Enhancing EFL learners' writing self-regulation: A mixed-methods study of automated and peer feedback

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Abstract

This study aimed to compare the effects of Automated Writing Evaluation Feedback (AWEF) and Peer Feedback (PF) on the development of self-regulation in writing among Iranian English as a Foreign Language (EFL) learners. The participants consisted of 58 intermediate-level Persian-speaking English learners, aged 25 to 30, enrolled in two intact IELTS preparation classes at a private language institute in Tehran. The learners were assigned into two experimental groups: one group (n = 30) received peer feedback, while the other (n = 28) received automated feedback through ProWritingAid. To assess the impact of these interventions, data were collected using the Writing Strategies for Self-Regulated Learning Questionnaire (WSSRLQ), semi-structured interviews, and classroom observations. Quantitative analysis using independent samples t-tests revealed significant improvements in self-regulation scores for both groups post-intervention, with the AWEF group showing a significantly greater increase. Qualitative analysis of interview and observation data further supported these findings, indicating that AWEF participants engaged in more structured and proactive revision practices, while PF participants developed greater reflective awareness and emotional resilience through collaborative interaction. Triangulated results confirmed that both feedback types positively influenced self-regulated writing behaviors, with AWEF demonstrating a stronger overall impact.

Key Words: Automated Writing Evaluation Feedback, Peer Feedback, Writing Self-Regulation

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1. Introduction

As English continues to function as the global lingua franca, mastery of the language has become increasingly vital for academic achievement and effective cross-cultural communication (Elder & Davies, 2006). Among the core academic competencies, writing occupies a particularly significant role. It serves as a key medium through which students articulate understanding, express viewpoints, and contribute meaningfully to scholarly discourse (Hyland, 2015). However, for learners of English as a Foreign Language (EFL), writing in English presents formidable challenges. These often stem from a limited vocabulary repertoire, frequent grammatical inaccuracies, and unfamiliarity with idiomatic expressions (Boroujeni, 2024; Derakhshan & Karimian Shirejini, 2020). Compounding these difficulties are the structural differences between English and learners' native languages, as well as limited opportunities for authentic language exposure beyond the classroom (Lee, 2011).

Traditionally, writing instruction emphasized the production of polished final drafts. However, pedagogical attention has progressively shifted toward a process-oriented view that foregrounds iterative stages of writing, including idea generation, drafting, revising, and language refinement (Duong et al., 2011; Memari Hanjani & Li, 2014; Westervelt, 1998). Within this paradigm, feedback plays a pivotal instructional role. Corrective Feedback (CF), in particular, is instrumental in guiding learners toward greater accuracy and coherence by facilitating informed revision processes (Graham & Sandmel, 2011). In academic settings, CF is commonly delivered through teacher feedback, Peer Feedback (PF), and Automated Writing Evaluation Feedback (AWEF), each bringing unique affordances to the development of writing competence (Ashrafganjoe et al., 2022; Lee, 2014). Whereas AWEF—provided via digital platforms—offers immediate corrective suggestions, PF fosters collaborative learning dynamics through peer interaction (Lundstrom & Baker, 2009; Memari Hanjani, 2021).

The efficacy of feedback, however, depends not merely on its form but on its focus. Hattie and Timperley (2007) proposed that feedback operates at different levels: addressing task performance, learning processes, self-regulation, or personal attributes. Among these, feedback that nurtures self-regulation is arguably the most influential, as it

empowers learners to monitor, adjust, and align their behaviors with learning goals. Nicol and Macfarlane-Dick (2006) emphasized that feedback should not be viewed solely as external information, but rather as a means of cultivating autonomous regulatory capacities. Self-regulation itself is "a dynamic construct that connects strategic capacity, intent, and learning behavior" (Dörnyei & Ryan, 2015, p. 169). In writing, it entails a writer's ability to independently plan, monitor, and evaluate their work (Harris, 2023). According to Asshabi et al. (2024), learners who actively manage and monitor their learning are better equipped to achieve goals and continue learning independently. Within Self-Regulated Learning (SRL) frameworks, feedback catalyzes cognitive and behavioral adjustments that help students meet academic targets (Zimmerman & Kitsantas, 2007). Feedback aimed at SRL has been associated with deeper learning, enhanced strategic use, and clearer awareness of knowledge gaps (Wisniewski et al., 2020). Although feedback is often hailed as "one of the most effective tools to increase learning success" (Hattie & Zierer, 2019, p. 7), its influence on fostering self-regulatory writing strategies—particularly in EFL contexts—remains inconclusive (Yang et al., 2022).

