

TRANSFORMATIVE ASSESSMENT IN ACADEMIC WRITING: AI-BASED FEEDBACK SYSTEMS WITH ADAPTIVE RUBRICS

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Abstract. *This study analyzed the effect of AI feedback on students' writing skills, providing reliable and impartial assessments. The study assessed the capability of artificial intelligence to provide feedback and conducted a comparative analysis with conventional methods employed for enhancing student writing skills. Sixty-three students in the Academic Writing course at the Modern College of Business Science were selected as the sample, of which 14 actively participated in focused discussions. A combination of pre-tests, post-tests, and rubrics aligned with course objectives served as the primary research tools, ensuring the feedback remained relevant. One group received feedback based on AI, while another received traditional feedback. Additionally, qualitative data was collected through focused discussions to gain deeper insights. The results suggest combining adaptive rubrics with AI-based feedback can enhance assessment methods and retention. These findings are expected to significantly contribute to the future use of AI in education, as there is substantial potential to transform feedback and assessment across various educational contexts.*

Key words: *AI-based feedback, writing skills, educational assessment, adaptive rubrics*

1. INTRODUCTION

Artificial Intelligence has emerged as a transformative technology across various domains, and the education sector is experiencing its sustainable implementation impact. AI can offer innovative methods to assess students and enhance the learning experience within an educational context. It provides tools for evaluating improvements in students' academic writing skills and gives personalized feedback suited to each learner, thereby simplifying evaluations. AI-powered feedback is highly suitable for evaluating a large number of writing assignments, demonstrating significant potential for efficiently assessing numerous students. Many applications exist for AI technology in education, from developing intelligent learning systems to automating student assessments. These technologies can be scaled and adapted for creating and implementing assessments in various countries (Hamon et al., 2022). AI writing assessment tools are designed to provide timely, consistent, objective, and relevant feedback, acknowledging their role as writing aids. This feature is handy for big classes where students do not receive as much

Submitted January 13th, 2025, accepted for publication February 26th, 2025

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individual attention from their teachers because of the time needed for constructive feedback. AI technologies can be integrated with rubrics to give appropriate feedback and assist effective learning. This alignment also helps maintain the reliability and independence of the assessment process, ensuring that students receive meaningful feedback aligned with their learning goals (U.S. Department of Education, 2023). However, these considerations allow for a response to the growing demand for efficient and reliable feedback methods in EFL and EST contexts. Teachers' comments on students' works represent traditional feedback, which has drawbacks like time constraints, subjectivity, and vagueness. This study investigates the influence of AI-based feedback on EFL students' writings to understand how AI could improve student feedback's timing, consistency, and objectivity. The findings of this research can result in the development of improved assessment tools that enhance student learning and elevate EFL educational outcomes. Furthermore, modifying rubrics and employing AI-driven feedback techniques can improve feedback quality, ensuring it aligns with the standard requirements and objectives of the writing courses, thereby streamlining the assessment process. The findings of this study hold significant implications for education, particularly in leveraging AI technologies to assess and provide academic writing feedback across various contexts. Such innovative feedback methods significantly enhance students' writing skills development. Although traditional feedback methods continue to possess significant value for students, they frequently prove inadequate due to their time-consuming nature, subjectivity, and inconsistency. These factors highlight the need for better ways to provide students with timely, objective, and constructive feedback. AI-based feedback methods can help improve students' writing by providing consistent and timely feedback. Therefore, this study primarily aims to analyze the effects of AI-based feedback on the writing competencies of college students. More specifically, it tries to:

1. assess the effectiveness of AI-based feedback in improving students' writing skills;
2. compare the effectiveness of AI-generated feedback with traditional feedback methods to identify any differences.

To guide this research, the following two hypotheses have been proposed:

(H1): AI-based feedback offers more precise evaluations of academic writing than traditional feedback methods.

Hypothesis

(H2): Traditional feedback is productive and positively enhances students' writing skills.

