

Research Article

The Impact of AI on Teachers' Math Teaching and Students' Learning from Diverse Socioeconomic Status

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Abstract

In recent years, with the continuous development of technology, AI technology has gradually improved and can be applied to various aspects of life and learning, especially in promoting continuous education reform, playing a crucial role. The impact of AI on mathematics education, particularly in terms of teaching strategies for primary and secondary school teachers and improving the mathematics performance of students from diverse socioeconomic status backgrounds, is explored in this review. Through a systematic literature of 8 relevant studies in Google Scholar and Scopus from 2015 to 2025, this paper identifies the AI tools impacting mathematics education. This paper fully demonstrates the purpose of the research report through surveys and interviews with different research subjects, combined with experiments such as table and figure. Key findings suggest that AI could enhance the teachers teaching strategies, improve teaching quality and assist the students in improving their mathematics performance, especially those from low socioeconomic status backgrounds. The study indicates that questionnaires were primarily used to compare the students of diverse socioeconomic status backgrounds and teachers of different school grades, who were the most significant participants in the reviewed papers. Additionally, this review discusses the application trends and profound impact of AI on education.

Keywords

AI, AI Tools, Mathematics, Mathematics Education, Low Socioeconomic Status, High Socioeconomic Status

1. Introduction

In today's increasingly connected world, AI is constantly influencing how people learn and live [1], whether it's in the teaching methods of educators within the education industry or in the learning processes of students at various grade levels and from different socioeconomic backgrounds. Before the emergence of AI, teachers usually employed traditional offline teaching to guide students in solving problems [2]. Later, knowledge could also be taught through remote online videos. In recent years, with the development and use of

various online intelligent AI tool, such as ChatGPT [3], and Deepseek, These tools have been able to assist teachers in their instruction and help students lacking additional tutoring to solve a variety of problems [4]. Previous studies show that these technological advancements have significantly impacted teachers' teaching strategies and students' learning efficiency. However, limited study has focused on mathematics education involving teachers and students from diverse socioeconomic statuses, especially the impact of AI on

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Received: 10 July 2025; **Accepted:** 21 July 2025; **Published:** 15 August 2025



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math education for those from low socioeconomic status backgrounds, who could potentially use AI to enhance their learning. Therefore, It is necessary to address reviews that introduce the influence of AI. It could help students from low socioeconomic status improve their mathematics performance, replacing the high costs they cannot afford to spend on extracurricular tutoring. In particular, in mathematics education, learning through AI can greatly enhance students' efficiency in organizing mistakes and seeking clarifications, as well as improve the teaching process for teachers, both in classroom instruction and in grading homework after class [5]. It aimed to explore the impact of AI on teachers' teaching strategies and students' learning from diverse socioeconomic status, particularly for those from low socioeconomic status backgrounds.

1.1. AI Impacts Teachers' Teaching Strategies in Math Classes

Existing literature indicates that AI technology significantly improves teaching efficiency through the processes of math lessons [6]. In terms of math classroom management, the application of VR/AR technology in geometry teaching allows for 3D geometry interactive operations. For teacher and AI collaboration, AI generates classroom lesson plans (such as Diffit tools), automatic test paper generation, and learning situation analysis reports. With the development of AI in the classroom, the teacher's role is transformed from a knowledge transmitter to a learning guide [7].

However, some other key risks include over reliance on AI, which may lead to 42% of teachers' mathematics lesson plans converging and 37% of novice teachers experiencing a decline in preparation ability for mathematical courseware [8]. The hidden dangers of educational equity and the widening gap in educational resources between developed and impoverished areas have led to the emergence of technology-enabled inequality [9]. The weakening of emotional interaction between teachers and students is a concern, as AI cannot replace the emotional support function of teachers, especially in early childhood education. Excessive reliance on technology may affect students' social skills development [10]. The anxiety and sense of responsibility regarding job substitution, along with the public's misunderstanding of AI replacing teachers, exacerbate teachers' professional crisis and affect their teaching enthusiasm [11].

1.2. AI Impacts Students' Learning from Diverse Socioeconomic Status

While the application of artificial intelligence technology in education is seen as a tool to promote equity, its actual impact is differentiated by students' socioeconomic status backgrounds. High socioeconomic status students often adapt more quickly to technological benefits, whereas low socioeconomic status students may face risks such as algo-

rithm bias and data exploitation due to limited resources [12]. In addition, there are significant disparities in the hardware and facilities available to different households. High socioeconomic status households can afford high performance devices, such as tablets, smart pens and stable networks, while low socioeconomic status students often rely on schools or public facilities. Moreover, students from diverse socioeconomic status backgrounds also exhibit differences in their proficiency with technology. Families with high socioeconomic status typically have greater digital literacy and can assist students in navigating complex AI tools (such as programming learning software), while students from low socioeconomic status may only use basic functions due to a lack of guidance [13].

