

AI-Based Automated Writing Feedback System for Student Revision Support

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Abstract

Feedback is a critical component of the writing learning process, but students often do not receive feedback in sufficient quantity or quality. Comments may be delayed or insufficiently detailed, making it difficult for students to understand how to revise their work. This paper presents an AI-powered writing feedback system designed to provide immediate, revision-oriented feedback to students. The platform focuses on three writing dimensions: Ideas and Supported Opinions, Organization and Structure, and Writing Competence. Rather than generating writing for students, the system provides feedback intended to guide students as they evaluate and revise their own work. The system was piloted in collaboration with SEA Literacy, a nonprofit serving under-resourced and refugee students, including a live writing workshop with approximately a dozen participants. In total, 20 users received feedback on 54 essays, and approximately 81% reported that the feedback was helpful. The pilot suggests that AI-assisted writing feedback systems may support access to timely writing guidance, particularly in settings where individualized teacher feedback may be limited. The system is not intended to replace teachers or writing mentors, but to provide consistent, structured feedback that can support student revision.

Keywords

Artificial Intelligence, Automated Writing Feedback, Educational Technology, Literacy Education, and Student Revision.

1. Introduction

As an instructional strategy, writing feedback is one of the most critical tools for student learning and academic development. Good quality feedback helps students understand their weaknesses, particularly with respect to organization, use of evidence, clarity, grammar, and argumentative structure, among others. However, in the majority of learning environments, there are constraints that limit prompt and individualized writing feedback. For instance, large classes take large amounts of time to write feedback comments, have limited resources, and lack individualized support for students. Moreover, many students have to wait for days to receive feedback on their written work, which hinders the immediate application of feedback for revision and learning.

Most importantly, students face several challenges in receiving timely and individualized writing feedback, challenges that are often outside of the control of the classroom environment. For example, feedback on assignments may not be received for days, often for days after the student has submitted the work, and then the opportunity for revision and improvement is limited. Opportunities for improvement are often further limited, as under-resourced students do not have individualized writing assistance outside of the classroom to supplement what occurs within it.

New educational assistance systems based on artificial intelligence and large language models are emerging and are being used in a wide variety of educational settings to support individual learners. Current AI-based educational

technologies are able to provide contextual recommendations, point out structural errors, and provide individual user guidance. Such systems aim to support learners in their learning process and teachers in classrooms. Many of these systems are able to provide feedback to learners more quickly than instructors, which can support a revision-oriented writing process.

Although AI-assisted educational technologies provide significant opportunities for personalized learning support, important concerns remain regarding their implementation in educational settings. Researchers have raised concerns regarding hallucinated information, overreliance on AI systems, academic integrity, and the overall quality and reliability of AI-generated educational guidance. As a result, responsible implementation and careful evaluation remain critical areas of ongoing research.

This paper outlines the design, deployment, and pilot of an AI-based automated writing feedback system intended to aid writers in revising and strengthening their writing. The system is a publicly accessible web application that provides writers with actionable feedback that is aligned with typical writing evaluation criteria. This pilot was implemented with students participating in SEA Literacy programs, a non-profit organization that supports under-resourced learners.

1.1 Research Objectives

- RO.1 To design and deploy an AI-based automated writing feedback platform for student use.
- RO.2 To evaluate whether students perceived the generated feedback as helpful and actionable.
- RO.3 To explore the role of AI systems in improving accessibility to revision-oriented educational support.
- RO.4 To analyze preliminary platform usage metrics and pilot implementation outcomes.
- RO.5 To identify current limitations and future opportunities for AI-assisted educational technologies.

These objectives were addressed through the development and public deployment of the AI-based writing feedback platform, pilot implementation through SEA Literacy workshops, collection of user interaction analytics, and analysis of participant helpfulness responses. The study evaluated both technical deployment outcomes and preliminary educational engagement metrics to assess the effectiveness and accessibility of the system.

2. Literature Review

Writing feedback is a major factor for student learning and their academic achievement. Feedback that informs students of their current level of performance and the goals that they are striving to meet, as well as actions that need to be taken in order to meet those goals, is one of the most powerful influences on learning, according to Hattie and Timperley (2007). Within the field of writing instruction, giving students structured feedback has been found to aid students in improving their organization, their writing's clarity, their argument or position, and overall writing quality. Writing interventions that are specifically designed to target writing and to give students the opportunity to revise their work have been found to have a particularly positive effect on students' writing (Graham and Perin, 2007). Wiliam (2011) similarly argues that assessment and feedback are most effective when they directly support ongoing learning and revision rather than merely evaluating final performance.

