

## Article

# Impact of Automated Writing Evaluation on Writing Efficacy of English Majoring Students

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**Abstract:** We explored the impact of an automated writing evaluation (AWE) system on the improvement of the writing efficacy of English majoring students through a survey with three research questions. The AWE system enhanced the grammar proficiency, writing structure, and overall writing quality of the participants. However, while the participants acknowledged the system's effectiveness in providing appropriate feedback and facilitating writing improvement, there is room for enhancement in creativity and adherence to academic writing standards. Overall, the results highlighted the promising role of The AWE system in improving English language learners' writing skills, suggesting the necessity for further integration and refinement to optimize their effectiveness.

**Keywords:** Automated writing evaluation (AWE), Writing efficacy, English major students, Writing skills assessment, Educational technology

## 1. Introduction

In the digital age, educational technology has revolutionized teaching and learning methodologies across various disciplines. Among the myriad of innovations, automated writing evaluation (AWE) systems have emerged as a promising tool in language education. The AWE system leverages artificial intelligence (AI) and natural language processing (NLP) and provides real-time feedback and assessment of written compositions, enabling students to evaluate their writing skills for improvement. Feedback literacy is the theoretical framework of automated written corrective feedback (AWCF) (Xue, 2024). Wu *et al.* (2023) used a mixed method to explore English as a Foreign Language (EFL) teachers' endeavors to human-computer-AWE integral feedback innovation. They emphasized the development of Level 2 (L2) writing teachers' feedback literacy based on situated social practices.

Feedback literacy is associated with writers' cognitive engagement with AWE feedback (Giessler, 2023). In the past, most students or writers evaluated their writing ability based on their teachers' feedback to improve their writing skills. The AWE system helps students identify areas where they lack proficiency or need improvement. However, the key factor influencing their learning is not the feedback itself, but the extent to which students engage with and act on that feedback (Zhang, 2020).

Despite the promising potential of the AWE system to enhance writing skills, it is essential to examine the dynamics of its integration and effectiveness, particularly for English major students. Therefore, we formulated the following research questions.

- (1) How does the AWE system affect English major students' writing efficacy, specifically in terms of grammar proficiency, structural organization, and overall writing quality?
- (2) What are English major students' perceptions of the effectiveness of the AWE system in delivering feedback and supporting the development of writing skills?
- (3) How does the AWE system contribute to students' long-term improvement and adherence to academic writing standards, and how are these outcomes influenced by their acceptance, usage patterns, writing anxiety, and overall performance?

## 2. Literature Review

### 2.1. AWE and Educational Technology

AWE's effectiveness has been extensively researched. McNamara and Kendeou (2022) constructed a framework to instruct students to practice writing. The researchers explained that the electronic AWE (e-AWE) was essential for the students. However, they emphasized that e-AWE systems needed to integrate advanced technologies into the AWE system, such as speech recognition

and gamification. Essentially, the e-AWE system exemplifies that cutting-edge technologies need to be integrated into education. Hibert (2019) reviewed 29 studies on the use of AWE in English as a Second Language (ESL)/EFL classrooms conducted between 2007 and 2018. He identified two issues: First, current research on AWE often neglects theoretical frameworks used in other educational technologies. Second, such research frequently replicates methodologies from general written corrective feedback research, failing to exploit the unique functionalities of the AWE system. Hibert also noted a lack of theories on technology adoption and integration in classrooms, as well as a lack of exploration into methodologies using the advanced technology. In 2023, Li utilized activity theory to examine participants' reflections on improving writing skills in an AWE system. Li suggested that aligning AWE with activity theory leads to meaningful pedagogical implications.

## 2.2. AWE and Writing Improvement

Lee (2020) performed a longitudinal study to track how two Korean university students improved their writing skills through AWE. In the study, the students drafted and revised their writings. In the beginning and the end, the two students were tested with the Test of English for International Communication (TOEIC) writing to assess the degree of their writing development. Their scores, errors, and quantitative measures of fluency and grammatical complexity were evaluated. The results showed that AWE feedback led to long-term enhancements of writing skills, indicating the advantage of AWE in writing exercises outside of class. Palermo and Wilson (2020) developed an AWE system, MI Write, and conducted a mixed-methods study to investigate the system's effectiveness in middle school students' writing. MI Write was incorporated into a traditional process-based approach and a strategy instruction model based on the self-regulated strategy development framework. The results showed that participants' writing performance significantly improved, and AWE was integrated with its characteristics consistent with the models, which was well-suited to deliberate practice. Wei *et al.* (2023) randomly selected 190 Chinese EFL students to explore the efficacy of training using AWE. They evaluated the impact of AWE training, utilizing Grammarly, an AI-driven platform, on multiple facets of writing skills. The improvement in task achievement, coherence and cohesion, vocabulary usage, and grammatical accuracy was assessed, and the results highlighted that learners' initial proficiency levels were important for their improvement in writing performance.