2. LITERATURE REVIEW

Since artificial intelligence (AI) has taken a vital role in educational assessment and enhancing student learning, this section reviews the relevant literature on AI role in evaluating EFL students' writing. Many researchers highlight AI disruptive potential in academic assessment. For instance, Kakungulu, Samuel J. (2025) emphasizes the scalability of AI and its rapid responses, while also cautioning about concerns related to academic integrity. In their study, Hooda et al. (2022) analyzed the significance of the I-FCN algorithm on student metrics during COVID-19. Additionally, Conway (2024) describes AI interfaces as complements to rubrics, promoting fair assessments. However, Pang and others stress the effective use of language and comprehensive staff training in AI systems. AI methods enhance student engagement and feedback quality; for example, Sundari et al.

(2025) found that Indian academicians view AI methods positively despite concerns about reliability. Guo et al. (2024) introduce EvalMate, an AI peer review system that enhances the quality of reviews. Additionally, Guo et al. (2024) explore the impact of AI on learning English as a foreign language, discovering that AI-enhanced feedback significantly boosts communication and writing skills. According to Fahmy (2024), students appreciate AI evaluation tools, although the feedback can influence their motivation and emotions. Mahamuni, Parminder, and Tonpe (2025) emphasize AI potential to improve assessment fairness and accuracy while raising ethical concerns. Even though AI-based rubrics simplify grading, using AI to assess writing comes with new challenges. These challenges span human language intricacies, bias, and fairness issues, restrictions, proper rubric application, and providing effective feedback (Hooda et al., 2022; Pang, Kootsookos, & Cheng, 2024). Kassorla (2024) argues that to address some of these challenges better, the rubric criteria must align with the course objectives and the capabilities of AI, as well-designed rubrics enhance evaluation transparency and quality (Olson & Krysiak, 2021). From their perspective, Almegren et al. (2024) assert that human evaluations are rated higher than those of AI despite AI constructive feedback. In line with this, Llamas-Nistal et al. (2013) emphasize that ChatGPT shows proficiency in grammar and language fundamentals; however, human assessors possess a more remarkable ability to maintain core themes. This insight raised by Llamas-Nistal and others has been illuminated by Rasul et al. (2023) when exploring the challenges and advantages of ChatGPT in higher education and foreign language assessments. Furthermore, Álvarez Valdivia et al. (2018) emphasize that rubrics enhance the standards of argumentative writing by allowing for objective evaluation without regard to differences in content (Correnti et al., 2022). Another study views that AI has transformed education facilitating assessment and granting teachers more freedom (Wang et al., 2023). Reinforcing this point, Austin et al. (2023) assert that AI analyzes data for more objective evaluations, thereby reducing bias. Devi et al. (2023) analyzed the impact of artificial intelligence grading on ethical standards, uncovering potential biases that may lead to inconsistent results.

Many relevant studies examine AI-generated feedback impact on students' writing. For example, Kakungulu and Samuel (2024) note that AI tools offer efficient, personalized educational evaluations. Benefits include improved feedback and assessment types, but challenges like academic integrity persist. Hooda et al. (2022) find that AI enhances feedback speed and accuracy in higher education, with the I-FCN algorithm outperforming others. The pandemic shifted focus to evaluating tools to improve student learning outcomes. Conway (2024) mentions that AI has transformed rubrics into robust systems supporting differentiated learning. This personalized feedback promotes fair assessments while maintaining academic standards. Pang, Kootsookos, and Cheng (2024) explore AI feedback tools in non-English-speaking nations, highlighting the impact of individual and language characteristics on feedback strategies. Sundari et al. (2025) find educators view AI-enhanced metrics positively, while concerns about algorithm reliability and bias remain. Guo et al. (2024) introduce EvalMate, which improves peer review quality through AI. Their study of 44 Chinese students demonstrates that AI feedback encourages better commenting strategies. The effectiveness of AI in EFL writing is further supported by Guo et al. (2024), which reveals that AI-assisted peer feedback improves feedback quality and writing skills in 124 students. Guo (2024) presents a refined peer review model using ChatGPT, highlighting AI potential to enhance peer feedback. Talan and Kalinkara (2023) discover that AI increases student motivation through personalized feedback despite mixed feelings regarding its impact on peer

relationships. Finally, Mahamuni et al. (2025) stress the importance of ethical regulations for AI assessment technologies, particularly concerning accuracy and privacy.