Empirical inquiry in this domain has predominantly examined how different feedback types affect textual aspects of student writing, often through comparative studies (Bitchener & Storch, 2016). However, much of this research has emphasized writing outcomes rather than the development of self-regulatory behaviors (Carless & Boud, 2018; Cheng & Liu, 2022). Studies on AWEF, for instance, have largely contrasted it with teacher feedback in terms of writing performance, while overlooking its potential to shape self-regulation (Link et al., 2022). Similarly, investigations comparing AWEF and PF have tended to focus on holistic writing improvement (Lazic & Tsuji, 2020) or on specific textual features such as cohesion and coherence (Chen & Cui, 2022). Moreover, research on self-regulation has primarily concentrated on teacher feedback, with scant attention to peer feedback (Yang et al., 2022).

In response to these gaps, the present study aimed to compare the effects of AWEF and PF on writing self-regulation among Iranian EFL learners. To ensure a comprehensive understanding, a mixed-methods explanatory sequential design was employed, integrating both quantitative and qualitative data.

2. Review of the Related Literature

2.1. Self-Regulation in Language Learning

Zimmerman's (2000) social cognitive theory conceptualizes SRL as a cyclical process comprising three interrelated phases: forethought, performance, and self-reflection. Each phase engages learners in distinct self-regulatory strategies to achieve academic objectives. During forethought, learners assess the task, set goals, and devise strategies for goal attainment processes underpinned by motivational beliefs that facilitate strategy adoption. The performance phase involves active task engagement coupled with progress monitoring. Here, self-control strategies (e.g., task management, self-instruction, help-seeking) intersect with self-observation strategies that systematically track performance. CF serves as an external scaffold in this phase, assisting learners in evaluating and refining their work in real time. The final phase, self-reflection, encompasses self-judgment, where learners appraise task quality and analyze reasons for success or failure. Insights from this evaluation inform future strategy adjustments, completing the cyclical nature of SRL. Zimmerman (2000) argued that SRL is foundational in language learning, as self-regulated learners demonstrate heightened metacognitive awareness, sustained motivation, and active engagement.

2.2. Empirical Studies on Feedback and Self-Regulation

While numerous studies have examined the effects of AWEF and PF on writing performance, findings have been varied. Lazic and Tsuji (2020) reported that combining AWEF with PF facilitated more effective revisions, particularly among lower-proficiency students. Similarly, Xie et al. (2020) found that both feedback types improved writing, though AWEF primarily bolstered accuracy and complexity, while PF enhanced accuracy. In contrast, Ginting and Fithriani (2022) highlighted students' preference for PF over AWEF (e.g., Grammarly), emphasizing the perceived relevance of peer-generated input. Chen and Cui (2022) further argued that PF was more effective than AWEF in enhancing cohesion and coherence. Özkanal and Gezen (2023) concluded that although AWEF, PF, and teacher feedback all positively influenced writing, AWEF and teacher feedback were perceived as more beneficial.

Beyond performance metrics, a smaller but growing body of literature has

examined CF's role in promoting self-regulation. Ekholm et al. (2015) demonstrated that learners' perceptions of feedback—together with self-efficacy and motivation—significantly fostered self-regulation during writing. Similarly, Taheri and Mashhadi Heidar (2019) found that focused written CF improved paragraph-writing accuracy, especially among highly self-regulated learners. Vasu et al. (2020) reported that both self-assessment and indirect teacher feedback enhanced SRL, with self-assessment proving more effective. Xu (2021) corroborated these findings, revealing that learners' feedback-seeking orientation predicted SRL strategy use in online writing courses. Nipaspong (2022) likewise illustrated the benefits of online written CF in enhancing SRL among mid- and low-proficiency students.

Further evidence comes from Vasu et al. (2022), who found that both self-assessment and indirect teacher feedback improved SRL behaviors, including goal-setting and strategy planning. Rahimi and Fathi (2022), employing a mixed-methods design, showed that wiki-mediated collaborative writing enhanced both SRL and writing performance. Sherafati and Mahmoudi Largani (2023) confirmed the superiority of computer-based feedback over traditional methods in advancing writing skills and SRL. Most recently, Prompan and Piamsai (2024) demonstrated that integrating PF with SRL instruction significantly improved both writing and SRL in Thai EFL learners, particularly in online settings.

Collectively, these studies affirm that diverse feedback forms—including self-assessment, teacher feedback, PF, and computer-based feedback—positively influence both writing performance and SRL. Nevertheless, despite extensive research on the dual role of teacher feedback (Yang et al., 2022), a notable paucity of studies remains examining how AWEF and PF specifically shape SRL strategies. Although comparative studies of AWEF and PF exist (Xie et al., 2020), to the best of the researchers' knowledge, no research has systematically explored their influence on SRL using triangulation methods.

