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Automated Written Corrective Feedback and ARCS-V Model for Enhancing Writing and Self-Efficacy of EFL Learners

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Abstract

Grounded in the reinforcement principle of behaviorism and Keller's ARCS-V (Attention, Relevance, Confidence, Satisfaction, and Volition) motivational model, this study explored the effects of Grammarly as an Automated Written Corrective Feedback (AWCF) gadget, combined with teacher feedback and the ARCS-V motivational model, on enhancing the writing performance and self-efficacy of Saudi EFL university students. The study implemented a quasi-experimental design with equivalent groups. The participants included 84 first-year Saudi female EFL students at King Khalid University, divided into an experimental group (43 students) that was exposed to both Grammarly and teacher feedback via the ARCS-V model, and a control group (41 students) that received only teacher feedback. To collect data, pre- and post-writing tests evaluating six writing subskills and a self-efficacy scale covering four domains were utilized. Quantitative data were analyzed using independent and paired-samples *t*-tests. Results demonstrated that the experimental group significantly outperformed the control group in both writing skills and all four self-efficacy domains, reflecting the positive effects of integrating AWCF with teacher feedback via the strategic application of the ARCS-V model. It has been noted that Grammarly is effective at providing feedback on grammar, punctuation, spelling, and vocabulary. However, in some contexts, it could not provide relevant explanations on overall coherence and organization. Therefore, the teacher's feedback is crucial. This study recommends integrating AI tools, human feedback, and motivation models for writing instruction.

Keywords: Automated Written Corrective Feedback (Grammarly), teacher feedback, ARCS-V model, writing performance, EFL Saudi learners

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Introduction

Writing is an indispensable skill that empowers learners to express their understanding through brainstorming ideas and critical thinking in a clear and well-organized manner. Mastering writing is a challenging task, especially for EFL learners, as it entails considering multiple skills simultaneously, including content development, grammar, vocabulary, mechanics, unity, coherence, and critical thinking. Students often lack these skills, especially before university, as they are not required to engage in producing or practicing condensed writing activities in schools. As a result, university students begin to struggle with developing their academic writing skills. They cannot create a well-knit paragraph that meets the writing standards. Khadawardi (2022) stated that many L2 students fail to produce well-written academic texts up to the standards set by their teachers, as required by the institutions where they study. Alqahtani and Alhamami (2024) attributed Saudi university students' deficiency in writing to their educational background, the poor implementation of technology, and students' negative attitudes toward L2 academic writing. According to their research results, students showed positive attitudes toward using technology in the classroom, which may help them overcome their writing difficulties. Studies have highlighted the need for support, new technical tools, extra motivation, and further enhancement of the writing skills of Saudi EFL learners (Alharbi, 2019; Alian, 2024; Alqahtani & Alhamami, 2024).

The learning process has been profoundly affected by the development and growing application of Artificial Intelligence (AI) tools. According to Johnson (2019), AI has revolutionized language instruction, making it more accessible and engaging. Alharbi (2023) analyzed 104 peer-reviewed articles from the Scopus database, revealing that students are increasingly employing various AI-supported writing gadgets to improve their writing performance. The tools are classified into four primary categories: (1) automated writing assessment gadgets, (2) gadgets offering automated writing correction feedback, (3) AI-driven machine translators, and (4) GPT-based automatic text generators.

Providing feedback on writing helps students recognize their errors and minimize them in future writing. Li et al. (2023) explained that feedback encompasses a range of skills, from basic elements such as spelling, structure, and punctuation to more advanced skills, including logical writing and argument development. This vast variety makes it difficult and time-consuming to provide extensive feedback. Therefore, utilizing Automatic Writing Feedback may help teachers reduce their workload by saving time and effort. In addition to supporting teachers, these tools can also help students. Barrot's (2023) research showed how automatic written corrective feedback (AWCF) through Grammarly can help students write more accurately. It was attributed to AWCF's capacity to improve students' awareness, provide flexible explanations grounded in metalinguistic justification, and encourage self-directed learning. Ranalli and Yamashita (2022) observed that the emergence of tools like Grammarly has provided users with an expanded selection of advanced error-correction tools that tackle both spelling and complicated grammar issues.

Although a substantial amount of research has explored the impact of AWCF on writing instruction and other psychological features (Barrot, 2023; Koltovskaia, 2020; Sanosi, 2022; Sari & Han, 2024; Thi & Nikolov, 2022), insufficient studies have focused on integrating it with motivational models that inspire learners to engage in writing actively and be more confident. The current literature has mainly focused on the use of AWCF tools in isolation, without employing motivating instructional models to enhance the learning experience. Therefore, addressing this gap is essential to exploring how integrating AWCF tools with motivational models can improve learner performance, motivation, self-efficacy, and confidence throughout the learning process.

Motivation is an empowering and driving force in learning and practicing skills, and if students lose their motivation, they cannot move forward or achieve their goals. By using practical motivating

techniques and models, teachers may effectively increase their students' motivation for learning. According to Angelo (2017), one of the most modern, inclusive, integrative, and flexible motivational models that uses a systems perspective to address issues is the ARCS-V model.

Keller's ARCS-V model consists of five aspects that help learners become motivated. They include attention, relevance, confidence, satisfaction, and volition. Attention is about grabbing the students' attention and maintaining their interest, while relevance involves linking the learner's information with the learning goals; confidence involves helping students set realistic expectations and strive for success; satisfaction aims to sustain students' efforts to complete the learning task; and volition or self-regulatory abilities is about maintaining students' motivation to learn (Keller, 2010; Keller, 2016).

There may be a relation between the implementation of motivational strategies and learners' self-efficacy, as increased efficacy can elevate self-confidence. Pajares and Schunk (2002) clarified that students' self-efficacy beliefs significantly affect their behavior in various ways. First, these beliefs affect the decisions students make; they tend to participate in assignments they feel confident about while avoiding those they do not. As students mature, they gain more autonomy over the activities and courses they choose, and their confidence plays a critical role in shaping these choices.

Students' writing skills, especially in the first year of university, require improvement and continuous feedback as they have limited exposure to intensive writing tasks during their earlier educational experiences, which leads to lower self-confidence when faced with academic writing demands. Therefore, the current study aims to utilize Automated Written Corrective Feedback (AWCF), alongside teacher feedback and the ARCS-V model, to improve students' writing and self-efficacy. The current study addresses these questions:

1. Are there any significant differences between the experimental group that obtained both AWCF with the teacher feedback through the ARCSV model and the control group that obtained the teacher feedback only through traditional teaching in Saudi EFL learners' overall writing skills?
2. Are there any significant differences between the experimental group that obtained both AWCF with the teacher feedback through the ARCSV model and the control group that obtained the teacher feedback only through traditional teaching in each writing subskill of Saudi EFL learners?
3. Are there any significant differences between the experimental group that obtained both AWCF with the teacher feedback through the ARCSV model and the control group that received the teacher feedback only through traditional teaching in Saudi EFL learners' writing self-efficacy subscales?