## 2.3. Impact of AWE on Writing Skill and Student Engagement

Digital literacy plays a significant role in writing performance. Ul Hassan and Akbar (2020) found a substantial connection between teachers' technological literacy and student academic success, indicating that teachers' technological literacy contributed 43% to students' overall academic achievement. This highlighted the importance of digital literacy. Higher levels of digital literacy are associated with students' engagement in writing. Moreover, digital literacy has become indispensable in language teaching and learning, as reading, writing, and communication are increasingly conducted and mediated by digital technologies (Zhang & Hyland, 2023). Students' digital literacy proficiency also significantly impacted their engagement with AWE, regardless of their second language proficiency level. Other than strong digital literacy, engaging with feedback from AWE is crucial for enhancing writing skills. Liu and Shao (2024) investigated the effectiveness of different web-based feedback, automatic feedback (AF), automatic feedback supplemented with teacher feedback (TF), and automatic feedback supplemented with peer feedback (PF), on the Pigai website, an AWE system. All modes improved writing skills across different proficiency levels. In the early age of learning English, teacher feedback plays an important role because they sufficient information and comments to motivate the students to enhance their writing ability (Pourdana & Asghari, 2021). Advanced technology enables AWE to be used, which automatically generates feedback and provides a better version of a draft. Researchers have investigated students' writing efficacy improvement with AWE. Ngo *et al.* (2024) conducted a three-level meta-analysis to explore the effectiveness of AWE in EFL or ESL. They found that AWE was helpful for vocabulary usage and enabled studying with peers. These results indicated that AWE is a beneficial tool for EFL or ESL students.

However, the overall impact of integrating AWE into instruction on learners' writing remains inconclusive. This is partly due to the diverse characteristics and needs of heterogeneous learners (Xu & Zhang, 2022). In other words, while AWE generally aids in improving writing skills, it is not generally accepted or beneficial for learners.

## 3. Method

### 3.1. Participants

50 sophomores majoring in English at a technology university in Taiwan participated in this study. Lin *et al.* (2018) investigated the reason why students felt anxiety in English writing. He identified five factors, including time restriction, teacher evaluation, peer competition, uninteresting topics, and correct format. The traditional method to improve writing ability is teachers'

feedback. We investigated the students' acceptance of using AWE and whether the AWE system enhanced their writing ability. The participants' TOEIC scores were 500 or above. Almusharraf and Bailey (2023) investigated the relationship between self-reported TOEIC proficiency scores, gender, and study experience on foreign language anxiety. They posited that anxiety was inevitable in English language acquisition. The researchers also suggested that TOEIC Reading scores served as a measure of writing ability, and listening scores as that of speaking ability. Therefore, a student's overall English proficiency was inferred from their TOEIC Listening and Reading scores. They concluded that if anxiety in these areas was alleviated, AWE improved speaking and writing performance.

### 3.2. Data Collection

We employed the technology acceptance model (TAM) and a Likert scale in the questionnaire survey to gauge participants' satisfaction levels (e.g., strongly agree, agree, neutral, disagree, strongly disagree). The independent variable was the writing efficacy of English major students, while the dependent variable was the AWE system usage. The questionnaire was created, including 10 questions to explore how AWE helped enhance the participants' writing ability across various aspects (Table 1).

We formulated research question 1 to examine the improvement of general writing skills and performance when using AWE. This aligns with research by Sun and Fan (2022), who surveyed the impact of AWE-aided assessment in a business writing course. Their results suggested that AWE systems helped improve language and organization in student writing, thus prompting this question to assess sophomores' acceptance of AWE for writing improvement. Question 2 was designed to examine grammatical performance. Waer (2023) found a negative correlation between writing apprehension and grammatical performance, as several learners lacked confidence due to difficulty in understanding grammar principles and fear in making mistakes. We determined if AWE improved the grammatical accuracy of the participants. Question 3 was formulated to investigate the impact of AWE on logic and organization, connecting to self-judgment and overall writing performance (Ling *et al.*, 2021). Question 4 was designed to explore the role of AWE. Given that AWE provides immediate feedback and suggests improved versions of drafts, we examined whether such feedback fostered student engagement in writing. Koltovskaia (2020) observed the varying levels of student engagement with automated writing corrective feedback (AWCF), implying that more positive feedback motivated students' interest in writing with AWE. Question 5 was designed to delve into vocabulary application and expression with AWE. Generally, a foundational vocabulary and understanding of grammar are essential for composing sentences and developing writing ability. Chen *et al.* (2022) found that a process-oriented approach with AWE helped students train for vocabulary and sentence structures, potentially leading to creative output. Question 6 was formulated to examine how AWE contributed to originality and creativity in writing, suggesting its potential to enhance the capacity for creative composition. Questions 7 and 8 were added to assess the overall effectiveness of AWE, regarding the suggestions and frequency of the AWE system for generating high-quality compositions. Wilson *et al.* (2023) reported that students showed positive reflection through AWE and goal-setting instruction, helping them achieve their desired writing improvements. Questions 9 and 10 aimed to confirm the perceived benefits and overall effectiveness of using AWE. With readily available information, AWE's efficacy was evaluated to validate students' responses regarding AWE's role in improving their writing performance (Table 1).