The growth of educational technology has led to the development of Automated Writing Evaluation (AWE) and Automated Essay Evaluation (AEE) systems that can provide students with extensive writing support. AEE systems are defined by Shermis and Burstein (2013) as computer programs that analyze written work and then provide written feedback that covers several dimensions, including grammar, organization, and mechanics. AEE systems have become very popular in recent years because they are able to provide instant feedback to students on work that they submit. Unlike teachers, AEE systems can provide feedback to students on a very large scale, and the feedback can be provided very quickly, often within minutes, thereby reducing the delay between a student submitting work and receiving feedback on that work. Warschauer and Grimes (2008) reported on research that they conducted that investigated the use of AEE systems to support student revision, and found that students were able to use the feedback provided by the AEE system to make instant revisions to their work.

A few intelligent tutoring systems have been created for writing as well. The system WritingPal is a web-based intelligent tutoring system that supports students through automated writing feedback as well as through instructional support. In a pilot study, Roscoe et al. (2014) evaluated the usability and engagement of WritingPal. Students used the system to complete various aspects of the writing process. The results of the study were promising in terms of both

usability and engagement. In a study that looked at the use of automated corrective feedback for writing, Ranalli (2018) found that, although students did not always use the feedback generated by the AI to make changes to their writing, they were able to when they chose to do so. The degree to which students were able to utilize the feedback that they received, however, was influenced by several factors, including their motivation, their writing ability, and the context in which the AI-generated feedback was provided.

The rapid development of so-called large language models (LLMs) has also opened up completely new application fields for AI in education. Thanks to advanced language models, tools can now be created that are able to provide individualized learning support and thereby enhance and support teaching in classrooms and study places across the world. Kasneci and his co-authors (2023) highlight the great opportunities provided by AI-powered Chatbots such as ChatGPT, while at the same time also listing the dangers and requirements for responsible use, including the risk of AI providing so-called hallucinated information (generated by the model but not supported by the original data or sources), providing inaccurate or biased feedback, or even of students relying too heavily on the AI and merely copying and pasting generated content into their own work. Zawacki-Richter et al. (2019) conducted a systematic review of artificial intelligence applications in higher education and identified personalized learning support, intelligent tutoring systems, and automated feedback generation as major areas of educational AI research.

In terms of research into the implementation of AI in education, it is becoming increasingly recognized that the way forward for this technology is through Human-AI collaboration rather than through the full automation of learning. Thus, whilst a machine can process vast amounts of data quickly and with very little fatigue, there are many tasks within the process of learning that are better performed by human beings. Consequently, AI systems are increasingly being viewed as a tool to support learning and as a means to assist human teachers in the educational process. They can provide the teacher with the ability to analyze large amounts of information and to process data quickly in order to assist with tasks that are repetitive and that take up a large amount of time. Holmes et al. (2019), Luckin et al. (2016), and UNESCO (2023) have thus argued that, in terms of education, the use of AI as a tool to support learning is positive. In particular, they have argued that whilst technology can provide answers to learning-related questions and that AI can offer individualized learning support and the provision of feedback on student work that is rapid, consistent, and of high quality, many tasks within education are better performed by human beings.

However, there are many open issues and several limitations to current AI-powered systems. In most cases, they are able to provide only grammar correction, automated scoring, and general writing support. In most cases, current studies are conducted in higher education settings. Few published studies have examined the deployment of AI-assisted writing feedback systems within nonprofit educational environments serving refugee and under-resourced student populations. There are many critical issues regarding the evaluation of AI-generated feedback, ensuring fairness, students' privacy, and measuring learning outcomes in AI-supported educational settings.

This study aimed to develop an AI-powered writing feedback tool that facilitates students' revision and writing processes in three educational dimensions: Ideas and Supported Opinions, Organization and Structure, and Writing Competence. As there is already substantial research indicating the potential of AI-assisted writing support, this study specifically explores the implementation and feasibility of using such a tool in a non-profit education environment serving under-resourced student populations. This pilot study was conducted in collaboration with SEA Literacy and reports on a qualitative analysis of user engagement and perceived usefulness of the AI-based writing feedback tool developed in this study.

The platform presented in this paper differs from the vast majority of the current AI-powered generative writing tools that are designed to assist students in generating writing on their behalf. There are, for example, chatbots like ChatGPT that are able to generate individual sentences, as well as extended paragraphs and full essays. However, the platform described here is designed to assist students in revising their own work for the improvement of aspects such as ideas, organization, and writing competence. As such, the generated feedback must be read by the student, and it is the student who must decide whether or not to incorporate the comments into the revised version of their own work. This is because feedback is most educationally valuable when it is carefully considered and applied by the student who produced the original work.