Literature Review

Automated Written Corrective Feedback

The implementation of corrective feedback in writing instruction is based on behaviorism, which contends that students' linguistic behaviors may be influenced and improved through reinforcement and correction (Ellis, 2009; Gass & Selinker, 2008). Automated written corrective feedback (AWCF) has recently captured the attention of several academics in the fields of learning, teaching, and assessment (Fan, 2023; Shi & Aryadoust, 2024). Written corrective feedback (WCF) is crucial in second language (L2) writing, serving as an interactive tool for L2 learners to enhance their writing proficiency (Bitchener & Ferris, 2012). AWCF was used in EFL classrooms to facilitate instructor management and provide students with immediate feedback even outside of class (Woodworth & Barkaoui, 2020).

AWCF is an online-mediated program that offers students instant feedback and suggestions to help them improve their written works (Koltovskaia, 2020). Its two primary elements are a feedback engine that produces automated written feedback and a scoring engine that delivers automated scores (Bai & Hu, 2017).

AWCF gadgets offer analytical input on semantics, syntactic structure, spelling, content, tone, and plagiarism, along with score options that enable teachers to evaluate learners (Ranalli et al., 2017). Within the AWE software, learners will get written feedback, including comments and/or corrections. Considering these aspects, a successful implementation of AWE software could reduce the feedback load on instructors, allowing them to concentrate on teaching and fostering teacher-student engagement (Li et al., 2023).

Researchers have called for the inclusion of automated feedback in writing teaching and learning to maximize teacher feedback, enabling teachers to focus on more difficult issues, such as content and style, rather than lower-order ones, like grammar and mechanics (Ranalli, 2018; Thi & Nikolov, 2022).

Grammarly is among the most widely used tools for AWCF. It enables users to easily correct grammatical errors, refine sentence construction, and improve their vocabulary. Grammarly now provides more advanced suggestions that enhance writing quality beyond simple grammatical corrections. As users interact with the editor, they will observe that it can identify minute details in text and provide recommendations for better style, tone, and clarity. With its improved suggestion features, this tool serves as a virtual writing coach, helping users communicate more effectively (Grammarly, 2020).

Recent studies indicate that automated feedback has positively influenced students' writing abilities. Guo et al. (2022) assessed the efficacy of EFL students' use of Grammarly feedback in improving their research writing. Results demonstrated that participants accurately corrected 85% of Grammarly-identified errors after revision, resulting in markedly reduced error scores. Barrot's (2023) study found that automatic written corrective feedback (AWCF) via Grammarly can help students write more accurately. The main reasons for the outcomes were AWCF's capacity to raise awareness, offer metalinguistic explanations, and involve students in self-directed learning. However, several difficulties were noted, including insufficient metalinguistic explanation, overcorrection, and cognitive strain. Sanosi (2022) investigated how Grammarly's AI-powered writing assistant influenced students' accuracy in academic writing. Results proved that the experimental group's written accuracy significantly improved after 14 weeks of using Grammarly. Those previous studies examined the effect of using Grammarly solely on writing performance without integrating any motivational model. Therefore, the current study aims to integrate the ARCS-V model with Grammarly to develop learners' writing skills and self-efficacy.

There are some disadvantages to the AWCF that impact learners' utmost benefit, such as a lack of active communication and dialogue that are often present in human-to-human feedback interactions. As a result, learners may not be able to ask for an explanation or gain a deeper understanding of the input they receive (Li, 2023). In addition, the AWCF may give learners incorrect feedback due to its inability to interpret the meaning, context, writing tone, and advanced linguistic forms that students use in their writing. Additionally, human pedagogical touch is lacking, errors are overcorrected, and individual differences are not adequately considered in AWCF (Guo et al., 2022; Ranalli, 2018). Students must learn how to use AWCF critically to maximize its benefits. If they reject or accept Grammarly feedback without careful consideration, their writing quality will only improve to a moderate extent (Koltovskaia, 2020).

Therefore, the current research endeavors to integrate both automated and human feedback to optimize students' writing performance and elevate their self-efficacy.

Aspects of the ARCS-V Motivational Model

Combining motivational and volitional theories, the ARCS-V model—Attention, Relevance, Confidence, Satisfaction, and Volition—forms a motivating design method that has demonstrated effectiveness across various contexts (Keller, 2010).

Keller (1984) provided explanations of the four aspects of the ARCS model along with strategies for achieving each component. Attention, as a component of motivation, is essential for learning. It can be fostered by presenting conflicting information with tangible examples and pictures, utilizing a variety of teaching techniques and media, incorporating humor, stimulating inquiry, and encouraging active engagement. Relevance links learning content to students' desires, experiences, and personal interests. Strategies to promote relevance include highlighting the current value and prospective usage of the content, tailoring lessons to individual needs (such as achievement or affiliation), modeling enthusiasm, and offering students choices for engaging with the content. Confidence involves helping students believe they can succeed. It includes offering self-evaluation tools, assigning challenging but achievable tasks, setting realistic goals, and enabling students to develop independence and new skills. These approaches help reduce anxiety and boost motivation. Satisfaction refers to learners' feelings of fulfillment from their accomplishments. It can be encouraged through verbal praise after completing complex tasks, providing both expected and unexpected rewards, delivering meaningful feedback, and avoiding punitive consequences for incomplete work.

Although Keller (2008) found that the ARCS model helps students initiate learning tasks, he noted that it does not sufficiently explain why students may struggle to complete them. To address this gap, he expanded the model by adding volition as a fifth component. Volition is the process of translating intention into action and requires deliberate effort, supported by internal self-regulation or external assistance, to achieve learning goals.

Research has employed the ARCS and ARCS-V models to inspire and encourage students to improve their academic performance and language proficiency in several settings. Xie and Zhu (2023) incorporated the ARCS model into writing instruction for EFL school students. The goal was to improve writing instruction and foster students' cognitive capacities and comprehensive language skills by effectively stimulating their motivation for English writing. Uçar and Kumtepe (2020) employed an online study to examine the effect of the ARCS-V model on students' academic performance, motivation, volition, and course interest. The findings indicated that students who employed motivational techniques showed markedly greater improvements in motivation, academic achievement, and course engagement. There were no notable changes in volition between the two classes. Keller (2016) redesigned a module in a graduate course using the ARCS-V model for a heterogeneous population of learners with diverse educational backgrounds to enhance motivation, performance, and the practical application of task analysis. Results revealed that all five motivating categories (ARCS-V) received positive responses from students, their interest in conducting job-task analysis increased, and the quality of their final submissions improved. It is noticed that these studies employed ARCS (V) alone as a motivational model to enhance academic achievement, motivation, or writing. None of them tried to use it with any of the AWCF tools to elevate students' writing skills and self-efficacy. For that reason, the current study tried to explore the use of Grammarly via the ARCS-V model for Writing and self-efficacy.

Writing Self-Efficacy

Self-efficacy, a component of Social Cognitive Theory (Bandura, 1986), investigates the influence of cognitive processes and beliefs on an individual's environment and behavior. This concept pertains to

the conviction in one's capacity to undertake the requisite actions to achieve certain goals (Bandura, 1997). Self-efficacy for learning is influenced by previous knowledge, individual characteristics (such as abilities and skills), and environmental or social support systems. Students engage with tasks to obtain cues that indicate their learning progress, which they utilize to assess their effectiveness for ongoing learning. The cues encompass academic achievements, variations of accomplishments and failures, feedback, praise, evaluation of models, credibility of persuaders, and physiological signs. Self-efficacy sparks learners' interest and motivates them to employ effective self-regulation techniques (Schunk, 1996).