On the other hand, AI also introduces educational and learning disparities for students of varying socioeconomic status [14]. Data indicate that students from high socioeconomic status backgrounds are more adept at using AI for metacognitive regulation, for instance, employing the Anki Interval Repetition System. In contrast, students from low socioeconomic status tend to rely more on AI for completing basic assignments. The error rate in emotion recognition AI for identifying anxiety levels in students from low socioeconomic status is 19% higher [15]. A report from University College London highlighted that, in the UK, low socioeconomic status students using adaptive systems experience an error accumulation rate 1.7 times faster than their high socioeconomic status counterparts, attributed to the lack of home tutoriat [16].

This study aimed to investigate the impact of AI on teachers' math teaching strategies and students' learning from diverse socioeconomic status, and thus two research questions were formulated:

Question 1. What are the effects of AI in mathematics teaching strategies with teachers from primary and secondary schools?

Question 2. How does AI impact on students' learning from diverse socioeconomic status backgrounds?

2. Methodology

Search Strategy

The study employed a systematic literature review to investigate the impact of AI on mathematics education. The search strategy involved using keywords such as: 'AI', 'mathematics education', 'low socioeconomic status and high socioeconomic status' to construct searches in the Scopus database and Google Scholar, for articles published between 2015 and 2025, that met the selection criteria. Initially, 818 articles were identified without setting data parameters. First, 132 papers were excluded, focusing on the peer-reviewed articles. Therefore, 686 peer-reviewed academic journal articles were recorded. Second, to achieve a more accurate quality assessment, the author removed 128 duplicate and irrelevant articles, leaving 558 articles. Third,

103 articles written in languages other than English, focusing on AI, were excluded. After scrutinizing the articles and abstracts, the number was reduced to 455. Then, 183 papers focusing on preschool and college students from different socioeconomic statuses were excluded. This left 272 articles relevant to primary and secondary school students. Next, 156 empirical studies were identified, with 116 unempirical arti-

cles excluded. Finally, 148 papers focusing on students' parents, as well as other adults who were not teachers, were removed due to the study's focus on students from different socioeconomic status backgrounds. Therefore, eight published articles on the impact of AI on mathematics education with a focus on teachers and students were reviewed for this study (see the [Figure 1](#)).