3. Research Methodology

This study employed a mixed methods research design to investigate the accessibility and effectiveness of an AI-based automated writing feedback system designed for student use. Both quantitative and qualitative methodologies were

incorporated to evaluate user engagement, perceived usefulness, and the educational potential of AI-assisted writing revision tools (Holmes et al. 2019). The qualitative component of the study focused on students' experiences using the platform, including their perceptions of the AI-generated feedback and its role in supporting revision-oriented learning. Additionally, qualitative observations provided insight into how the AI system influenced students' writing and revision experiences.

The pilot study consisted of approximately 20 users from a number of different organizations who were early adopters of the writing feedback platform during the pilot. A number of these users were involved in a live workshop held in collaboration with the nonprofit organization SEA Literacy, who work with under-resourced and refugee students. In total, 12 students from a number of different age groups and with different levels of prior writing experience participated in the workshop itself, whilst other users from around the world went through the material on the platform independently. Students had a range of different prior experiences with writing and were at different points in their educational careers, some having had consistent access to individualized support with writing, whilst others had not.

The platform supported several different written responses to be received by the AI and for that AI to return feedback to students. The three main categories that the AI returned feedback for were: Ideas and Supported Opinions, Organization and Structure, and Writing Competence. The goal of the feedback was to help students revise rather than complete their writing for them. This was achieved by the platform using a structured prompt and rubric-based approach to the feedback, focusing the AI's responses on the following: explanation, organization, evidence, clarity, and next steps for revision. The pilot was exploratory in nature, aiming to provide initial data on the usability of the system, how helpful students found the feedback, and initial levels of engagement with the platform. While initial findings were positive, the pilot was not intended to provide definitive learning outcomes.

Quantitative data from the quantitative component of the study have been analyzed by means of descriptive statistics. Such data include the number of times each essay has been analyzed by means of the automated feedback system, the number of participating students in the study, and percentages of students who responded helpfully to a series of questions about their experiences with the system. Qualitative observations of note from the qualitative component of the study include observations that the students made during interactions with the automated system and observations that the researcher made during the workshop in which the system was implemented. These data were analyzed to identify patterns related to accessibility and usability of the system to support revision to achieve higher standards of writing (Hattie and Timperley 2007).

Ethical implementation of educational AI was at the forefront of the design and implementation of this study. Data from all interactions on the writing feedback platform, as well as from the study's workshop, were collected voluntarily. No personally identifying information from students was intentionally collected or published. This research aimed to explore the potential of one aspect of AI in education in order to support increased learning accessibility rather than in order to avoid increasing the incidence of plagiarism (UNESCO 2023).

4. Data Collection

The primary data for this study were collected through a publicly accessible web-based AI writing feedback system and a pilot workshop conducted in collaboration with SEA Literacy, a nonprofit educational organization supporting under-resourced and refugee students. Students interacted directly with the platform by submitting written responses and reviewing the AI-generated feedback related to organization and structure, writing competence, supported ideas and opinions, and revision suggestions. Platform analytics systems were implemented to collect quantitative usage data, including the total number of users, total essay analyses completed, and user helpfulness responses. A built-in helpfulness feedback mechanism allowed users to indicate whether the generated feedback was beneficial to their writing revision process. Approximately 20 users generated over 50 essay analyses during the pilot phase, while approximately 81% of users reported that the feedback was helpful. Qualitative observations were also collected during the SEA Literacy workshop through student interaction, engagement patterns, and informal discussions regarding the usability and accessibility of the AI-generated feedback. These observations provided additional insight into how students perceived the role of AI-assisted educational systems within the writing revision process. Participation in both the platform interactions and workshop activities was voluntary. No personally identifying student information was intentionally collected or published. Ethical considerations related to responsible educational AI implementation, accessibility, and academic integrity were maintained throughout the study.

5. Results and Discussion

The pilot implementation of the feedback platform was conducted with students who participated through SEA Literacy workshops, literacy sessions, and independent platform use. The main goal of the study was to assess accessibility, usability, and perceived usefulness of an AI-based writing feedback system designed to support student revision. Approximately 81% of users reported that the AI-generated feedback was helpful for their writing revision process. The number of essay analyses also suggested that some users engaged with the platform beyond a single interaction. These findings indicate early promise for AI-assisted writing feedback in nonprofit educational settings, but they should be interpreted as preliminary because the study measured user perception and engagement rather than direct writing improvement.

5.1 Numerical Results

Preliminary platform analytics demonstrated encouraging early engagement and positive perceived usefulness among users (Table 1).

