

# EXPLORING THE ROLE OF AI IN SUPPORTING MATHEMATICAL WRITING

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## **Abstract**

With the increasing use of AI in real life and the development of AI technology, researchers in higher education institutions have been significantly interested in utilizing AI in mathematics education and classrooms. For example, AI is already being used for grading, tutoring systems, and providing appropriate feedback through commercial homework platforms. As AI technology improves, students are experiencing fewer opportunities to write their work on paper. Due to the limited time during class, instructors often cannot provide detailed feedback on students' work or their mathematical writing. This lack of practice in writing mathematics can lead to more mistakes and hinder students' conceptual understanding of mathematical topics. The purpose of this study is to explore the effectiveness of student learning through instant feedback on their handwritten work in class, using AI. The study was conducted over two developmental learning courses across two semesters at a four-year university. Data was collected from students' work on both the first and final tests, and their improvement in writing mathematics was assessed based on a rubric. This study will share educational strategies to support students' mathematical writing with the aid of AI and examine how these methods impact students' writing and performance in mathematics.

## **Introduction**

The advancing technology of Artificial Intelligence in mathematics education provides opportunities for appropriate efficient use of limited class time for instructors and students. Instructors can review students' work in short periods, and students can receive ideas for how to solve problems by utilizing AI. Despite the increasing use of AI in classrooms, there is limited research on how AI can effectively support students' mathematical writing. Weak mathematical writing skills can hinder students' logical understanding of problems and increase their mistakes. Utilizing AI in classroom can analyze student handwritten work and provide instant feedback with practice problems based on their level. The purpose of this study is to explore student learning through instant feedback on their handwritten work in class through AI support.

## **Purpose and Research Questions**

The goals of this research are to explore the effectiveness of AI-based feedback on students' mathematical writing, examine how this feedback influences student learning and performance, and identify best practices for using AI to support mathematical writing instruction. The primary research questions were:

- How does instructors' AI-based feedback on handwritten work impact students' mathematical writing skills?
- Does the use of AI-based feedback and appropriate problems lead to improved student performance in mathematics?

## **Methodology**

The study utilized a quasi-experimental design with pre-test and post-test assessments. The research was conducted over two semesters, Fall 2023 and Fall 2024. Participants were sixty-five participants who registered for a three-hour college course and a three-hour developmental learning course at a four-year university. Data was collected from three different sources: first and final tests to analyze student performance, four in-class student worksheets, and end-of-semester questionnaires. A rubric was developed and applied to assess the quality of students' mathematical writing on the worksheets.

## **Findings and Limitations**

Preliminary findings indicate that students who received AI-based feedback and appropriate practice problems improved their mathematical writing, enhanced their academic achievements, and showed increased engagement and motivation.

A limitation of this study, however, is that the numbers in AI-generated problems can sometimes be incorrect. This requires a brief review by the instructor, which can cause a delay and prevent the problems from being delivered to students immediately.

## **Implications and Future Research**

The findings suggest that instructors' AI-based feedback can be a valuable resource for enhancing mathematical writing instruction and that appropriate, instant feedback can lead to improved student learning outcomes. Further research is needed to explore the long-term effects and broader applications of AI in mathematics education. This study will share educational strategies to support students' mathematical writing with the aid of AI and examine how these methods impact students' writing and performance in mathematics.