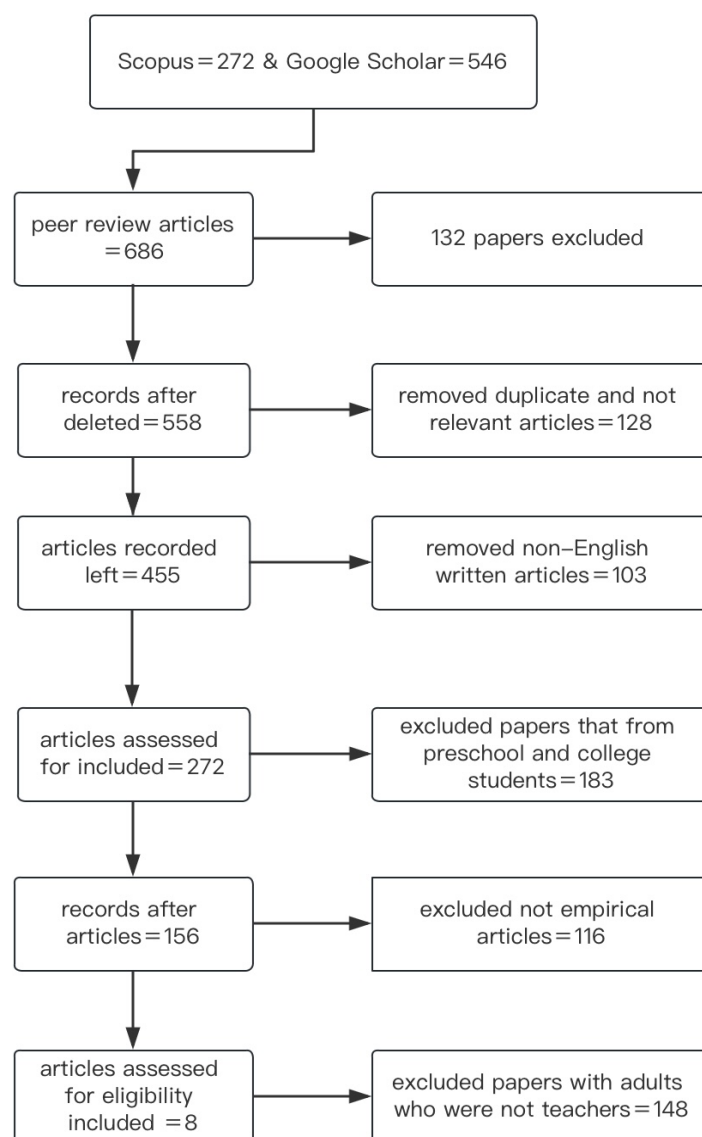


Figure 1. PRISMA flow diagram.

This [Table 1](#) includes the main titles of eight different references. Each line introduces data collections and respondents from primary school, middle school, to senior school, involving both teachers and students. It clearly shows that AI's impact is greater in senior schools than in primary schools and middle schools. The increased use and ac-

ceptance of AI in solving math problems are more noticeable in higher grades. Some students in lower grades may encounter difficulties when using AI, or the problem type itself may not be suitable for AI resolution. In such cases, they may resort to other means, such as asking their parents or teachers for help.

Table 1. List of the eight reviewed journals in this study.

Reference	Title	Data collection	Respondent
Lee & Yeo (2022)	Developing an AI-based chatbot for practicing responsive teaching in mathematics	Online form	Teachers (Middle school)
Wardat Y., Tashtoush M. A. & Jarrah A. M. (2023)	ChatGPT: A revolutionary tool for teaching and learning math	Experiment and measurement	Students and educators (Senior school)
Pashchenko O. A., Skorupska O. H. & Zhuravel A. V. (2024)	The role of technology in math education	Offline research	Teachers and professors (Senior school)
Rittle-Johnson B. (2017)	Development mathematics knowledge	Questions and interview	Children (Primary school)
Addi-Raccah A. & Oshra Dana (2015)	Private tutoring intensity in school: a comparison between high and low SES schools	Private tutoring	Teachers and students (Senior school)
Join Sun Lee & Herbert P. Ginsburg (2017)	Teachers' belief about Appropriate Literacy and Math Education for Low and Middle SES Children	Questions and interview	Teachers (Primary school)
Habeeb Omoponle Adewuyi (2024)	A systemic review of artificial intelligence in math education: The emergency of 4IR	Questionnaire and interview	Teachers and students (Senior school)
Chenglu Li, Wanli Xing & Walter Leite (2022)	Using fair AI to predict students' math learning outcomes in an online platform	Online form	Students (Middle school)

The systematic analysis of the study conducted from 2015 to 2025 on AI in mathematics education presented in this paper was used to answer the research question. The questions focused on the research methods adopted for AI in mathematics education. The findings showed that the reviewed study employed both quantitative and qualitative methods. In terms of data collection and analysis, it was observed that most of study samples used questionnaires and interviews [17]. Additionally, online forms were the most commonly used data collection method [18]. To address this research question, the articles used in this systematic study indicated that data were collected from various respondents, ranging from teachers to students of primary school, middle school and senior school [19]. Overall, the variety of data collection methods employed in this study reflects the researchers' commitment to capturing a comprehensive range of data for analysis, as well as the impact of AI on mathematics education with respect to both teachers and students. It also allows researchers to explore various aspects of AI implementation and its effects on teachers' teaching and students' learning practices in mathematics education [20].

3. Findings

3.1. Question 1: What Are the Effects of AI on the Math Teaching Process of Primary School and Secondary School Teachers

Findings show that teachers using AI in teaching can significantly improve their work efficiency. Wardat, Y. et al.

(2023) found that one of the most significant effects of incorporating technology into math education is the increase in the fun and interactivity of teaching. Interactive tools, such as virtual manipulatives, gamified learning platforms, and collaborative software, captivate students' interest by making math class more engaging. Specifically, Habeeb Omoponle Adewuyi (2024) explored that in school classrooms, teachers can use AI like ChatGPT in mathematics education to alleviate their workload, giving them more time to focus on other academic activities and providing additional support to students outside the classroom. Furthermore, Lee and Yeo (2022) also examined the use of AI, such as ChatGPT, by primary and secondary school teachers in their class for teaching mathematics. Their studies found that ChatGPT can provide comprehensive instruction and assistance in geometry, enhancing educational success by offering learners fundamental mathematics knowledge [21].