Table 1. Preliminary Platform Usage Metrics

Metric	Value
Total Users	20 Users
Total Essays Analyzed	54
Workshop Participants	12 Students
Positive Helpfulness Responses	81%
Platform Type	Web-Based AI Writing Feedback System

Approximately 54 essay analyses were completed across 20 users during the pilot phase. The ratio of analyses to users suggests continued interaction and engagement.

Additionally, approximately 81% of users reported that the generated feedback was helpful. These findings suggest that participants generally perceived the AI-generated recommendations as actionable and supportive of revision-oriented writing. The pilot workshop also demonstrated the feasibility of implementing AI-assisted educational technologies within nonprofit educational settings serving under-resourced students.

5.2 Graphical Results

Figure 1 illustrates the distribution of user helpfulness responses collected during the pilot implementation of the AI-based writing feedback platform. Approximately 81% of users reported that the generated feedback was helpful, suggesting generally positive perceptions regarding the usefulness of the system for writing revision.

User Helpfulness Responses

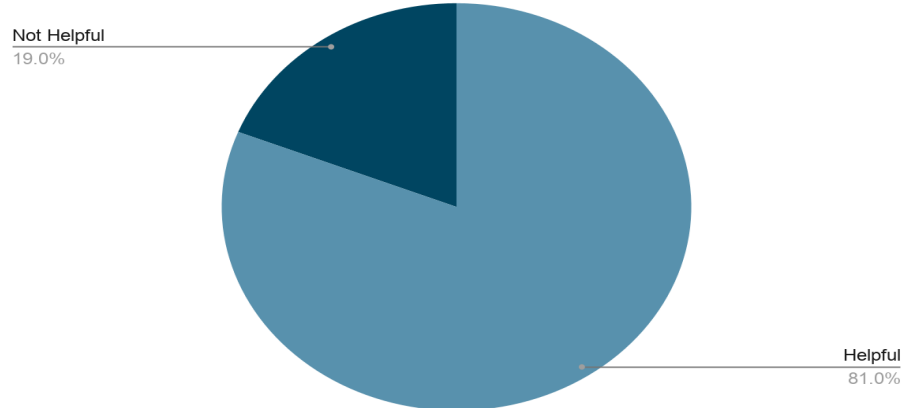


Figure 1. Distribution of user helpfulness responses

5.3 Proposed Improvements

Based on the findings of the study, several improvements are proposed to enhance the effectiveness, accessibility, and long-term educational value of the AI-based writing feedback platform

- **Expanded Multilingual Support:** Future versions of the platform should incorporate multilingual feedback capabilities to better support students from diverse linguistic backgrounds, including refugee and under-resourced student populations. This improvement may increase accessibility and educational inclusivity.
- **Enhanced Rubric Alignment:** The system should integrate more advanced rubric-based evaluation models aligned with standardized educational writing frameworks, such as AP English Language and general academic writing standards. Improved rubric alignment may increase the consistency and educational usefulness of the generated feedback.
- **Longitudinal Progress Tracking:** Future implementations should incorporate student progress tracking systems capable of monitoring writing improvement across multiple submissions over time. This would allow for more comprehensive analysis of long-term educational outcomes and revision development.
- **Teacher and Classroom Integration:** Additional features designed for teachers and classroom environments should be explored, including instructor dashboards, assignment management tools, and classroom analytics systems. These improvements may support more effective integration of AI-assisted feedback systems within traditional educational settings.
- **Scalability and Performance Optimization:** As platform usage increases, improvements in response speed, backend scalability, and system reliability will become increasingly important. Optimizing server performance and analytics systems may improve the overall user experience and reduce technical limitations.
- **Responsible AI Implementation:** Future development should continue prioritizing ethical educational AI practices, including transparency of AI-generated feedback, reduction of hallucinated responses, and safeguards against misuse for plagiarism or academic dishonesty.
- **Expanded Educational Research:** Larger-scale studies involving more diverse student populations and controlled educational environments should be conducted to further validate the effectiveness of AI-assisted writing feedback systems and better understand their long-term impact on writing development.