**Table 1.** Research Questions to assess effectiveness of AWE system.

Number	Question
1	I believe that using the AWE system can effectively enhance my English writing skills.
2	The AWE system is very helpful in assisting me to understand and correct grammar errors.
3	I believe the AWE system can enhance the clarity of my writing structure and logic.
4	I feel that the real-time feedback from the AWE system is crucial for improving my writing skills.
5	After using the AWE system, I have seen improvement in my vocabulary selection and expression in writing.
6	I believe that the AWE system is helpful in enhancing the originality and creativity of my writing.
7	I find that the AWE system is highly effective in providing specific suggestions for writing improvements.
8	I believe that regularly using the AWE system can help me independently produce high-quality English writing.
9	I believe that the AWE system is very helpful for learning and adhering to academic writing standards.
10	I believe that by using the AWE system, I can more effectively self-correct and improve in any form of English writing in the future.

### 3.3. Data Analysis

We categorized the research questions into four dimensions: general effectiveness of the AWE system in writing improvement, enhancement of creativity and originality, specificity and effectiveness of feedback, and academic writing and future improvement. The first category was related to how the AWE system enhanced writing skills (Parra and Calero, 2019) to examine feedback regarding AWE's contribution to writing improvement. The second category was related to how the AWE system supported creative writing. Jatin *et al.* (2023) described the AWE system as a convenient tool for developing students' writing, particularly their creativity. The participants in their study highly valued AWE's features, such as unlimited revision, interactivity, and immediate feedback. The third category was related to the quality and impact of AWE-provided feedback. Shi *et al.* (2022) observed a correlation between student engagement and the AWE system's feedback, implying that students' enthusiasm for using AWE progressively improved their writing proficiency. The final category was related to how the AWE system alleviated writing anxiety and enhanced writing performance in the long term. The quantitative data collected from the questionnaire survey were analyzed using SPSS to explore the reflections of English-major sophomores on their experiences with the AWE system (Table 2).

**Table 2.** Categorization of dimensions in the assessment of the AWE system.

Dimension	Question
General effectiveness of the AWE system in writing improvement	Q1: Writing skills
	Q2: Grammatical errors
	Q3: Structure and logic
	Q4: Instant feedbacks
	Q5: Vocabulary and expression
Enhancement of creativity and originality	Q6: Creativity and originality
Specificity and effectiveness of feedback	Q7: Specific suggestions
Academic writing and future improvement	Q8: High-quality English writing
	Q9: Academic writing standards
	Q10: Self-correctness

## 4. Results

The descriptive statistics of the survey results are presented in Table 3.

**Table 3.** Descriptive statistics of questionnaire survey results.

Dimension	Question	Number (N)	Mean (M)	Standard Deviation (SD)	Ratio of Agreement
General effectiveness of the AWE system in writing improvement	Q1: Writing skills	50	3.82	0.629	58%
	Q2: Grammatical errors	50	4.20	0.606	60%
	Q3: Structure and logic	50	3.86	0.729	46%
	Q4: Instant feedbacks	50	4.06	0.682	54%
	Q5: Vocabulary and expression	50	4.06	0.652	64%
Enhancement of creativity and originality	Q6: Creativity and originality	50	3.72	0.858	44%
Specificity and effectiveness of feedback	Q7: Specific suggestions	50	4.12	0.627	60%
General effectiveness of AWE system in writing improvement	Q8: High-quality English writing	50	4.10	0.614	62%
	Q9: Academic writing standards	50	3.94	0.740	52%
	Q10: Self-correctness	50	4.00	0.639	60%

The effectiveness of the AWE system in writing improvement showed the highest mean score ( $M = 4.20$ ). 60% of the participants thought the AWE system decreased their grammatical errors. The AWE system helped the participants understand the principles and application of grammar in writing. The second highest score was observed for Q4 and Q5 ( $M = 4.06$ ). 54 % of the participants agreed that the AWE system increased their levels of writing ability with its feedback, and 64% of the participants expressed that they gained the skills for proper application of vocabulary. The lowest mean score was obtained for Q1 ( $M = 3.82$ ).