Although the existing literature on AI-based feedback highlights its potential to transform educational assessment and feedback systems, few studies evaluate the effectiveness of these systems in higher education writing. Most of the literature has focused on a general assessment of educational activities or other aspects of AI in education. However, it has not fully addressed the specific needs of academic writing. Additionally, the research on the effectiveness of writing feedback using AI technologies compared to traditional approaches in student writing at higher education institutions is relatively limited. It is crucial to tackle these gaps to comprehend AI influence on enhancing academic writing in higher education and to improve current assessment tool features. Due to these gaps, the study raises the following question:

1. Which method provides better insights into college students' academic writing: AI-based or traditional feedback?

3. METHODOLOGY

The study included 63 students from the ENG 101 course at Modern College of Business and Science in fall 2024. They were randomized into an experimental group using Copilot feedback (32 students) and a control group receiving traditional feedback (31 students). Randomization used a random number generator to eliminate assignment bias. The sample represented diverse ages and genders among the course students.

The study utilized a combination of tools to collect the data required for assessing the effectiveness of feedback mechanisms. At the beginning of the semester, both groups took a pre-test and subsequently completed a final post-test to gather data on their writing. An AI-based feedback system, using specific rubric criteria, assessed the essays of the experimental group, while the control group received instructor feedback based on the same rubric. By the end of the semester, some students from both groups took part in the focus group discussions to provide qualitative data regarding the feedback mechanisms and feedback effectiveness.

The study used quantitative and qualitative approaches to evaluate AI-based and traditional feedback methods. Participants writing improvements in both groups were assessed by comparing pre-and post-test scores. Group discussions were analyzed to identify themes and sentiments about the feedback. These discussions provided insights into students' experiences with AI-based feedback versus traditional methods. The qualitative analysis aimed to determine perceived improvements in writing skills and the impact of feedback on academic performance.

4. RESULTS AND DISCUSSION

The figures and tables below compare the experimental and control groups' pre-test and post-test writing skills, highlighting the observed changes. The focus group findings will then be analyzed and discussed qualitatively.

4.1. Results Discussion

The data in Figure 1 and Table 1 show that AI-based feedback through Copilot significantly enhances students' writing skills, with an average improvement score of 10.50. This suggests that most students benefit from AI-based rubric feedback, as evidenced by a standard deviation of 3.00 and improvement scores ranging from 5 to 14. Variations in scores may result from differing writing skills and receptiveness to feedback. Additionally, pre-test scores increased from 68.75 to a post-test average 79.25, underscoring students' commitment to enhancing their writing. AI-based feedback systems like Copilot provide immediate, factual suggestions, which is especially valuable in large classrooms where teachers may struggle to give adequate feedback. These systems enhance individualized learning, ensure uniform assessments, and reduce biases found in human grading. They can support more students without compromising quality feedback. Further research on the long-term effects of AI feedback across disciplines is advisable. In conclusion, the results from the experimental group confirm that AI-based feedback effectively aids college students in improving their writing, supporting Hypothesis 2 (H2) that AI feedback exceeds traditional methods and advocates for adopting AI tools in education. This integration can notably enhance student achievement, as demonstrated by this study.

Table 1 Experimental Group Pre-Test, Post-Test Statistics (AI-Rubric Feedback)

Statistic	Student_ID	Pre_Test_Score	Post_Test_Score	Improvement
count	32	32	32	32
mean	16.5	69.5625	79.125	9.5625
std	9.38083152	5.769427209	6.752538352	2.993945503
min	1	60	66	5
25%	8.75	65.75	74.5	6.75
50%	16.5	70	79	9.5
75%	24.25	74	83.25	12
max	32	79	93	14