5.4 Validation

This study employed a mixed-methods approach to investigate the accessibility and usability of an AI-based automated writing feedback platform and the potential of this platform for education. It gathered quantitative data from platform analytics and qualitative data from student observations, thereby providing a comprehensive insight into students' use of the system and how they perceived the feedback generated by the platform. This mixed-methods approach strengthened the content validity of this study. Construct validity was ensured by using established concepts in education, i.e., revision-oriented feedback, personalized learning support, and educational technologies that utilize AI. The research objectives and corresponding methods of this study were aligned with the existing body of knowledge on effective feedback for education, writing improvement, and responsible use of AI in education. The research questions addressed real issues of accessibility to writing support for students, rapid generation of feedback, and AI-driven learning support that complements existing educational methods. Face validity was ensured by actual deployment of the platform and a pilot study that was conducted as a part of the SEA Literacy workshop. Students' interaction with the system, and their engagement and subsequent revisions, were observed. Students' writing submissions were analyzed using the automated writing feedback system. In this sense, the findings of this study are valid and useful for real-world applications. Reliability of this study was ensured by tracking analytics data and the automated generation of feedback using standardized procedures. The platform tracked the total number of analyses of essays, levels of participation by users, and levels of helpfulness perceived by users. Qualitative data were analyzed systematically to identify recurring themes that pertain to aspects of accessibility, usability, and writing revision support of the platform. Triangulation was used in this study. Quantitative data on engagement were compared with qualitative data from students' observations and from interactions with workshop facilitators. Use of multiple sources of evidence increased the reliability of findings with respect to usability and accessibility of AI-assisted writing feedback systems. This study has several limitations. The most important limitation is the relatively small number of participants in this study. The findings of this pilot study were subject to several constraints of the pilot study. Therefore, the findings of this study provide a plausible account of potential AI-assisted writing feedback for education.

5.5 Limitations

This study has a number of limitations. First, the study has a small number of participants, i.e., 20 in total, and 54 essay analyses in total. As a result, the findings of this study should be treated with caution and considered to be preliminary and exploratory in nature. Second, this study did not include a number of other features that would have been useful to include, i.e., a control group, teacher-feedback group, and pre-test/post-test writing samples.

Third, we rely on user perception (whether they found the AI feedback helpful) as our primary metric for this study. While we believe this to be an important usability metric and indicator of student engagement with the platform, it does not serve as a surrogate for other meaningful metrics such as improved writing quality, higher quality of written revisions, or longer-term measures of academic performance. Fourth, this study was deployed in a unique setting (nonprofit-organized early public deployment via a small set of teachers and their students) and thus may not generalize to other classrooms.

Future studies should build on the results of this study by, for example, involving a larger number of participants of different backgrounds, including a control group as well as teacher- or peer feedback, and, in addition to the essay analyses, also collect the students' pre- and post-test writing samples over time. A more in-depth analysis of the data, using more sophisticated statistical methods, should help answer whether AI-supported writing feedback improves writing quality over time.

6. Conclusion

This paper details the development and pilot implementation of an AI-based automated writing feedback system to enhance student revision by providing instant writing feedback to students. A pilot was conducted with approximately 20 users generating 54 essay analyses. The system was used in collaboration with SEA Literacy.

Feedback generated by the AI was found to be helpful for 81% of users. The automated writing feedback system is seen to have great potential in supporting students in their revision of written texts. Students who do not always have the possibility to receive immediate individual feedback on their written work can greatly benefit from the use of this system.

Please note that the results of this pilot study have to be viewed with caution, as only indicators for the functionality of the system are provided. Only the engagement and the subjective perception of the students as to the helpfulness of the feedback were measured. Thus, no statement can be made about the effect of the AI-based system on students' writing. Moreover, as no control group, no comparison with teacher feedback, or with peer feedback was done, and no longitudinal assessment of the writing of the students was conducted, the system under investigation is to be viewed as a very promising support tool for education instead of a substitute for human writing instruction given by human teachers.

Future work will include more extensive testing, an analysis of students' long-term writing development, a comparison with teacher feedback and peer feedback, and an in-depth study of responsible use of AI in education.

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Biography

Mr. Taha Nazir is a student researcher at Brookfield East High School in Brookfield, Wisconsin, with academic interests in artificial intelligence, educational technology, healthcare innovation, and biomedical research. His work focuses on the development and implementation of AI-assisted systems designed to improve educational accessibility and personalized learning support. He developed and deployed an AI-based automated writing feedback platform intended to provide students with rapid, revision-oriented feedback on written assignments. The platform was piloted through collaboration with SEA Literacy, a nonprofit organization supporting under-resourced and refugee students, where the system was used in educational workshop settings to evaluate student engagement and perceived usefulness.

of AI-assisted writing support. In addition to his work in educational technology, Taha has been involved in STEM-focused academic and community initiatives, including Science Olympiad, clinical volunteering, and outreach programs centered on student learning and mentorship. His broader research interests include the intersection of artificial intelligence and healthcare, particularly the use of intelligent systems to improve accessibility, decision support, and educational outcomes. Taha plans to continue pursuing research opportunities involving AI, medicine, and human-centered technology while expanding projects focused on improving access to educational resources for underserved communities.