Self-efficacy in writing entails one's ability to effectively arrange writing techniques and utilize language tools to achieve expressive goals (Teng & Zhang, 2016). Zimmerman and Bandura (1994) clarified that the perceptions of self-efficacy in writing affect the actual ability and individual expectations of writing proficiency. Higher personal standards and perceived academic self-efficacy help individuals set goals for developing their writing skills. Bruning et al. (2013) proposed three elements for the self-efficacy model: ideation, conventions, and self-regulation. The ideation process encompasses generating and formulating ideas, as well as reasoning for writing. In contrast, linguistic competence is essential for successfully applying conventions since writers need to use appropriate semantic and syntactic knowledge to convey their ideas accurately. Self-regulation, as the third criterion, is associated with self-management and emotional control, while also encompassing evaluations of cognitive and linguistic attributes during the writing process.

For enhancing self-efficacy, writers evaluate the quality of their writing performance through continuous feedback. They keep employing strategic self-regulation. They seek to develop positive perceptions of their writing proficiency by employing strategic self-regulation or metacognitive strategies. Writers with self-efficacy attitudes and less apprehension can effectively implement strategies and enhance the quality of their written work (Takarroucht, 2022). Learners can also receive insightful feedback from their teachers, which will accordingly boost their writing achievement and self-efficacy (Schunk & Swartz, 1993).

Several studies examined the influence of various instructional and pedagogical approaches on students' writing self-efficacy. Guo and Li (2024) investigated the impact of teaching writing through an electronic portfolio on the second language writing proficiency and self-efficacy of Chinese EFL students. Results showed that teaching writing through an electronic portfolio enhances writing efficiency and self-efficacy of learners. El-Garawany (2024) investigated the impact of QuillBot usage on EFL writing competence, anxiety, and self-efficacy of Egyptian university students. According to the results, the collaborative use of QuillBot can improve EFL writing competence, decrease writing anxiety, and enhance self-efficacy. Another study combined the use of Automated Writing Evaluation (AWE) on EFL learners' writing self-efficacy, self-regulation, anxiety, and performance. Sari and Han (2024) utilized a quasi-experimental design wherein students in the experimental group got feedback from both automated resources and the teacher. In contrast, students in the control group got feedback only from the teacher. Results showed that the use of integrating automated and teacher feedback surpassed conventional teacher-only feedback in improving the learners' writing and self-efficacy. All the previously mentioned studies combined online tools such as online portfolios or AWE tools to improve writing and self-efficacy. They lack motivational aspects or models, such as the ARCS-V, to enhance writing and self-efficacy. Therefore, the present study contributes by investigating the combined integration of AWCF, teacher feedback, and the ARCS-V motivational model in developing EFL learners' writing skills and writing self-efficacy.

Methodology

Design

The study adopted a quasi-experimental design for equivalent groups. Two groups participated in the study. They were allocated to the experimental group, which received Automated Written Corrective

Feedback and teacher feedback based on the ARCS-V model, and the control group, which received teacher feedback only. The two groups had pre- and post-writing tests measuring six writing skills: content, organization, coherence, grammar, vocabulary, and mechanics. They also responded to a writing self-efficacy scale with four elements: content and ideas, mechanics and conventions, organization and coherence, and self-regulation, before and after the study treatment.

Participants and the Context

Eighty-four first-year female students at King Khalid University in Saudi Arabia took part in the study intervention for 12 weeks during the first semester of the 2024/2025 academic year. The first group, comprising forty-three students, was randomly selected and allocated to the experimental group. The other section, consisting of forty-one students, was designated as the control group. Because they were chosen at random, the subjects are all the same age, have the same educational background, and have the same language proficiency. Their prior experience in English writing was similar, and they shared many common academic and linguistic characteristics. Both the experimental and control groups were taught under equivalent instructional conditions. They received the same number of sessions, instructional time, and writing tasks to ensure consistency and minimize the influence of extraneous variables.

The researcher informed both the experimental and control groups about the nature of the study before the intervention, and they voluntarily participated. The researcher declared that the data obtained was only for research purposes, assuring their privacy and anonymity, and they have the right to withdraw at any time. To ensure that there were no statistically significant differences between the experimental group and the control group in terms of writing skills and self-efficacy prior to the intervention, an independent samples t-test was performed as shown below.

Table 1 shows that there was no statistically significant difference between the Control and Experimental groups in any pre-writing test skill or in the total score (14.41 vs 14.11, respectively).

Table 1. *Differences between The Experimental and Control Groups on The Pre-Writing Test*

Skill	Group	N	M	SD	DF	T	P
Content	Control	41	2.39	0.86	81.8	0.343	0.733
	Experimental	43	2.33	0.87			
Organization	Control	41	2.34	0.82	79.8	0.366	0.716
	Experimental	43	2.28	0.73			
Coherence	Control	41	2.21	0.75	81.1	0.659	0.512
	Experimental	43	2.32	0.71			
Grammar	Control	41	2.43	0.74	81.9	0.553	0.582
	Experimental	43	2.34	0.75			
Vocabulary	Control	41	2.46	0.55	82.0	0.550	0.584
	Experimental	43	2.39	0.58			
Mechanics	Control	41	2.56	0.59	78.8	0.799	0.427
	Experimental	43	2.44	0.76			
Total	Control	41	14.41	3.51	82.0	0.378	0.706
	Experimental	43	14.11	3.71			

SD: Standard Deviation, DF: Degree of freedom, T: Independent test, < 0.05*: Statistically Significant, ≤0.001**: Highly Statistically Significant.

Table 2 presents the pre-application findings for the content and ideas self-efficacy subscale. The analysis revealed no statistically significant differences between the two groups on individual items or the total score, with mean total scores of 14.29 and 15.04, respectively.

Table 2. *Differences between Groups on The Pre-Application of Content and Ideas Self-Efficacy Subscale*

Item	Group	N	M	SD	DF	T	P
I can generate many ideas for my writing.	Control	41	2.82	0.99	81.3	0.802	0.425
	Experimental	43	3.00	0.95			
I can make the best use of my ideas in writing.	Control	41	2.80	0.87	81.2	0.924	0.385
	Experimental	43	2.97	0.83			
I can brainstorm ideas and utilize them appropriately.	Control	41	2.48	0.71	81.8	1.716	0.090
	Experimental	43	2.76	0.78			
I have a wide range of vocabulary to express my thoughts in writing.	Control	41	3.14	0.79	79.7	0.811	0.420
	Experimental	43	3.27	0.70			
I can include realistic ideas with supporting real-life examples and details.	Control	41	3.02	0.75	81.6	0.007	0.994
	Experimental	43	3.02	0.73			
Total	Control	41	14.29	3.70	81.3	0.951	0.344
	Experimental	43	15.04	3.55			

SD: Standard Deviation, DF: Degree of freedom, T: Independent test, < 0.05*: Statistically Significant, ≤0.001**: Highly Statistically Significant.

