London International Conferences
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Revolutionizing Education: A Study on Intelligent Tutoring Systems In U.S Education

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Abstract

Over the decades, AI has been drastically impacting health care, entertainment, finance, transportation, and many other industries, but specifically, how has it impacted education systems in the United States? With a better ability at examining data points, strengths, and weaknesses, in this study, we investigate how MATHia, an intelligent tutoring system, uses AI and how it has affected student performance in mathematics. AI-driven online tutoring offers a human-like learning environment that encourages collaboration with the students in order to learn from them and create individualized courses based on the students' emotions, progress, and learning preferences. MATHia was developed to resemble a human tutor and personalize learning based on each individual's area of weakness. Did these online tutors present a cost-effective and revolutionary solution to real-life tutors? Was MATHia effective in enhancing students' knowledge of the mathematical concepts they had to learn? What can be done in the future to further expand the benefits of these systems? This research answers all of these questions by taking three standpoints into consideration (educational, economic, and futuristic standpoints), each with its own unique data, problems, and solutions to these problems.

Keywords: Intelligent Tutoring Systems, ITS, MATHia, Artificial Intelligence, AI, education, future, Research, Study, Students, Personalized Feedback, Algorithm

1. Introduction

1.1. What is AI

Artificial Intelligence (AI) is human-like intelligence demonstrated by self-learning machines and computers which mimic human behavior. It is even used by many of the most important programs in today's world, including Amazon, Google, and Microsoft. AI consists of methods that aid in simulating human behavior in computers and other devices. Even though we humans are the ones who created AI, we can only really manage it up until a point because AI eventually learns how to develop on its own.

1.2. Online tutoring AI

With the widespread popularization of Artificial Intelligence, online tutoring has emerged. AI driven online tutoring offers a human-like learning environment that encourages collaboration with the students in order to learn from them and create individualized courses based on the students' emotions, progress, and learning preferences (Fancsali et al., 2021). Additionally, it provides real time feedback and direction to the user based on their learning style, speed, and areas for improvement. Finally, online tutoring systems are flexible as they are constantly developing and evolving to better serve the learner through the use of a variety of learning mediums.

2. AI in Education

MATHia is an intelligent tutoring system that uses a 1 on 1 adjustable learning system that resembles a human tutor. Students 6 through 12 receive personalized support to help them prepare for the end of course examination. The AI driven tutoring provides students with personalized help based on their areas of weakness and helps them stay on path to master the end of course examination. AI tutoring has the potential to significantly impact and advance education through various means. One key benefit is personalized learning. AI tutoring systems can analyze a student’s performance data and adapt to their individual needs and learning styles. By doing so, these systems provide personalized recommendations and adaptive feedback, ensuring that students receive targeted support in areas where they need it most. This personalized approach enables students to progress at their own pace, focusing on areas that require more attention and accelerating their learning in subjects where they excel.

Additionally, AI tutoring can enhance the accessibility of education. With the help of AI-powered tools, students can access learning materials and tutoring assistance from anywhere at any time. This flexibility removes geographical and time constraints, enabling students in remote areas or those with busy schedules to receive quality education and support (Fordham University).

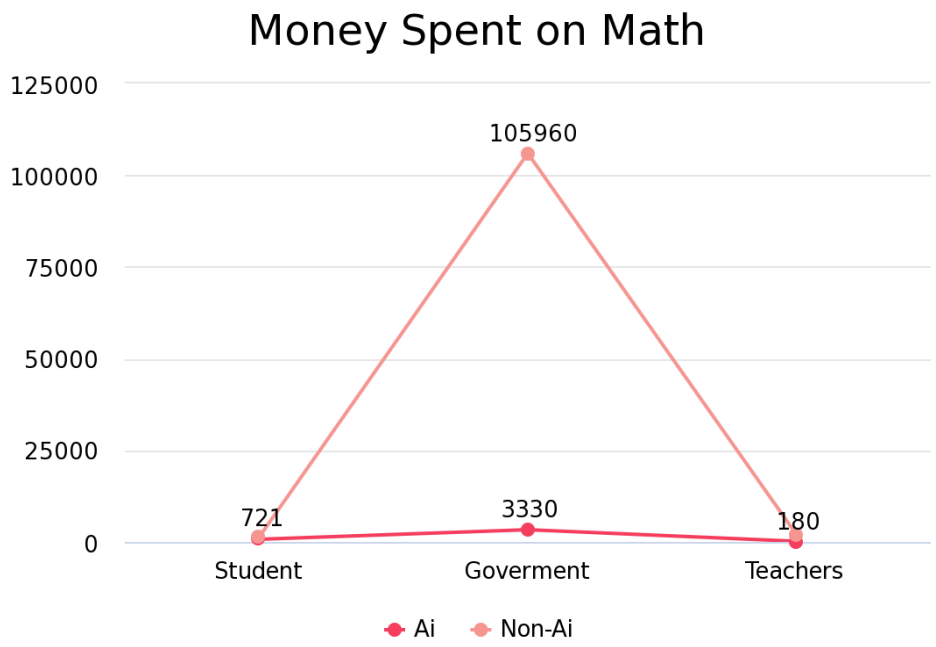
Furthermore, AI tutoring systems can handle large amounts of data and provide detailed insights into students' progress and areas of improvement. Educators can leverage these analytics to identify common learning gaps, optimize teaching strategies, and tailor their instruction to meet the specific needs of individual students or groups. This data-driven