Accordingly, this study addresses this gap by investigating and comparing the effects of AWEF and PF on the self-regulation of Iranian EFL learners during academic writing. Employing a mixed-methods explanatory sequential design—including

questionnaires, interviews, and observations—the study seeks to answer the following research questions:

RQ1. Are there significant differences in the effects of AWEF and PF on Iranian students' writing self-regulation during the academic writing process?

RQ2. How do Iranian students experience self-regulation during the writing process when receiving AWEF and PF?

3. Method

3.1. Participants

The participants in this study consisted of 58 English language learners, including both male and female individuals, aged between 25 and 30 years, all native Persian speakers. These individuals were enrolled in two intact classes at a private language institute in Tehran, where they were confirmed to possess intermediate proficiency in English, specifically at the B1 level according to the Common European Framework of Reference (CEFR). This proficiency level was assured by the institute to maintain consistency across the groups.

Convenience sampling technique was employed to select the participants from the intact classes, based on their availability and willingness to participate. The participants were assigned into two experimental groups: one group, consisting of 30 students, received PF, while the other group, with 28 students, received feedback through an AWEF, specifically ProWritingAid.

For the qualitative aspect of the study, 10 participants from each group (20 in total) were randomly selected to participate in semi-structured interviews. These interviews aimed to gather in-depth insights into how feedback influenced the participants' self-regulation strategies during the writing process. Before participating, all individuals signed informed consent forms after being fully informed about the study's objectives, procedures, confidentiality, and their right to withdraw at any time without consequences.

3.2. Instruments

3.2.1. Writing Strategies for SRL Questionnaire (WSSRLQ)

The Writing Strategies for Self-Regulated Learning Questionnaire (WSSRLQ), adapted from Teng and Zhang (2016), was used as the primary instrument to assess participants' SRL strategies during the writing process (Appendix A). This self-assessment tool measures various cognitive, metacognitive, behavioral, and motivational strategies that learners employ to regulate their writing tasks. The WSSRLQ focuses on how learners plan, monitor, and reflect on their writing. It includes a series of items rated on a seven-point Likert scale, where participants assess the extent to which each statement applies to them, with responses ranging from "*not at all true of me*" (1) to "*very true of me*" (7).

To ensure clarity, the questionnaire was translated into Persian. After piloting the translated version with a small sample, its reliability was calculated using Cronbach's alpha, yielding a value of 0.84, indicating high internal consistency. Additionally, two experts in second language acquisition and educational assessment reviewed the final version to confirm that the questionnaire accurately measured self-regulated learning constructs within the context of EFL writing.

3.2.2. Semi-structured Interviews

In addition to the WSSRLQ, semi-structured interviews were conducted to collect qualitative data. The semi-structured format allowed for flexibility, enabling the interviewer to explore emerging topics while maintaining consistency with the predetermined questions (Adams, 2015). First, five interview questions were designed to probe aspects of self-regulation, specifically focusing on how the feedback (PF or AWEF) impacted participants' writing process and their self-regulation strategies. To ensure the content validity of the interview questions, the Content Validity Ratio (CVR) was calculated based on expert evaluations, confirming that the items adequately represented key aspects of self-regulation and feedback impact.

After that, the interview questions were piloted with a small group of participants to ensure clarity and appropriateness. Based on feedback, adjustments were made to

improve the wording and understanding of the questions. To ensure reliability, the interviewer received extensive training in conducting consistent interviews and avoiding leading questions. The questions were also reviewed by two experts in language learning and self-regulation to ensure cultural and linguistic relevance. After this rigorous process, three final main questions with possible follow-ups remained (Appendix B).

The interviews were conducted individually in a quiet environment, and lasted approximately 20 minutes each, and were audio-recorded with participants' consent to ensure accurate transcription and analysis. It is worth noting that prior to participation, all students signed informed consent forms that explained the study's aims, confidentiality measures, and their right to withdraw at any time, thereby adhering to ethical research standards. Ethical considerations also included maintaining participants' anonymity and allowing responses in Persian to facilitate authentic expression.

3.2.3. Observation

Classroom observations were conducted to supplement the questionnaire and interview data. One of the researchers observed two writing sessions in each group to gain deeper insight into the participants' self-regulation strategies during the writing process. In the AWEF group, she focused on how students interacted with the ProWritingAid tool, looking for evidence of self-regulation behaviors such as goal-setting, progress monitoring, and revisions based on automated feedback. In the PF group, the she observed how students engaged in peer feedback exchanges, concentrating on the communication of feedback and how participants applied this feedback to improve their writing. Additionally, she paid attention to how students regulated their writing process by incorporating feedback and making decisions on revisions (See Appendix C for the observation checklist).

