The implementation Khanmigo as a mathematics tutor: A study from students' perspectives

Overview of Project

Exploring ways in which Artificial Intelligence (AI) can assist students in their mathematical learning endeavor is an active research area. For this project we want to inspect the capabilities of Khanmigo, an AI-powered tutor and teaching assistant from Khan Academy, to assist and support students in the learning process of college algebra. For a semester, students will complete assignments with embedded activities supported by Khanmigo and will reflect on the benefits and drawbacks found when using this tool. With the help of surveys/interviews, we will explore the students' experience of using AI as a tutor and draw recommendations for its implementation.

The following research questions guide the study.

RQ 1) What is the perception of the use of AI as a tutor before/after interacting with the software?
RQ 2) What are the perceived benefits, if any, of using AI as a tutor on the learning process of the students? What are the perceived drawbacks, if any?
RQ 3) If there are benefits, what is the most effective way to implement this technology? If there are drawbacks, what is the most effective way to mitigate them?
RQ 4) What mathematical content is more suitable for the use of this technology?

Type of Data

Homework responses from students and surveys/interviews before and after the use of Khanmigo

Audience

Students of 103B: College Algebra

Time Required

Half semester. Around 7 weeks

Technology and Other Materials

- License for the use of Khanmigo
- Khanmigo-embedded learning algebra activites

Project Plan

Related Literature

"College algebra is a basic mathematical subject that serves as a terminal course for students in many majors as well as a prerequisite to courses such as pre-calculus, statistics, business calculus, finite mathematics, and mathematics for elementary education majors" (Haver et al., 2007). Therefore, learning college algebra is a cornerstone for students' success.

Exploring how to support students in their learning has been a research interest over the years. Recently, with the rise of generative, researchers have explored the use of such tools in mathematics classrooms (Lee et al., 2024) (Wardat et al., 2023). They have found that instructors and learners have a mix of positive and negative perceptions of the use of AI in the classrooms. For example, users have identified that AI can be used to provide accurate, fast and helpful answers to user's queries, however, they are concerned with the lack of human reasoning and understanding on the software, which can sometimes lead to errors or misconceptions.

In particular, Park and Manley (Park & Manley, 2024) developed a "study to examine the capabilities of ChatGPT as a tool for supporting students in generating mathematical arguments that can be considered proofs". Students engaged with ChatGPT-embedded proving activities and communicated their perspectives on the benefits and pitfalls of the use of ChatGPT. **This article is the main inspiration of the current project.**

Methods

To answer the research questions, we will collect data from one or two sections of a 103B: College Algebra course during the Spring 2025 semester at MSU. 103B is the second part of a yearlong course offered to students that have completed the first part, 103A, satisfactorily. Students are from humanities, business and STEM majors. Students usually take this course to fulfill the quantitative education requirement of their major or in preparation for other classes like calculus or chemistry. Habitually, students struggle with mathematics and lack either confidence or interest in developing their mathematical skills. So, the main goal of having two parts of this course is to help students build conceptual understandings in a half pace manner.

The steps of the project are:

1) The creation of a survey/interview to explore the perception of the benefits and drawbacks of the use of AI in learning mathematics. Such survey/interview will be conducted at the beginning and end of the semester.
2) The creation and completion of multiple Khanmigo-embedded algebra activites along the semester.

3) Offering guidance and tutoring to students for the use of Khanmigo.

Expected results

On the one hand, the project would allow the principal researcher (me) to gain experience in the creation and implementation of this kind of experiment, preparing me for my present and future role as an educator.

On the other hand, in line with Park and Manley (Park & Manley, 2024), I expect a mix of opinions from the students using Khanmigo. Some students will find Khanmigo a knowledgeable assistant, a trustworthy source of guidance when no one else is around to help them. In the same way, I expect other students to find the interaction with the AI as a lengthy or difficult process, hence, to be not helpful and even and obstacle on their learning process.

Overall, I expect the results to be a suitable source of information to reflect on the role of generative AI as a mathematics tutor. To establish the benefits and drawbacks of the use of this technology and possible recommendations for its implementation in the classrooms.

Reflections

AI technologies are replacing the way we interact with information and have impacted several teaching and learning practices. But it should not be surprising. "Technology is, by definition, disruptive … When it comes to education, technology has offered several opportunities and disrupted our practice several times in the past". (Giannakos, et al., 2024). Searching books in public libraries have been replaced by google searchs, classrooms have become zoom calls and learning from an expert is watching their explantion videos on YouTube.

Again and again, technology has impacted educational practices and we, as educators and learners, have embraced it and improve the learning processes. AI technology is not the exception. When tutoring I observed my students using AI's like ChatGPT, Mathway or Photomath to find the solutions for their homework. Some students were typing the incorrect prompt and did not know why they had a flawed answer. Others used the tools as a shortcut to the answer, then missed the opportunity to learn from solving problems. Consequently, I decided to develop this project to explore the integration of AI into mathematical education, boosting its the benefits and mitigating its drawbacks.

References

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