approach allows for more efficient and effective education delivery, resulting in improved learning outcomes (Jimenes, Boser, 2021).

3. Economic

To figure out the cost of switching everything in the state of Texas into MATHIA or any online learning would be a huge plus on the economic side. The biggest cost would be manufacturing the Aim but since we already have MATHIA fully developed we won't have to worry about that. The U.S. spends 870 billion dollars on education (National Center for Education Statistics, n.d.). With a data set taken from the school district in Texas. The math portion gets 12.18% that means we spend around 105.966 billion dollars on Math.

Now for the spending that the AI would need. First, all students have to acquire laptops. 87% of American teens have access to a desktop or laptop computer. That requires us to give the remaining 13% of students their own personal laptops (COE - Children's Internet Access at Home, n.d.). With students spending $761.32 on average for a laptop. We get around 1.585 billion dollars on laptops for students who don't have any. We also have to look at the maintenance cost of the AI which can be all the way from 20,000 to 500,000 (Palokangas, 2023). The last cost would be the cost of internet which 95% of students already have access to internet (COE - Children's Internet Access at Home, n.d.-b) and the cost for internet subscriptions is around $660 per person. Which would come up to be around $528 million dollars. The annual subscription to MATHIA would cost around $45 per student. Which would end up being around 720 million dollars a year. Altogether it would cost around $3.333 billion dollars in cost yearly to keep up with the costs of switching to MATHIA. So we save around $102.6327 billion dollars of course there are unexpected accidents like server breakdowns but they won't cost too much.



Graph. 1. Comparison of math expenses of the student, government, and teachers prior to and after the use of AI.

Now the uncertainties that are available. First, since we are giving laptops to kids they might break them, we could either supply one and the rest would be on the family if they broke but if we don't do that we can't be sure how many laptops would break as there is no data set that we could find. Second, we don't know how many extra servers we would need to sustain such a large project as we do not have access to MATHIA's financial spending on current servers or the exact amount of users they have.

4. Future of AI

4.1. Limitations of Online Tutoring AI

Due to long implementation delays, difficult integration, a lack of ethics, and exorbitant prices, AI has limitations. Long implementation timeframes, integration issues brought on by a lack of comprehension, and AI's lack of human ethics are all factors. Installation, repair, and upkeep all have high costs (Bisen et al., 2022).

4.2. Solution

Incorporating AI-powered Intelligent Tutoring Systems into our school's educational system is a good way to revolutionize the existing teaching and learning processes, but, as with most things, there are drawbacks. AI has a promising future in teaching because of its flexibility and accessibility. Furthermore, our study revealed that AI significantly reduces the cost of

education. Not only does this help government funds spend less money, but it also benefits students because they can access tutors whenever they want and anywhere without having to be in a specific location with a real tutor. With the rise in AI learning applications, online learning will undoubtedly expand in the future. Therefore, we think that the employment of intelligent tutoring systems in education will be advantageous because of their individualized teaching strategies that will help each student perform at their highest level. We anticipate learning more in the future about the use of intelligent tutoring systems for a variety of subjects, including English, which requires one's own perspectives and critical thinking.

Conclusion

AI is the name for self learning intelligent program based machines that carry out duties assigned by humans. With AI's rising popularity, there are more Intelligent Tutoring Systems (ITS), often known as online tutoring systems, emerging. We specifically looked into MATHia its effects on student performance. The study conducted on Intelligent Tutoring Systems has deepened the understanding of their effects on the education system and economy. The results demonstrate that ITS have revolutionary impact. The accessibility, versatility, and financial advantages it offers give online tutoring a bright future.

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