3.3. Procedure

The study was conducted as part of a seven-week structured English writing course, with two sessions held each week, designed to prepare students for the IELTS exam. Each session lasted 1 hour and 45 minutes, with a blend of qualitative and

quantitative methods to assess SRL strategy use. The study employed a three-phase SRL-based feedback model, adapted from Yang and Zhang (2023), comprising the forethought, performance, and self-reflection phases.

The writing procedure followed a structured multi-drafting approach in which students composed initial drafts, received feedback, revised their work, and reflected on their progress. Writing topics were carefully selected from authentic IELTS Writing Task 2 prompts to ensure relevance and alignment with exam preparation objectives. These topics were chosen based on their diversity in theme and complexity, offering a comprehensive range of issues that encouraged critical thinking and argument development. To support students' development of self-regulatory strategies, explicit instruction was integrated into the course curriculum. The instructor provided targeted lessons on goal-setting, planning, self-monitoring, and self-reflection, using modeling, guided practice, and scaffolded activities. This instruction aimed to equip students with the metacognitive tools necessary to manage their writing processes effectively and to engage meaningfully with both peer and automated feedback.

In the forethought phase, participants set specific writing goals aligned with task requirements, guided by the instructor to focus on planning and self-monitoring strategies. This was facilitated through explicit goal-setting exercises where students were prompted to identify specific aspects of their writing to improve, such as coherence or grammar. The instructor used guided questioning and reflective prompts to help students articulate clear, measurable goals. Planning strategies were taught through structured outlines and writing schedules, while self-monitoring was encouraged by having students regularly check their drafts against these goals using checklists and error logs. In the performance phase, participants received feedback either from peers (PF group) or the ProWritingAid tool (AWEF group), enabling them to assess their writing against their goals and adjust their cognitive and metacognitive strategies accordingly. Finally, in the self-reflection phase, students critically reflected on their performance, identifying strengths and areas for improvement. The error log, which documented errors, revisions, and reflections, played a crucial role in tracking progress.

Participants were divided into two groups: the PF group, which initially focused on

lexical resources and later on grammatical accuracy, and the AWEF group, which received automated feedback on lexical resources in the first round and grammatical accuracy in the second. Both groups engaged in a multi-drafting process involving submitting drafts, receiving feedback, revising, and reflecting on revisions using the error log. This process was designed to capture the development of SRL strategies over the course of the study.

The data collection timeline began with the administration of the WSSRLQ in the first session to assess baseline self-regulation. From sessions 2 to 13, students worked on various IELTS Writing Task 2 topics, progressing through the SRL feedback cycle of goal-setting, feedback receipt, revision, and reflection. For the PF group, students exchanged drafts with peers and received written or verbal feedback focusing initially on lexical resources, followed by grammatical accuracy in later sessions. They then revised their drafts based on peer suggestions and reflected on their improvements using the error log. For the AWEF group, students submitted their drafts to the ProWritingAid tool, which provided immediate, detailed automated feedback first on lexical choices and later on grammar. Students reviewed this feedback individually, made revisions accordingly, and documented their changes and reflections in the error log. This iterative cycle of drafting, receiving feedback, revising, and reflecting was repeated across multiple sessions to reinforce the development of self-regulatory strategies tailored to each feedback type. In session 14, the WSSRLQ was re-administered to assess any changes in self-regulation responses of the participants. Additionally, qualitative interviews were conducted with a subset of participants to explore their experiences with the SRL feedback cycle and the effectiveness of the feedback methods. Each interview lasted approximately 20 minutes and was recorded for analysis.

Throughout the course, participant observations were conducted to examine interactions with feedback, engagement in self-regulation, and adjustments to writing strategies. These observations, documented in field notes, were analyzed in conjunction with interview data to provide a comprehensive understanding of SRL strategy application during the writing process.

4. Results

4.1. First Research Question

Before conducting independent samples t-tests, the assumption of normality was assessed using the Shapiro-Wilk test. The results indicated that self-regulation scores were approximately normally distributed for both groups at both time points. For the AWEF group, the pre-test ($W = 0.960$, $p = .350$) and post-test scores ($W = 0.953$, $p = .242$) did not significantly deviate from normality. Similarly, for the PF group, the pre-test ($W = 0.934$, $p = .061$) and post-test scores ($W = 0.950$, $p = .200$) also showed no significant violations of normality. These results supported the use of parametric tests for subsequent analyses. Also, for both the AWEF and PF groups, pre-test and post-test scores demonstrated acceptable skewness values within the range of -1 to +1, indicating that the data were approximately normally distributed. This justified the use of parametric tests for group comparisons. Therefore, to examine the impact of AWEF and PF on students' writing self-regulation, two independent samples t-tests were conducted to compare the self-regulation scores of the two groups before and after the intervention. The descriptive statistics for both the pre-test and post-test scores are presented in Table 1.