Table 3 displays the pre-application outcomes for the mechanics and conventions self-efficacy subscale. Similarly, the two groups did not differ significantly on any item or on the aggregated score, with mean totals of 14.21 for the control group and 15.13 for the experimental group.

Table 3. *Differences between Groups on The Pre-Application of Mechanics and Conventions Self-Efficacy Subscale*

Item	Group	N	M	SD	DF	T	P
I can write words in correct spelling.	Control	41	2.78	0.88	81.9	1.699	0.093
	Experimental	43	3.11	0.93			
I can use correct punctuation in my writing.	Control	41	3.00	0.83	82	1.488	0.140
	Experimental	43	3.27	0.88			
I can write simple, compound, and complex sentences.	Control	41	2.65	0.61	79.6	0.868	0.388
	Experimental	43	2.79	0.77			
I can use appropriate verb tenses, pronouns, articles, plurals, and subject-verb agreement.	Control	41	2.92	0.75	81.8	1.433	0.156
	Experimental	43	3.16	0.75			
I can use different parts of speech (nouns, verbs, adjectives, and adverbs) correctly.	Control	41	2.85	0.88	79.5	0.347	0.729
	Experimental	43	2.79	0.77			
Total	Control	41	14.21	3.41	81.8	1.233	0.221
	Experimental	43	15.13	3.41			

SD: Standard Deviation, DF: Degree of freedom, T: Independent test, < 0.05*: Statistically Significant, ≤0.001**: Highly Statistically Significant.

Table 4 shows the pre-application results for the organization and coherence self-efficacy subscale. Consistent with the prior subscales, no statistically significant group differences were detected at the item or total score levels (14.02 vs. 14.25).

Table 4. *Differences between Groups on The Pre-Application of Organization and Coherence Self-Efficacy Subscale*

Item	Group	N	M	SD	DF	T	P
I can write well-organized paragraphs, including topic sentences and details.	Control	41	2.85	1.06	80.6	0.657	0.513
	Experimental	43	3.00	0.97			
I can arrange my ideas in a logical sequence.	Control	41	2.82	0.86	79.7	0.086	0.932
	Experimental	43	2.81	0.76			
I can proofread and edit my writing to improve its organization.	Control	41	2.92	0.78	81.5	0.225	0.800
	Experimental	43	2.88	0.76			
I can improve the unity and organization of my writing.	Control	41	2.70	0.67	81.8	0.385	0.701
	Experimental	43	2.76	0.75			
I can write adequate evidence to support my argumentation.	Control	41	2.70	0.64	81.7	0.565	0.573
	Experimental	43	2.79	0.70			
Total	Control	41	14.02	3.46	81.3	0.313	0.755
	Experimental	43	14.25	3.30			

SD: Standard Deviation, DF: Degree of freedom, T: Independent test, < 0.05*: Statistically Significant, ≤0.001**: Highly Statistically Significant.

Table 5. *Differences between Groups on The Pre-Application of The Self-Regulation Self-Efficacy Subscale and The Scale Overall Total*

Item	Group	N	M	SD	DF	T	P
I can write my writing assignment immediately after the teacher asks.	Control	41	2.97	0.96	81.7	0.340	0.735
	Experimental	43	3.04	0.95			
I can set clear goals for my writing.	Control	41	3.02	0.85	79.2	0.273	0.785
	Experimental	43	2.97	0.73			
I can continue writing even when it is challenging.	Control	41	2.80	0.84	90.9	0.340	0.735
	Experimental	43	2.74	0.78			
I can focus on my writing even if there are distractions or I am not in a good mood.	Control	41	2.31	0.81	79.8	1.697	0.094
	Experimental	43	2.60	0.72			
I can follow my prepared plan and write perfectly.	Control	41	2.87	0.71	80.3	0.194	0.874
	Experimental	43	2.90	0.64			
Total	Control	41	14.00	3.66	78.9	0.374	0.710
	Experimental	43	14.27	3.14			
The overall total	Control	41	56.53	10.4	76.9	1.054	0.295
	Experimental	43	58.72	8.41			

SD: Standard Deviation, DF: Degree of freedom, T: Independent test, < 0.05*: Statistically Significant, ≤0.001**: Highly Statistically Significant.

Table 5 reports the pre-application data for both the self-regulation self-efficacy subscale and the overall self-efficacy scale. The results indicate no statistically significant differences between the two groups across all items and total scores, with subscale means of 14.00 and 14.27, respectively. Likewise, the overall scale total showed no significant variation, yielding mean scores of 56.53 and 58.72.

Data Collection

The experimental group has been taught the eight chapters of *Unlock 1: Writing and Critical Thinking* (Ostrowska et al., 2019) in 16 sessions, including two introductory sessions aiming to familiarize students with the Grammarly App and train them on how to interact with the feedback provided. Two additional sessions were allocated for administering the pre- and post-writing tests, as well as the self-efficacy scale. Each session lasted for two hours. The study implementation started in the first week of September 2024 and was completed in the last week of November 2024.

Procedure

Using the ARCS-V model with the Grammarly App and teacher feedback required navigating through the various steps of the motivation model and utilizing the App with supportive feedback from the teacher as well. Students engaged in diverse practices and activities throughout each session as follows:

Attention: In this phase, the teacher attracts students' attention by introducing engaging prompts, such as presenting a picture or a brief video related to the topic under discussion (e.g., a tourist destination). The teacher then asks questions about the place in the picture and provides key vocabulary and descriptive expressions that students can use during oral discussion before writing. Following this initial engagement with the topic, the teacher gradually shifts students' attention to common writing challenges by presenting examples of frequent writing errors and inviting students to predict possible corrections. In this phase, the teacher also uses Grammarly suggestions in class to stimulate curiosity about utilizing automated feedback.

Relevance: The teacher connects the writing tasks to students' interests, such as the importance of traveling, keeping fit and healthy, describing a new place, writing about their daily routine and lifestyle, and emphasizing the need for improving writing and how it helps in real-life contexts, such as writing a personal CV for applying for jobs. A brainstorming session was held in this phase to generate ideas, and key vocabulary was introduced to help students start writing. The teacher also provides sample excerpts from previous students' writings and discusses repeated errors, such as the misuse of tenses, singular and plural forms, articles, sentence structure, and subject-verb agreement.

Confidence: Students' competences are built step-by-step, and their writing anxiety is reduced through model paragraph analysis and identifying paragraph constructure: the topic sentence, supporting arguments, and concluding sentences, focusing on correct grammar use, cohesion, coherence and vocabulary. After that, they practice group and individual writing tasks on specific topics in class and input their paragraphs into Grammarly to receive feedback. Some samples of their writing are orally discussed by explaining the given suggestions (e.g., grammar, spelling, and word choice), and the teacher also provides appropriate feedback on the content, ideas, and coherence of the written paragraphs.

Satisfaction: In addition to in-class writing practice, students in both the experimental and control groups were assigned structured out-of-class writing tasks to ensure comparable levels of practice and exposure. The teacher guided students to engage with these tasks and reflect on their progress. When they met in class, students practiced peer review to observe their own and their peers' development by discussing highlighted comments. In the experimental group, this process was supported

by Grammarly feedback, while the teacher also provided comprehensive feedback on content and the logical organization of ideas, acknowledging students' progress in writing.