Experimental Group Pre-and Post Test and Improvement

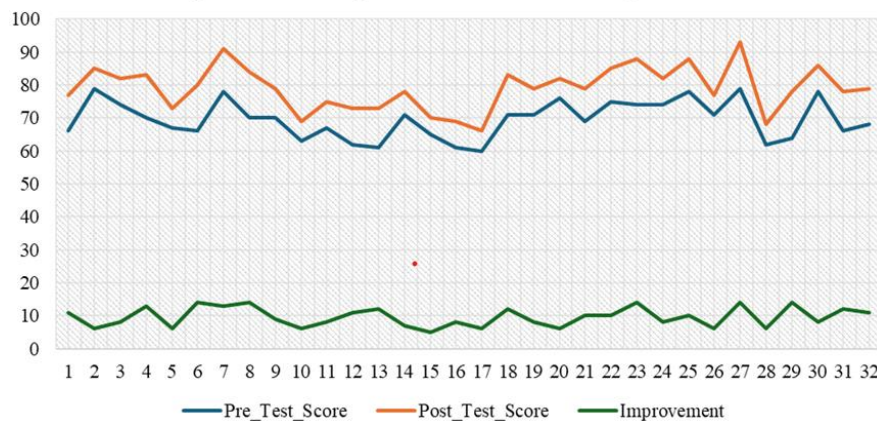


Fig. 1 Experimental Group Pre-and Post-Tests and Improvement (AI-driven Feedback)

4.2. Traditional Feedback Pre-Test and Post-Test Statistics

Table 2 and Figure 2 present data comparing pre-test and post-test writing scores in the control group to illustrate the effectiveness of traditional feedback methods.

4.2.1. Results and Discussion

Using the conventional feedback model, the control group data proves its effectiveness in enhancing students' writing skills. As shown in Figure 2 and Table 2, students exhibited moderate improvement, with a mean score of 6.39 (SD = 2.17). This improvement was consistent with moderate AI feedback, resulting in mean scores between three and nine. Writing skills progressed significantly, rising from 68.32 in the pre-test to 74.71 in the post-test. Though traditional assessments improved writing abilities, AI feedback was more effective. Many reported a positive impact on their skills, but the degree of improvement varied based on their responsiveness to feedback and initial proficiency. Personalization and granularity in traditional feedback can enhance learning, even if it takes longer in smaller classes, allowing instructors to provide tailored support. The variability in scores indicates that traditional feedback can address individual student needs. Different methods of traditional feedback add a personal touch, guiding students according to their unique situations. In well-resourced institutions, traditional feedback has shown effectiveness. The study concludes that these feedback systems outperform others in education. Access to teaching resources is crucial, as this study highlights their role in boosting performance metrics and suggests directions for future research. Control group results reinforce social cognitive theory, emphasizing the importance of feedback in students' writing performance. Despite the complexities of writing feedback, consistent improvements strongly support Hypothesis 2 (H2), underscoring traditional feedback vital role in education, allowing for adaptation to motivation, correction, guidance, and performance assessment related to subject knowledge.

Table 2. Control group pre- & post-test statistics (traditional feedback)

Statistic	Student_ID	Pre_Test_Score	Post_Test_Score	Improvement
count	31	31	31	31
mean	16	68.32258065	74.70967742	6.387096774
std	9.092121131	5.095011264	5.423366411	2.17067454
min	1	60	65	3
25%	8.5	66	71	5
50%	16	68	74	7
75%	23.5	72	78.5	8.5
max	31	78	85	9

4.3. Comparative Analysis

The experimental group shows higher mean and median improvements than the control group, indicating that AI-based feedback is more effective in enhancing students' performance. The experimental group also has a broader range of post-test scores and improvements, suggesting that AI-based feedback can lead to higher maximum gains. Both groups show positive improvements, supporting the hypotheses that both AI-based

and traditional feedback methods enhance students' writing skills. However, AI-based feedback appears to offer more precise and impactful evaluations, leading to greater overall improvement.