Table 1.

*Descriptive Statistics for Self-Regulation Scores (Pre-test and Post-test)*

Group	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD
AWEF	28	111.29	11.89	206.78	12.44
PF	30	109.38	5.73	173.72	9.23

As shown in Table 1, both groups had similar self-regulation scores at the pre-test stage, with the AWEF group (M = 111.29, SD = 11.89) having a slightly higher mean than the PF group (M = 109.38, SD = 5.73). However, after the intervention, the AWEF group demonstrated a significantly higher post-test mean score (M = 206.78, SD = 12.44) compared to the PF group (M = 173.72, SD = 9.23), suggesting a greater improvement in self-regulation in the AWEF group. To determine whether these differences were statistically significant, independent samples t-tests were conducted for both pre-test and post-test scores (see Table 2).

Table 2.

Independent Samples t-test for Self-Regulation Scores (Pre-test and Post-test)

Levene's Test of Equality of Variances		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	
Pre-test: variances assumed	**Equal**	1.234	0.271	0.876	56	0.385	1.91	2.19	
Post-test: variances assumed	**Equal**	2.340	0.132	-11.57	56	0.000	-33.06	2.86	

Based on Table 2, Levene's Test for Equality of Variances was non-significant for both the pre-test (F = 1.234, p = 0.271) and post-test (F = 2.340, p = 0.132), indicating that the assumption of equal variances has not been violated. The pre-test comparison yielded a non-significant result (t (56) = 0.876, p = 0.385), indicating no significant difference in self-regulation between the two groups before the intervention. This suggests that the groups were homogeneous in terms of self-regulation at the outset. However, the post-test results revealed a statistically significant difference between the two groups (t (56) = 11.57, p <.001). The AWEF group significantly outperformed the PF group in writing self-regulation after the intervention, strongly suggesting that AWEF had a more substantial impact on improving students' self-regulatory behaviors throughout the academic writing process. This is illustrated in Figure 1.

Figure 1.

Mean Self-Regulation Scores for AWEF and PF Groups (Pre-test vs. Post-test)
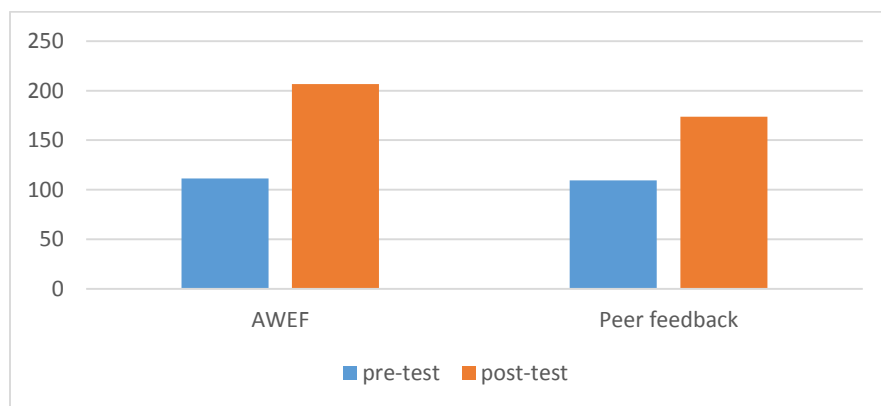
As depicted in Figure 1, the AWEF group demonstrated a more substantial improvement in self-regulation, confirming that AWEF had a greater impact on enhancing students' ability to regulate their writing process compared to PF.

4.2. Second Research Question

The second research question sought to explore how students engaged in self-regulation during the writing process, specifically in response to the type of feedback they received—either AWEF or PF. To address this, both semi-structured interviews and classroom observations were conducted, providing rich, contextualized data on students' perceptions of feedback, their engagement with it, and the self-regulatory strategies they employed.

4.2.1. Semi-structured Interviews

The qualitative data collected through interviews offered valuable insights into how students navigated the self-regulation process when engaging with AWEF or PF. Interview transcripts were systematically coded, with both deductive and inductive coding methods employed. Some codes were derived from the theoretical framework of self-regulated learning deductively (Zimmerman, 2000), while others emerged organically from the participants' responses inductively. The coding process involved multiple rounds of review and refinement to ensure consistency and accuracy. Codes that appeared frequently across transcripts were grouped into broader themes, while less common but meaningful responses were retained as sub-codes. Throughout the analysis, the frequency of each code was recorded to assess the prominence of specific self-regulatory behaviors within each feedback group. Several sub-codes and broader themes were identified, reflecting recurring patterns in participants' self-regulatory behavior. These were categorized separately for the AWEF and PF groups to highlight potential similarities and differences in their experiences. A summary of the key sub-codes and emerging themes is presented in Table 3.

