made me feel uncomfortable to give critical comments, so I just gave less critical comments. This was because I know my friends, and they know me. I just don't want to hurt other people's feelings." (Student K). These reflections suggest that anonymity may have encouraged more honest peer feedback, which potentially contributed to greater involvement in critical thinking activities.

RQ 3: How do students perceive the impact of PCF on the development of their critical thinking skills?

In addition, the study aimed to investigate students' perspectives on how participating in PCF activities affected their critical thinking development. Students' perceptions of the impacts of PCF on critical thinking were categorized into six major themes, based on Facione's (2023) critical thinking framework: interpretation, analysis, inference, evaluation, explanation, and self-regulation (Table 8).

Table 8
Student Perceptions on the PCF Impacts

Major theme	Sub-theme
Interpretation	Understanding the content of another author's essay
Analysis	Identifying arguments
Inference	Drawing reasonable conclusions
Evaluation	Assessing the credibility of arguments
Explanation	Presenting arguments
Self-regulation	Self-monitoring
	Self-correcting

In terms of interpretation, students reported that reading their peers' essays helped them understand different perspectives and gain a clearer understanding of the essay content. One student from the anonymous PCF+TF group noted, "When I read my peer's essay, I tried hard to understand the essay content. I saw other perspectives from my peer's essay" (Student C). For analysis, students highlighted their improved ability to identify whether supporting statements aligned with the main idea, as stated by a participant from the named group: "By using PCF, I can recognize whether the supporting statements support the main idea or not" (Student N).

In the area of inference, students expressed that PCF helped them distinguish reasonable conclusions from weak ones, while in evaluation, they noted a greater ability to assess the credibility of arguments based on evidence such as references. One anonymous group member stated, "When I read arguments on my peer's essay, I know whether the arguments are credible or not, by looking at the references." (Student E). Regarding explanation, students felt that giving and receiving feedback helped them learn how to present arguments more clearly and logically. Self-regulation emerged through two sub-themes: self-monitoring, where students reflected on their critical thinking development, and self-correcting, where students applied what they learned from feedback to revise their own essays. As one student explained, "I can revise my own essay after using PCF" (Student F).

Discussion

Critical Thinking for the Three Groups

The findings revealed significant differences in critical thinking performance among the three groups, with the anonymous PCF+TF group achieving the highest post-test scores, followed by the named PCF+TF group and the traditional classroom group. This suggests that integrating peer corrective feedback with teacher feedback was more effective than teacher feedback alone in enhancing critical thinking, and that anonymity in peer feedback may further amplify these benefits.

Prior studies support this outcome. Van and Duong (2022) demonstrated that peer feedback encourages critical thinking, particularly in evaluating each other's work and, consequently, suggesting feasible solutions. Lin et al. (2021) found that the peer-review learning method had the potential to greatly enhance student inclination towards critical thinking. These results align with the current study, where students actively engaged in assessing peer work, leading to improved interpretation, evaluation, and reasoning skills. This strengthened the notion that peer review was a learning technique where

students evaluate their peer performance using criteria provided by the teacher to enhance their ability to solve problems, foster student-centered learning, promote active engagement and enable in-depth learning (Al Abri et al., 2021; Çevik, 2015; Chang et al., 2020; Fan & Xu, 2020; Sumardi et al., 2020).

In particular, the anonymous condition may have encouraged more honest and critical feedback by reducing the social pressure students might feel when their identities are revealed. This aligns with findings from Rotsaert et al. (2018), Su (2023), and Zeng and Ravindran (2025), which suggest that anonymity promotes more honest communication, fostering deeper cognitive engagement and critical thinking development. These insights reinforce the impact observed in the current study, where students in the anonymous PCF+TF group demonstrated greater improvement in critical thinking skills.

In addition to peer feedback, teacher feedback also played a critical role. Ghahari and Farokhnia (2018) highlighted the value of teacher guidance in peer feedback contexts, noting that expert oversight enhances learning outcomes. This aligns with Vygotsky's sociocultural theory and the concept of the Zone of Proximal Development (Lantolf et al., 2015), where learners benefit from interaction with more knowledgeable others. In the current study, the presence of teacher feedback in both peer feedback groups likely helped students reflect further on the comments they gave and received, thus deepening their critical thinking development.

PCF on Three Critical Thinking Aspects

Students in the anonymous PCF+TF group achieved higher mean scores in the post-test in all aspects of critical thinking skills—focus, logic, and argumentation—compared to those in the named PCF+TF group. This finding suggests that anonymity played a crucial role in enhancing students' critical thinking performance. When students could provide feedback anonymously, they felt more comfortable expressing critical and honest evaluations, as supported by interview data. This aligns with findings by Zhang (2024), who reported that anonymous peer reviewers tended to be more analytical and honest in their feedback than those who were identifiable. The findings are also consistent with more recent studies, such as Zeng and Ravindran (2025) and Su (2023), which suggest that anonymity fosters more honest communication and can lead to deeper cognitive engagement. This environment appears to reduce social inhibition and peer pressure, allowing students to concentrate more on the task of critically analyzing and improving written work rather than dealing with interpersonal concerns.

Additionally, a study by van den Bos and Tan (2019) found that anonymity in online peer review encouraged students to focus on content quality rather than interpersonal relationships, leading to more constructive comments and greater engagement in critical thinking. This further supports the findings of the current study, suggesting that the structure of anonymous feedback can create a supportive environment for critical discourse.