Volition: The teacher encourages self-regulation by asking students to track their Grammarly performance (alerts, error rates, etc.). When there is improvement, they are rewarded and encouraged to set personal goals every week (e.g., "This week, I will reduce misuse of verb tense by 50%"). They also share their viewpoints and their comments on what they have learned and how they benefited from the Grammarly App at the end of each week. Figure 1 shows the study intervention based on the ARCS-V model.

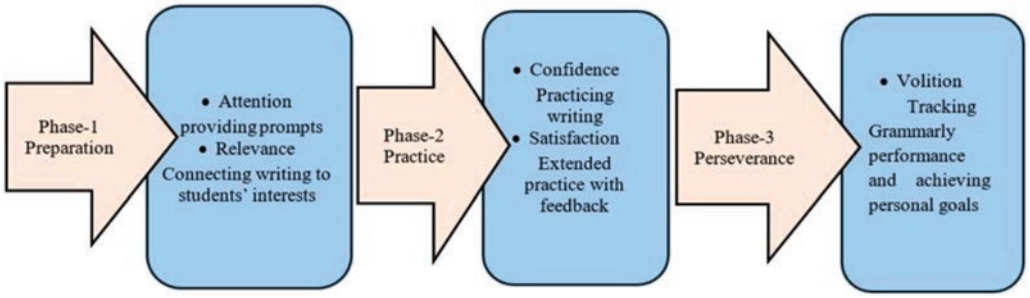

Figure 1 *The Intervention of Automated and Teacher Feedback Based on The ARCS-V Model*

Instruments

A pre-test and a post-test have been implemented for both the experimental and control groups. Each group experienced a pre-test to verify their equivalent skills before the experiment. The post-test was conducted to assess the efficacy of the AWCF (Grammarly) scaffold, combined with teacher feedback and the ARCS-V model, in enhancing students' writing skills and self-efficacy. The two tests included writing a paragraph of twelve sentences about a specific topic (Appendix A). To determine the time and reliability of the two tests, a pilot study was carried out on a different group of students at the same level before the experiment. Based on the average time spent on writing the two paragraphs, the required time for the exam was 50 minutes. The two tests were given to four TEFL experts to assess their suitability for the students' academic level, and they approved the content. A rubric for evaluating each writing skill has been used for checking the test (Appendix B). The writing test was scored by one expert rater using a standardized rubric, which helped ensure consistency in scoring and minimize potential bias.

A five-point Likert scale for measuring students' self-efficacy in writing was adapted and developed from Brunning et al. (2013). It encompassed twenty items categorized into four sections: content and ideas, mechanics and conventions, organization and coherence, and self-regulation (Appendix C). It was given to the same TEFL experts to test its content suitability and organization. They reviewed the scale and suggested several modifications, which were incorporated into the final version.

Regarding the assessment of the study instruments' reliability, the internal consistency of each instrument was examined using Cronbach's alpha. For the writing test, a high level of internal consistency was obtained ($\alpha = 0.907$), indicating that the scoring rubric provided consistent evaluation across its components and criteria. This suggests that the assessment of students' writing performance was stable and reliable. For the self-efficacy scale, the results also showed high internal consistency ($\alpha = 0.900$), indicating that the scale items consistently measured the underlying construct of students' writing self-efficacy. This reflects the coherence of the scale in capturing students' perceptions of their writing ability.

Table 6. *Cronbach's Alpha among The Studied Participants for Measuring The Reliability of The Study Instruments (n = 84)*

Study instrument	Cronbach's alpha
Writing test	0.907
Self-efficacy subscale	0.900

Results

The data were coded, entered, and analyzed using the Statistical Package for the Social Sciences (SPSS) (Version 20.0; Armonk, NY: IBM Corp). Quantitative data were expressed as mean ± standard deviation (SD) after confirming normality using the Shapiro–Wilk test. An independent t-test was used to examine differences between the two groups. A paired t-test was conducted to assess within-group differences (pre- and post-test). The reliability of the study instruments was evaluated using Cronbach's alpha coefficient to assess internal consistency. When the probability (P value) was less than 0.05* or 0.001**, the results were considered statistically significant and very statistically significant, respectively.

To answer the first research question, the results shown in Table 7 indicate that the experimental group (received feedback from both AWCF and the teacher through ARCS-V model) displayed a statistically significant difference compared to the control group (obtained feedback from the teacher only) in terms of students' overall writing skills with mean total score (17.31 vs 21.18) respectively, this significant difference showed the effective use of the AWCF with the teacher feedback through the ARCS-V model.

Table 7. *Differences between The Experimental and Control Groups on The Post-Writing Test*

Skill	Group	N	M	SD	DF	T	P value	ES
Content	Control	41	2.68	0.72	81.9	3.102	0.003*	0.32
	Experimental	43	3.18	0.76		T1: 2.395 T2: 8.353	P1: 0.021* P2: <0.001**	
Organization	Control	41	2.85	0.72	81.8	3.833	<0.001**	0.39
	Experimental	43	3.46	0.73		T1: 5.496 T2: 9.125	P1: <0.001** P2: <0.001**	
Coherence	Control	41	2.75	0.69	79.2	3.141	0.002*	0.36
	Experimental	43	3.30	0.88		T1: 4.835 T2: 9.063	P1: <0.001** P2: <0.001**	
Grammar	Control	41	2.95	0.86	75.0	5.112	<0.001**	0.51
	Experimental	43	3.81	0.66		T1: 5.928 T2: 15.237	P1: <0.001** P2: <0.001**	
Vocabulary	Control	41	3.00	0.70	80.6	4.387	<0.001**	0.44
	Experimental	43	3.65	0.65		T1: 6.806 T2: 13.265	P1: <0.001** P2: <0.001**	
Mechanics	Control	41	3.07	0.64	81.2	4.544	<0.001**	0.45
	Experimental	43	3.76	0.75		T1: 5.147 T2: 13.489	P1: <0.001** P2: <0.001**	
Total	Control	41	17.31	2.64	81.9	6.421	<0.001**	0.58
	Experimental	43	21.18	2.88		T1: 10.324 T2: 23.548	P1: <0.001** P2: <0.001**	

SD: Standard Deviation, DF: Degree of freedom, T: Independent test, < 0.05*: Statistically Significant, ≤0.001**: Highly Statistically Significant.
T1, P1: Paired t test in control group (pre/post), T2, P2: Paired t test in experimental group (pre/post).

For the second research question, Table 7 shows that the experimental group scored higher than the control group in all writing subskills: content, organization, coherence, grammar, vocabulary, and mechanics. The experimental group had higher mean scores in each skill (content: M = 3.18 vs. 2.68; organization: M = 3.46 vs. 2.85; coherence: M = 3.30 vs. 2.75; grammar: M = 3.81 vs. 2.95; vocabulary: M = 3.65 vs. 3.00; mechanics: M = 3.76 vs. 3.07). These differences were statistically significant ($p \leq .01$). These results suggest that combining AWCF with teacher feedback using the ARCS-V model improves students' writing performance.

Regarding the third question, Table 8 reports that post-application outcomes for the content and ideas self-efficacy subscale revealed statistically significant differences between the two groups across all items and in the composite score (16.46 vs. 19.13), with a statistically significant difference on the pre/post comparison within each group.