For instance, platforms like Prodigy Math use game mechanics to turn math practice into an adventure. Teachers have reported that this gamified approach significantly reduces math anxiety and encourages reluctant learners to participate actively in lessons. A case study from a middle school in California, Pashchenko O. A. et al. (2024) found that teachers noticed increased interest in mathematics classes and more efficient teaching strategies. These examples also highlight one of the most significant benefits of incorporating AI technology into math education, the increase in student engagement and the enhancement of class interest by making math both fun and engaging [22].

3.2. Question 2: How Does AI Impact Students' Learning with Diverse Socioeconomic Status Backgrounds

With the development of AI, Chenglu Li et al. (2024) found that the AI technology makes learning easier for students from low socioeconomic status, as evidenced by a study on mathematics questions in an online platform. Some primary school and secondary school students can use AI tools such as ModMath or Read & Write to build interest and confidence in mathematics [23]. Many students from low socioeconomic status families, who cannot afford private tutors like their high socioeconomic status counterparts [24]. Many math problems that they did not understand in class can be solved by AI when they return home after class.

However, Ramon Mayor Martins (2024) found that some middle and high school students from low socioeconomic status backgrounds use tools like ChatGPT to complete their homework and understand math problems they previously did not grasp in class. For some primary school students from grade one to grade six, AI technology can also improve their math education, particularly for those from low socioeconomic status [25]. Audrey Raccah & Oshra Dana (2015) explored private tutoring intensity in schools and found that since the advent of AI technology, students from low socioeconomic status families have shown significant improvements in their grades compared to before. ChatGPT provides personalized support and instant feedback, guiding students through complex mathematical problems and identifying areas where they may need additional assistance. By offering an interactive learning experience, AI technology such as ChatGPT helps low socioeconomic status students build confidence in their mathematical skills, ultimately leading to greater success in the subject [26].

4. Discussion

4.1. The Impact of AI on Teachers and Students

4.1.1. The Impact of AI on Teachers' Math Teaching Strategies

The study focused on the impact of AI on teachers' teaching strategies in mathematics education across different school grades and among students from diverse socioeconomic status backgrounds. The first research question examined the effects of AI on the teaching processes of primary and secondary school teachers, especially in the subject of mathematics education. Findings in this study showed that the technology of AI could improve the efficiency of teachers' teaching, saving time on calculation during math classes, aligning with the findings of Hill et al. (2017). Moreover, the study indicated that the impact of AI increased the enjoyment and interactivity of teachers' teaching strategies,

with some useful technology tools of AI improving the efficiency of school teachers, similar to the findings of Yu et al. (2022).

Findings in this study also showed that using AI could assist teachers in preparing lessons after class, saving time, and reducing workload. On the contrary, the research like that of Zhilmagambetova R. et al. (2023) found that while AI improved the teachers' teaching quality, it did not necessarily help teachers save time or reduce post class workload. One possible reason is the relatively limited scope of AI usage. It is essential to use AI not only in classroom teaching but also to assist with post class office work, achieving a true integration of in class and post class work efficiency [27]. Not only that, another explanation could be the use of AI to make teachers' classroom teaching more engaging and interactive. However, Singh et al. (2022), showed that AI did not significantly improve teacher & student interaction and classroom more fun, possibly due to the limited variety of AI types and the immaturity of the technology used, which did not allow for a high level of participation and experience in the classroom. Moreover, this paper argues that AI has an important impact on improving teachers' teaching efficiency, making lectures more interesting and interactive in the classroom. For instance, under the teaching of AI assisted tools and facilities provided by schools [28].

4.1.2. The Impact of AI on Students' Learning with Diverse Socioeconomic Status

Findings in this study showed that research on students from low socioeconomic status backgrounds, AI could help them to improve math performance, this result is similar to Hill & Seah and Rittle Johnson (2017), who explored that AI played an important role in students' learning, especially for those from low socioeconomic status backgrounds. It is possibly due to the fact that parents from low socioeconomic statuses cannot afford the high cost of extracurricular tutoring, and they prefer to prepare relevant AI tools or apps for their children. This cheap and effective method can also effectively improve their study performance [29].