However, the current findings contrast with those of Chen et al. (2014), which found that anonymous groups demonstrated lower effort and poorer performance compared to identified groups in relatively unstructured, technology-mediated settings. One possible explanation for this discrepancy is that in the current study, anonymity was embedded within a structured peer review process that integrated peer corrective feedback with teacher feedback (PCF+TF). This combined feedback framework may have provided sufficient guidance and motivation to sustain students' engagement, thereby reducing the lack of involvement reported in earlier studies.

As a whole, these findings highlight the potential value of integrating anonymous peer feedback mechanisms in writing instruction, particularly when combined with teacher guidance.

Through this approach, teachers may foster a more honest and cognitively stimulating environment that enhances students' capacity to think critically and evaluate written arguments thoroughly.

Students' Perceptions on the PCF Impacts

The findings of this study affirm the potential of PCF as a pedagogical strategy for cultivating critical thinking. As Halpern (2013) emphasized, critical thinking is the ability to analyze, evaluate, and synthesize information to make reasoned decisions. Similarly, Taghinezhad et al. (2018) noted that critical thinking plays a central role in knowledge integration and effective problem-solving. In line with Facione's (2023) framework, students in this study reported improvements on multiple aspects of critical thinking, including interpretation, inference, evaluation, explanation, and self-regulation. These improvements were evident not only in their writing outcomes but also in the depth of cognitive engagement expressed during interviews.

Recent studies support these findings. For example, Nurkhamidah et al. (2024) observed that peer feedback tasks in online writing settings encouraged students to adopt a more critical perspective, leading to better expression of arguments and evidence. Likewise, Pham et al. (2020) found that giving and receiving peer feedback helped EFL students improve their reasoning and reflect critically on their own writing decisions. The development of self-regulation—highlighted through self-monitoring and self-correcting behaviors—aligns with Nguyen (2016), who argued that peer feedback activities promote metacognitive awareness by requiring learners to evaluate both others' work and their own. This repetitive process helps students adopt evaluation criteria and apply them to revisions and future tasks.

Furthermore, students' ability to recognize the logic and structure of arguments aligns with findings by Kuyyogsuy (2019), who found that structured peer review promotes deeper analysis and logical reasoning among EFL learners. Importantly, the perception of learning from multiple perspectives also reflects the value of interactive dialogue in enhancing interpretation and inference, as supported by Filius et al. (2018) and Deng and Sitthitikul (2024). These insights highlight that PCF, particularly when supported with clear criteria and reflective opportunities, can foster a supportive, cognitively rich environment that empowers learners to engage critically with both their own work and that of their peers.

Despite these encouraging outcomes, it is important to recognize that several contextual and methodological factors may influence how effectively the PCF+TF combination can be implemented and sustained across different learning environments. While the findings provide promising evidence of its potential to enhance students' critical thinking, they should be interpreted cautiously. Factors such as students' cultural background, familiarity with technology, and institutional context may influence how they engage in peer feedback activities. The relatively small sample size and focus on a single university context also limit the generalizability of the findings. Addressing these contextual and methodological factors in future research and instructional design will be essential to ensuring the broader practicality and sustainability of PCF+TF practices.

Conclusion

This study demonstrates that integrating PCF combined with TF significantly enhances students' critical thinking skills, particularly in the aspects of focus, logic, and argumentation. Anonymity proved to be a valuable element in fostering honest, critical engagement, leading to more reflective and higher-quality peer feedback. The findings suggest that, with careful planning and clear instructional guidelines, PCF+TF—especially when conducted anonymously—can be an effective pedagogical tool for cultivating critical thinking in language learning environments. Students benefited from the opportunity to engage with diverse peer perspectives and demonstrated improved capacity for

analytical and evaluative thinking. Importantly, this study also highlights the value of providing students with multiple feedback cycles and reflective opportunities, which collectively promoted cognitive engagement and creativity in written arguments. Teachers are encouraged to facilitate supportive learning environments that promote both collaboration and critical discourse.

Pedagogical Implications

The findings of this study offer several practical implications for language teachers and institutions aiming to enhance students' critical thinking through feedback practices. Integrating PCF with TF can promote students' engagement in analytical and evaluative thinking while writing. Teachers can facilitate this process by providing explicit training on how to provide constructive feedback, using clear rubrics to guide evaluations, and modeling effective feedback practices. Institutions can further support teachers by providing professional development programs and technological infrastructure to manage online peer review effectively. However, potential challenges may arise, including students' resistance to peer evaluation, limited digital literacy, and increased teacher workload in facilitating and monitoring feedback. Addressing these challenges through training, gradual implementation, and institutional support can ensure the sustainable integration of PCF+TF in diverse language learning contexts.

Limitations and Future Studies

This study is subject to two main limitations. First, the sample was limited to second-year undergraduate students enrolled in an English Education program, which may not reflect the broader range of thinking patterns among different majors, academic levels, or educational stages. Second, the study focused solely on the impacts of PCF integrated with TF on students' critical thinking through the use of technology, without exploring their perceptions of technology use during the PCF activities. Future studies should consider:

1. Including students from diverse academic disciplines and years, including graduate programs.
2. Involving diverse groups, such as students with various levels of academic performance.
3. Adapting PCF+TF activities for younger learners in primary or secondary education.
4. Investigating the long-term impact of PCF integrated with TF on students' critical thinking development.
5. Exploring effects on other cognitive aspects, such as creative thinking, computational thinking, and problem solving.
6. Examining students' perspectives on the technological aspects involved in PCF activities.

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Ethics Approval Statement

The study protocol complied with ethical principles and was approved by the Research Ethics Committee at Bengkulu University's Institute for Research and Community Service under No. 19/KER-LPPM/EC/2023, including informed consent and ability to withdraw.

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