According to Table 9, the post-application findings for the mechanics and conventions self-efficacy subscale similarly demonstrated statistically significant intergroup differences on every item and on the overall subscale score (16.80 vs. 19.72). In addition, both groups showed significant improvement between their pre- and post-test results.

As presented in Table 10, the post-intervention assessment of the organization and coherence self-efficacy subscale also demonstrated statistically significant differences between the two groups on all measured items and on the total score (16.48 vs. 19.04). Both groups demonstrated significant gains when comparing their pre- and post-test results.

Table 8. *Differences between Groups on The Post-Application of Content and Ideas Self-Efficacy Subscale*

Item	Group	N	M	SD	DF	T	P	ES
I can generate many ideas for my writing.	Control	41	3.34	0.72	81.3	3.031	0.003*	0.32
	Experimental	43	3.81	0.69		T1: 5.496 T2: 10.66	P1: <0.001** P2: <0.001**	
I can make the best use of my ideas in writing.	Control	41	3.14	0.69	81.9	3.781	<0.001**	0.39
	Experimental	43	3.72	0.70		T1: 4.554 T2: 11.05	P1: <0.001** P2: <0.001**	
I can brainstorm ideas and utilize them appropriately.	Control	41	2.97	0.68	81.9	4.003	<0.001**	0.40
	Experimental	43	3.58	0.69		T1: 5.646 T2: 11.85	P1: <0.001** P2: <0.001**	
I have a wide range of vocabulary to express my thoughts in writing.	Control	41	3.58	0.74	75.4	3.979	<0.001**	0.42
	Experimental	43	4.16	0.57		T1: 5.595 T2: 17.86	P1: <0.001** P2: <0.001**	
I can include realistic ideas with supporting real-life examples and details.	Control	41	3.41	0.66	81.8	3.037	0.003*	0.32
	Experimental	43	3.86	0.67		T1: 5.060 T2: 12.69	P1: <0.001** P2: <0.001**	
Total	Control	41	16.46	2.84	81.6	4.354	<0.001**	0.43
	Experimental	43	19.13	2.78		T1: 7.776 T2: 17.78	P1: <0.001** P2: <0.001**	

SD: Standard Deviation, DF: Degree of freedom, T: Independent test, < 0.05*: Statistically Significant, ≤0.001**: Highly Statistically Significant.
T1, P1: Paired t test in control group (pre/post), T2, P2: Paired t test in experimental group (pre/post).

Table 9. *Differences between Groups on The Post-Application of Mechanics and Conventions Self-Efficacy Subscale*

Item	Group	N	M	SD	DF	T	P	ES
I can write words in correct spelling.	Control	41	3.31	0.72	80.9	5.383	<0.001**	0.51
	Experimental	43	4.13	0.67		T1: 6.806 T2: 14.51	P1: <0.001** P2: <0.001**	
I can use correct punctuation in my writing.	Control	41	3.48	0.67	81.9	3.982	<0.001**	0.40
	Experimental	43	4.09	0.71		T1: 6.172 T2: 11.85	P1: <0.001** P2: <0.001**	
I can write simple, compound, and complex sentences.	Control	41	3.00	0.63	81.9	4.708	<0.001**	0.46
	Experimental	43	3.67	0.68		T1: 3.545 T2: 14.82	P1: 0.001** P2: <0.001**	
I can use appropriate verb tenses, pronouns, articles, plurals, and subject-verb agreement.	Control	41	3.46	0.71	79.1	3.372	0.001**	0.35
	Experimental	43	3.95	0.61		T1: 6.806 T2: 11.12	P1: <0.001** P2: <0.001**	
I can use different parts of speech (nouns, verbs, adjectives, and adverbs) correctly.	Control	41	3.53	0.74	81.2	2.038	0.045*	0.22
	Experimental	43	3.86	0.70		T1: 8.385 T2: 17.44	P1: <0.001** P2: <0.001**	
Total	Control	41	16.80	2.53	81.9	5.159	<0.001**	0.49
	Experimental	43	19.72	2.64		T1: 11.039 T2: 24.24	P1: <0.001** P2: <0.001**	

SD: Standard Deviation, DF: Degree of freedom, T: Independent test, < 0.05*: Statistically Significant, ≤0.001**: Highly Statistically Significant.
T1, P1: Paired t test in control group (pre/post), T2, P2: Paired t test in experimental group (pre/post).

Table 10. *Differences between Groups on The Post-Application of Organization and Coherence Self-Efficacy Subscale*

Item	Group	N	M	SD	DF	T	P	ES
I can write well-organized paragraphs, including topic sentences and details.	Control	41	3.39	0.73	81.5	3.252	0.002*	0.34
	Experimental	43	3.90	0.71		T1: 6.223 T2: 13.95	P1: <0.001** P2: <0.001**	
I can arrange my ideas in a logical sequence.	Control	41	3.21	0.57	81.9	3.542	0.001**	0.36
	Experimental	43	3.67	0.60		T1: 2.059 T2: 5.974	P1: 0.046* P2: <0.001**	
I can proofread and edit my writing to improve its organization.	Control	41	3.41	0.63	80.7	2.790	0.007*	0.29
	Experimental	43	3.83	0.75		T1: 6.172 T2: 29.34	P1: <0.001** P2: <0.001**	
I can improve the unity and organization of my writing.	Control	41	3.29	0.55	76.5	3.395	0.001**	0.36
	Experimental	43	3.79	0.77		T1: 7.515 T2: 13.12	P1: <0.001** P2: <0.001**	
I can write adequate evidence to support my argumentation.	Control	41	3.17	0.58	80.1	4.652	<0.001**	0.46
	Experimental	43	3.83	0.72		T1: 5.878 T2: 11.92	P1: <0.001** P2: <0.001**	
Total	Control	41	16.48	2.36	80.3	4.466	<0.001**	0.45
	Experimental	43	19.04	2.86		T1: 9.099 T2: 22.06	P1: <0.001** P2: <0.001**	

SD: Standard Deviation, DF: Degree of freedom, T: Independent test, < 0.05*: Statistically Significant, ≤0.001**: Highly Statistically Significant.
T1, P1: Paired t test in control group (pre/post), T2, P2: Paired t test in experimental group (pre/post).