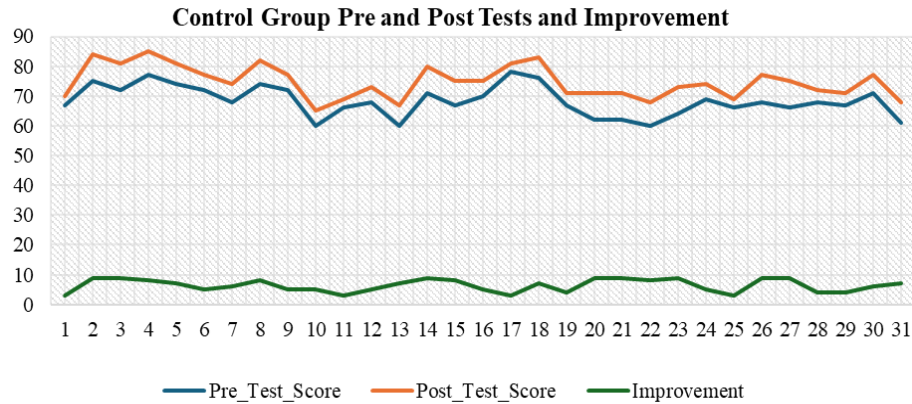


Fig. 2 Control Group Pre-and Post-Tests and Improvement (Traditional Feedback)

4.4. Focus Group Discussion and Qualitative Insights

4.4.1. Result Discussion

As shown in Table 3, focus group discussions revealed that students in the experimental group found AI-powered feedback more precise, realistic, and helpful than the standard feedback provided to the control group. Many participants noted that the feedback from the AI tool was self-explanatory and significantly enhanced their writing skills. Additionally, students felt that AI positively impacted their writing outcomes. While the control group did receive some favorable comments, their feedback was rated lower in clarity, usefulness, and impact. This indicates that, although traditional feedback methods can be effective, AI-based feedback tools can improve clarity and usefulness, fostering better writing skills. These insights underscore the benefits of AI-based feedback systems in education, assisting students in rapidly enhancing their academic performance. Future research should investigate the long-term effectiveness of these systems across various subjects. The focus group findings support Hypothesis 1 (H1), which asserts that AI systems outperform traditional methods, highlighting the transformative potential of AI feedback in education and providing students with precise, relevant insights.

Table 3. Quantitative Analysis of focus Discussion Views

Group	Clear and Easy to Understand	Somewhat Clear	Difficult to Understand	Highly Useful	Moderately Useful	Not Useful	Significant Positive Impact	Moderate Impact	Little to No Impact
Experimental	6	1	1	7	1	1	7	2	1
Control	7	2	1	6	3	1	6	3	1

5. CONCLUSIONS

The experimental group's results align with relevant studies, increasing confidence in AI-based feedback for learning. For example, Kakungulu Samuel J. (2025) highlights that AI assessments scale effectively, personalize learning, and save time, which is evident in the group's consistent improvement in writing skills. Similarly, Hooda et al. (2022) emphasize the significance of AI in delivering prompt, authentic feedback correlating with the observed advances in writing scores. Furthermore, Conway (2024) notes that integrating AI into rubrics shifts feedback away from rigid criteria, supporting practical learning and reducing biases. This is consistent with the experimental group's performance, where AI tools provided timely and effective feedback, as Pang et al. (2024) and Sundari et al. (2025) noted.

The study confirms the alternative hypothesis (H1), showing that AI feedback significantly exceeds traditional methods, with the experimental group achieving a mean improvement score of 10.50 compared to 6.39 in the control group. This validates the effectiveness of AI feedback regarding speed, objectivity, and personalization. The findings advocate for AI feedback systems in classrooms to enhance academic achievement, as traditional feedback (H2) improved from a pre-test mean of 68.32 to a post-test mean of 74.71, but remains inferior to AI feedback. Earlier sections raised issues such as gaming and equity, highlighting the need for more research into AI feedback systems. The focus of this study on AI feedback through texts and visuals reinforces its educational credibility, contingent upon overcoming challenges. It supports the (H1) hypothesis that AI-driven feedback is better for writing skills, as evidenced by the significant advancement of the experimental group over non-users. Based on these conclusions, the research recommends:

1. training educators on using AI tools, ensuring reliability, and addressing bias;
2. supervising AI use to enhance traditional feedback;
3. tailoring AI feedback to meet individual student needs for grading fairness;
4. evaluating and refining AI feedback tools for effectiveness using plagiarism checks.

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