In the general effectiveness of the AWE system in writing improvement, the highest-rated variable was the AWE system's ability to assist students in understanding and correcting grammar errors ( $M = 4.20$ ), as 60% of the participants thought that it reduced grammatical mistakes and improved their application of grammar principles in writing. The importance of real-time feedback ( $M = 4.06$ ) and vocabulary improvement ( $M = 4.06$ ) scored higher than other variables. 54% of the participants acknowledged that the AWE system enhanced their overall writing abilities through corrective feedback, while 64% reported improved vocabulary usage and expression. The lowest-scored variable was the system's overall impact on English writing skills ( $M = 3.82$ ). However, 58% of the participants believed that the AWE system strengthened their English writing (Table 4).

**Table 4.** Item-level analysis: general writing improvement dimensions.

Number	Question
1	I believe that using the AWE system can effectively enhance my English writing skills.
2	The AWE system is very helpful in assisting me to understand and correct grammar errors.
3	I believe the AWE system can enhance the clarity of my writing structure and logic.
4	I feel that the real-time feedback from the AWE system is crucial for improving my writing skills.
5	After using the AWE system, I have seen improvement in my vocabulary selection and expression in writing.

The results of the enhancement of creativity and originality and the specificity and effectiveness of feedback, which corresponded to the research question number two, are presented in Tables 5 and 6. For Q6 ( $M = 3.72$ ) and Q7 ( $M = 4.12$ ), 60% of the participants thought that the feedback from the AWE stimulated their interest in writing. For creativity and originality, the participants rated the AWE system's contribution moderately ( $M = 3.72$ ). While 44% acknowledged that the system enhanced the originality of their work and fostered creativity, a room for improvement was pointed out. In terms of feedback effectiveness, participants scored the system highly ( $M = 4.12$ ), with 60% agreeing that the AWE system's specific suggestions significantly stimulated their interest in writing and contributed to improving their skills.

**Table 5.** Perceived impact on creativity and feedback specificity.

Category	Question	N	M	SD	Agree
Enhancement of Creativity and Originality	Q6: Creativity and originality	50	3.72	0.858	44%
Specificity and Effectiveness of Feedback	Q7: Specific suggestions	50	4.12	0.627	60%

**Table 6.** Creativity and feedback specificity.

Number	Question
6	I believe that the AWE system is helpful in enhancing the originality and creativity of my writing.
7	I find that the AWE system is highly effective in providing specific suggestions for writing improvements.

The research question 3 was related to academic writing and future improvement (Tables 7 and 8). The highest mean score was observed for Q8 ( $M = 4.10$ ). The lowest mean score was observed for Q9 ( $M = 3.94$ ). 52% of the participants said that they did not have much experience in writing academic writing, so they did not know the rules of academic writing. The potential of the AWE system to help students independently produce high-quality English writing was scored high ( $M = 4.10$ ), with 62% of the participants acknowledging its convenience and effectiveness in refining drafts into better versions. The system's role in teaching and reinforcing academic writing standards scored lowest ( $M = 3.94$ ). While 52% of the participants recognized its usefulness, many lacked sufficient experience in academic writing, which limited their understanding of these standards.

**Table 7.** Academic writing and application perceptions.

Category	Question	N	M	SD	Agree
Academic Writing and Future Improvement	Q8: High-quality English writing	50	4.10	0.614	62%
	Q9: Academic writing standards	50	3.94	0.740	52%
	Q10: Self-correctness	50	4.00	0.639	60%



**Table 8.** Future writing development.

Number	Question
8	I believe that regularly using the AWE system can help me independently produce high-quality English writing.
9	I believe that the AWE system is very helpful for learning and adhering to academic writing standards.
10	I believe that by using the AWE system, I can more effectively self-correct and improve in any form of English writing in the future.

## 5. Conclusions

We surveyed if the AWE system improved writing efficacy of English major students at a technical university in Taiwan, in this study. The results showed that the AWE system significantly enhanced grammar proficiency and vocabulary. A majority of participants (60%) found it helpful in understanding and correcting grammatical errors. Similarly, 64% acknowledged improvement in their vocabulary selection and expression. The system's real-time feedback was also highly valued, with 54% of participants agreeing it was crucial for improving overall writing skills. While the AWE system's impact on creativity and originality was less pronounced (44%), it provided specific suggestions for writing improvements. 60% of the participants found the system highly effective in offering targeted feedback, highlighting its utility in guiding users toward better writing. The participants generally held a positive outlook on the AWE system's long-term benefits for writing skill improvement. 62% believed that regular use helped them write high-quality compositions independently. 52% regarded the system's helpfulness in learning and adhering to academic writing standards, and their limited experience hindered more effective use.

English major students perceived the AWE system positively, particularly its impact on grammar proficiency, writing structure, and overall writing quality. Although there is room for improvement in creativity enhancement and academic writing standards, most participants recognized the AWE system's value in terms of specific feedback and writing improvement over time. Continued integration and refinement of the AWE system are necessary to enhance the effectiveness of the AWE system in supporting English language learners.

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