Table 11. *Differences between Groups on The Post-Application of The Self-Regulation Self-Efficacy Subscale and The Scale Overall Total*

Item	Group	N	M	SD	DF	T	P	ES
I can write my writing assignment immediately after the teacher asks.	Control	41	2.97	0.96	70.9	4.111	<0.001**	0.44
	Experimental	43	3.72	0.66		T1: N/A T2: 7.294	P1: N/A P2: <0.001**	
I can set clear goals for my writing.	Control	41	3.02	0.85	65.8	4.196	<0.001**	0.46
	Experimental	43	3.67	0.52		T1: N/A T2: 9.845	P1: N/A P2: <0.001**	
I can continue writing even when it is challenging.	Control	41	2.80	0.84	75.9	4.677	<0.001**	0.47
	Experimental	43	3.58	0.66		T1: N/A T2: 9.557	P1: N/A P2: <0.001**	
I can focus on my writing even if there are distractions or I am not in a good mood.	Control	41	2.31	0.81	79.8	5.544	<0.001**	0.53
	Experimental	43	3.25	0.72		T1: N/A T2: 8.854	P1: N/A P2: <0.001**	
I can follow my prepared plan and write perfectly.	Control	41	2.87	0.71	81.1	6.015	<0.001**	0.56
	Experimental	43	3.79	0.67		T1: N/A T2: 14.82	P1: N/A P2: <0.001**	
Total	Control	41	14.00	3.66	66.3	6.018	<0.001**	0.59
	Experimental	43	18.02	2.27		T1: N/A T2: 15.29	P1: N/A P2: <0.001**	
The overall total	Control	41	63.75	8.08	77.4	7.536	<0.001**	0.65
	Experimental	43	75.93	6.61		T1: 3.44 T2: 35.55	P1: <0.001** P2: <0.001**	

SD: Standard Deviation, DF: Degree of freedom, T: Independent test, < 0.05*: Statistically Significant, ≤0.001**: Highly Statistically Significant.
T1, P1: Paired t test in control group (pre/post), T2, P2: Paired t test in experimental group (pre/post).

Finally, Table 11 shows that the post-application results for the self-regulation self-efficacy subscale—and the overall self-efficacy scale—revealed statistically significant differences between the experimental and control groups across all items and total scores. The mean subscale totals were 14.00 and 18.02, respectively, while the overall scale means were 63.75 and 75.93. A statistically significant pre-/post-improvement was observed within the experimental group across all metrics. In contrast, the control group demonstrated a significant pre/post change only in the overall scale total, with no significant differences in any individual items or in the self-regulation subscale total.

Figure 2 shows the suggested review of one student's writing. Although these suggestions are beneficial and particularly effective, teacher feedback is often more critical and valuable. Students often rely on their native language and translation for writing, and the application may lack alternative suggestions for improved meaning and content in the review suggestion section. It improves the overall quality of writing by utilizing generative AI techniques. The teacher proposed improved options for clarifying content and meaning with explanations. For instance, the student wrote, "My aunt came to us from Jeddah," which lacked suggestions in the review. A more appropriate phrasing would be "came to visit us" or "visited us." Although there is a suggestion to "improve it in generative AI," it is not accompanied by an explanation. In addition, the provided synonyms for "came" include "arrived" and "reached." The teacher clarified the differences between these two verbs in context and their appropriate usage, indicating their inappropriate use in the previous example. This limitation has been noted in

Figure 2 *Grammarly Review Suggestions*

prior research, which emphasizes that Grammarly feedback is regarded as mechanical and predominantly limited to grammatical range. It frequently fails to offer accurate, context-sensitive suggestions and lacks the metalinguistic clarity that human instructors provide (Barrot, 2023; Faisal & Carabella, 2023; Jitpaisarnwattana & Saville, 2025; Ranalli, 2018). In this study, teacher feedback was essential in bridging those gaps throughout the instructional sessions.

Discussion

The results presented above indicated that students in both groups were comparable in their writing performance and self-efficacy prior to the intervention. However, following the intervention, it became evident that the experimental group—who received both Grammarly with teacher feedback via the ARCS-V model—showed significantly greater improvement than the control group, who received only teacher feedback. These findings highlight the prominent advantage of combining automated feedback with the teacher feedback via a motivational pedagogical framework in enhancing students' writing performance and self-efficacy.

The statistically significant gains observed in grammar, mechanics, and vocabulary in the post-test may be attributed to the structured and category-based feedback given by Grammarly, as well as the teacher feedback guided by the ARCS-V model. The automated error categorization and targeted revision suggestions probably helped students to focus on specific linguistic forms which might be the reason for the higher mean scores in these lower-order writing skills (grammar M = 3.81, mechanics M = 3.76, vocabulary M = 3.65) compared to higher-order components such as content (M = 3.18), organization (M = 3.46) and coherence (M = 3.30). These findings align with previous studies reporting improvements in linguistic accuracy when automated feedback is systematically integrated into writing instruction (Barrot, 2023; Sanosi, 2024).

Although there were significant differences between the experimental and control groups in all writing sub-skills, the three lower writing skills were most affected. Specifically , grammar (ES = 0.51) , mechanics (ES = 0.45) , and vocabulary (ES = 0.44) have larger effect size than the other three higher writing skills such as content (ES = 0.32) , coherence (ES = 0.36) , and organization (ES = 0.39) which may be attributed to the integration of both Grammarly and the teacher feedback via the ARCS-V model as Grammarly provides detailed explanations, accompanied by examples, that may help students identify their repeated errors, especially those related to grammar, mechanics, and correct word choice, such as using articles, prepositions, subject-verb agreement, singular and plural forms, and using suitable vocabulary in context as shown in Figure 2. These tailored suggestions, designed for

each student, might help them identify their mistakes and learn to avoid them in subsequent writing opportunities. The improvement in higher-level writing skills can also be attributed to the complementary role of teacher feedback, integrated through the ARCS-V motivational framework, which provided guidance on content development, coherence, and organization. These results align with other research, such as Sari and Han (2024) and Khojasteh et al. (2025), which found a positive effect of combining AWF with Teacher feedback, especially in enhancing coherence and task achievement.

The teacher's feedback went beyond simply helping students with meaning clarification, content improvement, or grammar; it also included advice on how to plan and organize their writing, focus on one main idea per paragraph, use topic sentences to express their ideas, show how ideas are logically arranged with appropriate transitions, stay focused within paragraphs, and provide a comprehensive conclusion. For example, as illustrated in Figure 3, which presents the Grammarly feedback on a student's writing, the teacher provided complementary feedback on the same sample by advising the student to focus on one main idea per paragraph and develop it with supporting details. The teacher suggested selecting the idea of "enjoying a beach trip with the family" and the supporting details of the sunset and the memorable experience. Grammarly was helpful for students, but it cannot replace the insightful advice of teachers, especially in the organizational aspects of writing.

The post-intervention results of the self-efficacy scale indicated that the experimental group had significantly higher scores in the content and ideas domain (M =16.46 vs. M =19.13) and the mechanics and conventions domain (M = 16.80 vs. M = 19.72) than the control group. No differences between groups were found at pre-scale scores. Improvement in content-related skills, such as idea generation, vocabulary use, and supporting arguments, alongside improvement in mechanics, e.g., spelling, grammar, punctuation, and sentence construction, suggests that the experimental group's self-efficacy was boosted by the structured and combined use of automated written corrective feedback and teacher support guided by the motivational model. The immediate, categorized feedback allowed multiple revisions, and the teacher's support within the ARCS-V framework might have deepened students' confidence in engaging with the corrections. This finding aligns with previous research linking automated feedback to increased writing self-efficacy (e.g., Yilong et al., 2024). It also corresponds with studies that have found the use of the ARCS model in instructional design to be beneficial for motivation in writing contexts, such as Mirzaei et al. (2024).