Table 3.

Themes, Codes, and Sub-codes for SRL in AWEF and PF Groups

Theme	Code	AWEF Sub-code	AWEF Frequency (n=10)	PF Sub-code	PF Frequency (n=10)
Forethought Phase	Goal Setting	Specific writing goals for structure & grammar	9	Clear goals related to task completion	6
		Long-term skill improvement	10	Immediate task-oriented goals	8
	Motivation/Task Interest	Intrinsic motivation for writing	9	Task-focused motivation, evolving interest	6
	Self-Efficacy	High confidence in writing improvement	9	Moderate confidence, growing through feedback	6
Performance Phase	Self-Monitoring	Active monitoring through AWEF feedback	10	Reflective monitoring post-feedback	9
	Time Management	Structured time allocation for each task phase	10	Growing time management, some procrastination	7
	Strategy Use	Outlining, summarizing, and drafting strategies	10	Revision strategies based on feedback	6
Self-Reflection Phase	Self-Evaluation	In-depth evaluation with feedback comparison	10	Reflection primarily for final revisions	6
	Feedback Utilization	Revisions based on AWEF feedback	10	Use of peer feedback for revisions	5
	Emotional Regulation	Active stress management	8	Growing emotional resilience	7

During the forethought phase, both groups showed evidence of goal-setting and motivation, though AWEF participants demonstrated more structured, long-term planning. AWEF participants set clear goals related to improving writing structure and coherence, as one participant explained, "*I set a clear goal to focus on structure and coherence in my writing. Every time I revised, I checked if my ideas were well organized.*" In contrast, PF participants were more focused on task completion and meeting deadlines, with one stating, "*My main goal was just to finish the essay on time and make sure it was readable.*"

In terms of motivation, the AWEF group demonstrated more intrinsic motivation for writing, driven by a desire for personal growth and mastery. As one participant shared, "*I*

enjoy writing now because I know I can improve. The feedback is really helpful and encourages me to get better." On the other hand, PF participants were initially more motivated by external factors such as grades or deadlines, but began developing intrinsic motivation over time, as noted by one student, "*I think I became more interested in improving my writing once I noticed the grade and realized I could actually do better.*"

In the performance phase, AWEF participants showed more active engagement with feedback, with one participant stating, "*After every draft, I check my writing against the feedback, then I focus on the areas I need to improve.*" PF participants were more reflective in their engagement with feedback, often waiting until later stages to apply revisions. Regarding time management, AWEF students demonstrated structured planning, while PF students needed more support in managing time effectively, with some expressing difficulty in pacing their work.

In the self-reflection phase, AWEF participants were more consistent in reflecting on their drafts and incorporating feedback iteratively, as evidenced by one participant: "*I always reflect on what I did well and what I can improve. I check my progress against the goals I set.*" In contrast, PF students reflected mostly during final revisions, indicating a less iterative approach to self-evaluation.

4.2.2. Observations

Observations of the AWEF group revealed highly structured and intentional engagement with the writing process, particularly through their interaction with the ProWritingAid tool. Students actively engaged with the feedback, often evaluating each suggestion critically and applying it to improve their drafts. The researcher observation noted, "*I saw this student going through the feedback from ProWritingAid line by line, highlighting suggestions and then immediately applying them in their text.*" This demonstrated not only effective use of the tool but also a self-regulated approach to learning.

In the PF group, observations indicated a more gradual development of self-regulation. Initially, students were more focused on fixing surface-level errors, but as the course progressed, they began to engage more deeply with peer feedback. An observer remarked, "*At first, feedback exchanges were about fixing minor issues, but later I noticed*

students discussing each other's ideas more deeply."

4.2.3. Data Triangulation

The triangulation of quantitative and qualitative data provided a comprehensive view of the impact of AWEF and PF on students' self-regulation in writing. Quantitative results showed that the AWEF group significantly outperformed the PF group in terms of self-regulation scores post-intervention. Qualitative findings reinforced these results, showing that AWEF participants demonstrated more systematic and proactive feedback engagement, as well as more robust self-regulation practices throughout the writing process. However, the PF group also showed improvement, particularly in their emotional resilience and reflective approach to feedback. This triangulation suggests that while both types of feedback contributed to students' development, AWEF had a more profound impact on self-regulation in writing.