On the other hand, from the comparison of the impact of AI on the learning of low socioeconomic status students, this study highlights the importance of AI in helping low socioeconomic status students. In the absence of sufficient family financial support, cheaper AI tools can be used to assist in learning and replace extracurricular tutoring teachers, thereby improving their study performance. On the contrary, the result in Ethics (2022) showed that AI could not significantly improve low socioeconomic status students' learning performance. The reason for this result is likely due to Ethics (2022)'s study of the inadequate facilities in the schools where these students are located, which have not popularized AI technology equipment and instruments to each low socioeconomic status students, making it difficult for them to fully utilize advanced AI technology. Findings of the study show that students from high socioeconomic status families

believed that AI is not as effective as hiring offline tutors outside of class to provide tutoring, they consider this method to be superior. Not only that, using AI for online learning can easily lead to students becoming overly dependent on AI tools for study, resulting in a reluctance to actively engage with problems and fostering lazy thinking [30].

4.2. Implications of Practice

For teachers, findings in this study suggested that the help of AI with teachers teaching strategies, particularly in mathematics classes [31]. It is suggested that teachers who have prior experience with AI teaching share their insights with new and young teachers, or share their proficiency in using AI teaching methods in mathematics with teachers across different subjects and grade levels. This can encourage other subjects and teachers of various grades to proficiently incorporate AI in teaching, enhancing teachers' teaching efficiency and reducing the burden of lesson preparation [32]. Not only that, there is a need for more AI teaching equipment, which should be popularized from primary school to secondary school, enabling more teachers to benefit from AI assisted teaching and making intelligent education a future trend. For students, findings in this study suggested that AI improved the students' learning performance, particularly for those from low socioeconomic status backgrounds [33]. Additionally, students should share some useful AI learning tools with peers from similar socioeconomic status backgrounds, helping each other and progress together, and most importantly, reducing the financial strain on their families [34]. For students' parents, providing corresponding support to their children is crucial, and they should not think that AI is useless for their learning, and it is also a very cost effective way, greatly saving family expenses [35]. On the other hand, due to the immature self-discipline of teenagers, it is necessary to prevent them from becoming overly addicted or dependent on AI and not wanting to think about problems on their own mind. So making reasonable use of AI tools to learn, allocating study time well, avoiding spending a lot of time on AI, and also developing the habit of independent thinking on their own mind is very important [36].

5. Conclusion

With the development of AI in the field of education, especially in mathematics, AI plays a crucial role in educational reform and development. These positive impacts, whether in terms of teacher teaching or student learning, are especially beneficial for students from low socioeconomic status families who do not have enough support, providing relatively fair learning platforms. Not only that, AI can also help teachers prepare lessons and save a lot of time, allowing them to invest more energy into personalized classroom teaching, making relatively dull math classes more interest-

ing, and increasing students' more engagement in class. For students, especially for those from low socioeconomic status backgrounds, personalized learning provided by AI can make up for the shortcomings of traditional classrooms, which is particularly useful for schools with insufficient resources. In addition, AI can provide extra resources such as after-school tutoring to help compensate for the lack of family support. However, excessive reliance on AI may reduce teacher-student interaction, which may be more important for students from low socioeconomic status, especially in terms of fairness issues. Balancing the role of teachers is also a challenge. AI and humanistic care ensure that technology does not replace necessary interpersonal support. AI has enormous potential to address educational inequality and improve learning outcomes for students from low socioeconomic status backgrounds by providing personalized adaptive learning experiences, bridging the gap caused by resource constraints in underfunded schools.

Given the previously discussed limitations, the main limitation is the sample size, as it is not representative. For future researchers, it is necessary to expand the research samples, including a wider range of grades, teachers, and students. This systematic review study has its limitations, like any other study. It is limited by the relatively small number of studies available and is not extensive enough, which affects the universal applicability of the research. The findings of this study are mainly applicable to primary and secondary school students and do not target younger kindergarten children who may not be able to use AI tools correctly due to the requirements of AI technology. Furthermore, some of the methods provided by AI for advanced mathematics in universities are not flexible enough to be applied to complex mathematical logical reasoning and proof steps. Therefore, the scope of this review is not applicable to all educational environments and populations.

In conclusion, AI plays an important role in improving the efficiency of teachers' teaching and especially in helping students from low socioeconomic status backgrounds improve their study performance. This will be a trend of mutual integration and progress between humans and AI in future education. The future of education hinges on a synergistic partnership between humans and AI, ensuring equitable access to quality education.

Abbreviations

AI Artificial Intelligence

Author Contributions

Dong Wen is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest.

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