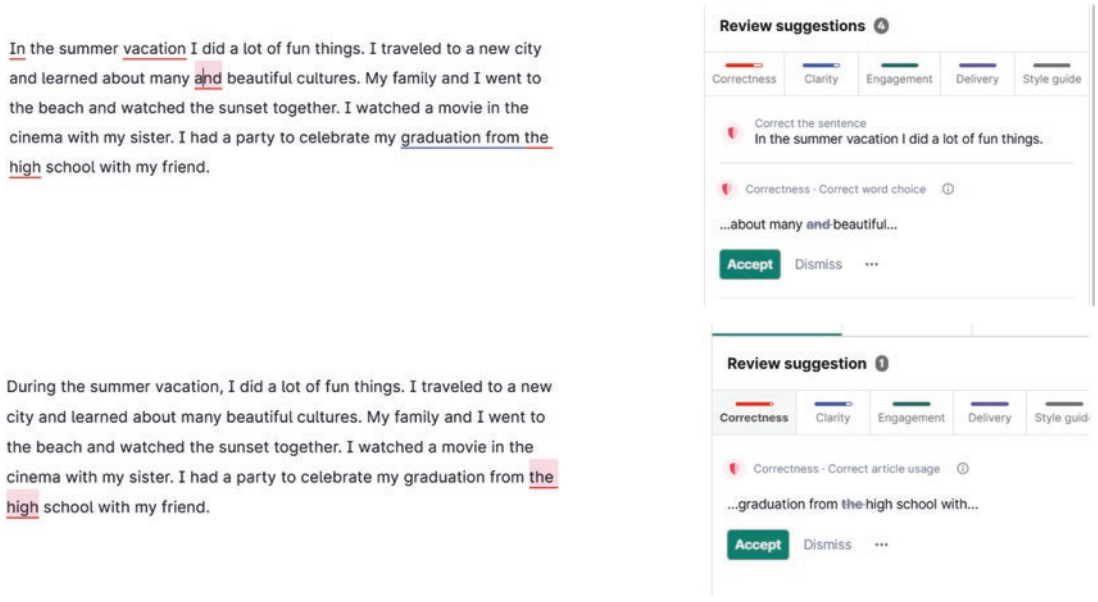

Figure 3 *Grammarly Feedback on Mechanics and Article Usage*

Similarly, statistically significant post-intervention differences in the self-efficacy scale were observed in the domains of organization and coherence (M =16.48 vs. M = 19.04) and self-regulation (M = 14.00 vs. M = 18.02), with the experimental group demonstrating stronger gains across all items. Improvements in organizational aspects (e.g., logical order, unity of paragraph, and development of argument) might be attributed to the combination of teachers' structured feedback via the ARCS-V model and iterative revisions prompted by automated feedback. Remarkably, changes in self-regulation were very pronounced, including goal setting, persistence, focus, and adherence to writing plans, suggesting that the ARCS-V motivational model played a central role in strengthening students' control over their writing processes. The relevance and confidence components embedded in the intervention likely supported sustained engagement during drafting and revision. This pattern aligns with studies reporting positive effects of ARCS-based instructional design on motivation and writing-related outcomes (e.g., Mirzaei et al., 2024; Xie & Zhu, 2023). However, as the present study did not isolate the independent contribution of each component, interpretations remain limited to the combined instructional approach.

The findings also indicate that the control group experienced improvements in writing skills and in the first three self-efficacy domains due to teacher feedback; however, no measurable progress was observed in their self-regulation domain as they were not exposed to any motivational models.

Conclusion

The results of the present study indicate that the use of Grammarly, alongside teacher feedback via the ARCS-V model, significantly improves students' writing skills and self-efficacy, which may be attributed to Grammarly's primary features: ease of use and accessibility. It helps students set their goals, identify the audience, and determine formality, tone, and intent. It offers immediate feedback on grammar, punctuation, spelling, word choice, and style, along with detailed explanations of the suggestions. Despite all these merits, in some contexts, it was unable to provide relevant suggestions. Meanwhile, it lacks the human touch and the encouraging, interactive atmosphere of class discussions with the teacher's feedback. Grammarly is an effective tool that is useful for both students and teachers, but it cannot replace the role of the teacher, which is highly crucial for refining and modifying students' writing. Integrating both types of feedback—human and machine—instead of relying on one source, was effective, as Grammarly helped correct grammatical errors, mechanics, punctuation, and word choice, which in turn saves the teacher time and effort. Meanwhile, it does not contribute to overall coherence, knitting, or refining thoughts, nor does it provide a clear explanation of specific rules in certain contexts. Therefore, the teacher's rich, contextualized pedagogical feedback, focusing on content and organization, filled the gap left by the machine in that area.

Writing is one of the most complex skills that requires students to be highly motivated and interested in practicing. Therefore, the current study integrated the ARCSV motivational model with Grammarly and teachers' feedback to improve their writing performance and self-efficacy. It creates a supportive, engaging, and stimulating learning environment, which in turn keeps students motivated, encourages them to self-regulate whether inside or outside the classroom, and helps to overcome their fear of writing. The attention, relevance, confidence, satisfaction, and volition aspects work together to provide engaging and up-to-date topics for writing, discussion, and addressing their repeated errors through real examples. This environment creates a supportive and enthusiastic atmosphere where their self-confidence increases and writing anxiety decreases, leading to a sense of satisfaction that they have achieved. The current study's findings emphasize the importance of incorporating technological resources, human feedback, and motivational techniques to improve the writing skills and self-efficacy of EFL learners.

Implications and Limitations

The current study has substantial implications for how to teach EFL writing. First, using automatic written corrective feedback (AWCF) tools, such as Grammarly, in combination with teacher feedback, could create an approach that works better than either alone to help students improve their writing abilities. Based on the study results, integrating multiple sources of feedback may be beneficial in supporting students' writing development. In particular, the combined use of automated feedback and teacher-guided support may help address both lower-order and higher-order writing skills, as reflected in the observed improvements across writing subskills. Therefore, EFL teachers are encouraged to adopt a blended feedback approach, incorporating AWCF tools alongside structured teacher feedback, to enhance students' writing performance.

Second, the integrated use of the ARCS-V motivational model, alongside automated written corrective feedback and teacher feedback, may contribute to enhancing students' self-efficacy and self-regulation in writing. Writing tasks should be interesting, connected to students' goals, needs, and context. Teachers should also provide an inspiring environment where students feel supported and encouraged to persevere and offer motivational strategies to help them overcome writing challenges.

Future research may benefit from using more advanced statistical methods, such as mixed-design ANOVA, to better capture interaction effects and control for error rates. As this study used a combined instructional approach with AWCF, teacher feedback, and the ARCS-V model, it did not isolate the independent contribution of each component. Interpretations are therefore limited to the overall effect of the intervention rather than the impact of each element alone.

The study has a relatively small sample size, which may limit the generalizability of its findings to broader EFL contexts. Moreover, the short duration of the intervention may not have been sufficient to capture the long-term effects of AWCF and ARCS-V possibilities on learners' writing development and self-efficacy. Therefore, the study illustrates directions for future research. Further studies could examine the long-term effects of combining AWCF, teacher feedback, and motivational models on students' writing development over a longer period and with a larger sample.

Use of Generative AI

This manuscript made use of Grammarly to assist in paraphrasing and improving the clarity of text. No AI tools were used for the generation of research hypotheses or the writing of conclusions. The final manuscript was authored and reviewed by the listed authors without additional AI input.

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