5. Discussion and Conclusion

The primary aim of this study was to investigate whether there were significant differences in how the two feedback types—AWEF and PF—affected learners' self-regulation, both in terms of quantitative scores and qualitative experiences. The results indicated that students in the AWEF group demonstrated a statistically significant increase in self-regulation scores compared to the PF group. While both groups showed improvement in their use of self-regulation strategies, such as goal-setting, planning, self-monitoring, and self-reflection, the AWEF group exhibited more substantial enhancements. The qualitative data further revealed that the AWEF group was more actively engaged in the feedback loop, using the feedback to continuously revise their work. However, the PF group tended to focus more on the interpersonal aspect of receiving feedback, which sometimes resulted in less frequent revisions and adjustments in their writing process.

The differing outcomes between AWEF and PF may be attributed to several factors, particularly the nature of the feedback and the cognitive processes involved in each feedback type. A key feature of AWEF systems, such as the one used in this study,

is their ability to provide real-time, structured feedback on various writing aspects, including grammar, vocabulary, sentence structure, and organization (Alias et al., 2024). This feedback allows learners to quickly identify and correct mistakes, facilitating iterative cycles of writing, reflection, and revision. Continuous interaction with the AWEF system likely promoted higher levels of metacognitive awareness and self-monitoring, both of which are essential components of self-regulation (Zimmerman, 2000). Furthermore, the superior performance of the AWEF group could be attributed to the fact that the feedback they received was tailored to specific aspects of their writing, providing clear, actionable advice that learners could apply immediately (Fu et al., 2024). This structure likely led to greater engagement with the feedback, as learners were able to track their progress, refine their strategies, and engage in meaningful self-assessment. On the other hand, the peer feedback process, while offering social interaction and perspective-taking, may not have provided the same level of specificity and immediacy, which could have hindered the development of more consistent self-regulation strategies.

The impact of AWEF can also be understood within the broader framework of self-regulation, particularly Zimmerman's (2000) theory, which emphasizes the importance of self-observation and feedback in fostering self-regulation. AWEF tools provide an external form of self-observation, allowing learners to monitor their progress and adjust their strategies in real time. On the contrary, PF may require more cognitive effort to interpret and apply, which could potentially detract from the focus on self-regulation. Therefore, the findings suggest that AWEF's consistency and personalized support make it a more powerful tool for promoting self-regulation in language learning, although PF still plays a valuable role in collaborative learning and social interaction.

These findings align with previous research, particularly studies that have highlighted the benefits of AWEF in supporting self-regulation in writing. For instance, Xie et al. (2020) found that AWEF enhanced both the accuracy and complexity of writing, which indirectly facilitated greater self-regulation by prompting learners to reflect on their mistakes and revise accordingly. Similarly, the study by Özkanal and Gezen (2023) corroborates the idea that AWEF, when used effectively, leads to positive writing outcomes, suggesting that the structured nature of automated feedback helps learners engage in sustained self-regulation through repeated cycles of feedback and revision.

These studies suggest that automated systems provide consistent and specific feedback, empowering learners to manage their writing process more effectively and promoting greater self-regulation and metacognitive awareness (Zimmerman, 2000). The present study's results also align with those of Lazic and Tsuji (2020), who noted that combining AWEF and peer feedback led to greater improvements in writing for students with lower proficiency levels. This suggests that the automation and precision of AWEF offer an essential foundation for learners, not only improving writing skills but also fostering the development of self-regulatory behaviors, as evidenced by the significant improvements in the AWEF group in this study.

However, the present findings contrast with some other studies that emphasize the perceived advantages of peer feedback. For instance, Ginting and Fithriani (2022) found that students generally favored PF over AWEF, particularly due to its perceived relevance, interactivity, and the social element associated with peer interactions. These researchers argued that peer feedback fosters more personal engagement with the writing process, which can enhance motivation and result in a more meaningful revision process. On the other hand, the current study found that AWEF, rather than PF, contributed to greater self-regulation. This discrepancy may be due to the differing nature of the feedback processes. While PF provides valuable social and collaborative elements, it may lack the immediate and specific guidance that AWEF offers, especially for students who struggle with more advanced writing tasks. Similarly, Chen and Cui (2022) suggested that PF is particularly effective in improving cohesion and coherence in writing, and this emphasis on content-level feedback could explain why some students may prefer PF over automated systems. However, the findings of this study contradict this view, as the AWEF group demonstrated superior improvements in self-regulation, likely due to the more direct and task-focused nature of automated feedback. The immediacy of AWEF likely encouraged students to engage in repeated cycles of reflection and revision, which are crucial for developing self-regulation skills.

The findings of this study have significant implications for educational practice, particularly in emphasizing the integration of AWEF tools into curricula. Additionally, the results support the potential benefits of a mixed approach that combines AWEF with PF to enhance learning outcomes. The study also underscores the growing importance of

educational technology in fostering self-regulation and metacognitive awareness among learners. However, several limitations must be considered, including the relatively small and homogenous sample size and the reliance on self-reported data. These factors may limit the generalizability and reliability of the findings. Future research should explore the combined effects of AWEF and PF, examining their impact across different proficiency levels and cultural contexts. Furthermore, additional studies could investigate other forms of technology-enhanced feedback and conduct cross-cultural comparisons to assess how these feedback mechanisms perform in diverse educational settings.

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Appendix A

WSSRLQ Questionnaire

Not at all true of me	Not true of me	Slightly not true of me	Neutral	Slightly true of me	True of me	Very true of me
1	2	3	4	5	6	7

Text Processing

1. When writing, I use some literary devices to make the composition more interesting.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

2. When revising, I check for grammar mistakes.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

3. When revising, I check spelling and punctuation.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

4. When revising, I check the structure for logical coherence.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

5. When revising, I check the cohesiveness or connection among sentences.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

6. When revising, I check whether the topic and the content have been clearly expressed.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Knowledge Rehearsal

7. I write useful words and expressions taught in writing courses to help me remember.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

8. I speak out useful words and expressions taught in writing courses to help me remember.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

9. I read my class notes and the course material over and over again to help me remember.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Idea Planning

10. I read related articles to help me plan.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

11. I use the internet to search for related information to help me plan.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

12. I think about the core elements of a good composition learned to help me plan.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Goal-Oriented Monitoring and Evaluating

13. When I learn English writing, I set up goals for myself in order to direct my activities.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

14. I check my English learning progress to make sure I achieve my goal.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

15. I evaluate my mastery of the content in writing courses.

1	2	3	4	5	6	7

16. I monitor my learning process in writing courses.

1	2	3	4	5	6	7

17. When I am writing, I tell myself to stick to my plan.

1	2	3	4	5	6	7

18. I set up a learning goal to improve my writing.

1	2	3	4	5	6	7

Peer Learning
19. I brainstorm with peers to help me to write.

1	2	3	4	5	6	7

20. I discuss with my peers to have more ideas to write.

1	2	3	4	5	6	7

21. I work with other students in writing courses.

1	2	3	4	5	6	7

Feedback Handling
22. I am open to peers' feedback on my writing.

1	2	3	4	5	6	7

23. I am open to teachers' feedback on my writing.

1	2	3	4	5	6	7

24. I try to improve my English writing based on peers' feedback.

1	2	3	4	5	6	7

25. I try to improve my English writing based on teachers' feedback.

1	2	3	4	5	6	7

Interest Enhancement
26. I look for ways to bring more fun to the learning of writing.

1	2	3	4	5	6	7

27. I choose interesting topics to practice writing.

1	2	3	4	5	6	7

28. I connect the writing task with my real life to intrigue me.

1	2	3	4	5	6	7

29. I try to connect the writing task with my personal interest.

1	2	3	4	5	6	7

Motivational Self-Talk
30. I remind myself about how important it is to get good grades in writing courses.

1	2	3	4	5	6	7

31. I tell myself that I need to keep studying to improve my writing competence.

1	2	3	4	5	6	7

32. I tell myself that it is important to practice writing.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

33. I pay much attention to writing courses to learn more.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

34. I tell myself to practice writing to get good grades.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

35. I persuade myself to work hard in writing courses to improve my writing skills.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

36. I persuade myself to keep on learning in writing courses to find out how much I can learn.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

37. I tell myself that I should keep on learning to write.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Emotional Control

38. I tell myself not to worry when taking a writing test.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

39. I tell myself to keep on writing when I want to give it up.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

40. I find ways to regulate my mood when I want to give up writing courses.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Appendix B

Interview Questions

1. How do you set goals and plan your writing when using [AWEF / peer feedback]? and can you describe any specific strategies you use during this phase?
2. Can you explain how you monitor your progress and manage your time while writing, especially when you receive feedback from [AWEF / your peers]?
3. How do you reflect on your writing after receiving feedback? And what role does this reflection play in your revisions and motivation to improve?

Appendix C

Observation Checklist

SRL Phase	Observation Focus	AWEF Group (✓/X)	PF Group (✓/X)	Comments
Forethought	Student sets specific writing goals (e.g., structure, grammar)			
	Student plans task based on feedback requirements			
Performance	Student actively engages with feedback tool (AWEF) / peer feedback (PF)			
	Student critically evaluates and applies feedback			
	Student manages time effectively during writing phases			
Self-Reflection	Student reflects on progress and feedback during revisions			
	Student uses feedback to make iterative improvements			
Affective Behavior	Student shows persistence, motivation, or manages stress			