# Exploring the Impact of AI-Enhanced Classroom Instruction on Learning Outcomes of College Students

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**Abstract:** In recent years, artificial intelligence (AI) has been increasingly integrated into educational settings worldwide. This study aims to explore the effectiveness of AI classroom teaching for Chinese undergraduate students, focusing on its influence on learning outcomes and student engagement. The research uses a quantitative approach, utilizing surveys and academic performance data to evaluate two main objectives: (1) the impact of AI teaching methods on academic performance compared to traditional instruction; (2) the level of student engagement and satisfaction with AI-based learning tools. The study sample includes undergraduate students from multiple universities in China, allowing for a diverse representation of various disciplines. Data will be collected through standardized tests, questionnaires, and academic records, ensuring the reliability and validity of the results. The findings will provide insights into the potential advantages and challenges of AI integration in higher education and inform future strategies for adopting AI in Chinese classrooms. By exploring both the academic and practical aspects of AI-driven education, this research aims to contribute valuable knowledge to the growing field of AI in education, particularly in the context of Chinese higher education. The results are expected to have implications for educators, policymakers, and AI developers interested in enhancing the effectiveness of educational technologies.

**Keywords:** AI-enhanced classroom instruction; Learning outcome; College students; Engagement

## 1. Introduction

The rapid advancement of artificial intelligence (AI) has led to significant transformations across various sectors, with education being a notable area of change. AI-based teaching methods, such as adaptive learning systems, intelligent tutoring systems, and AI-driven content delivery, are reshaping how students engage with educational materials [1]. As AI technologies become more integrated into educational settings, they offer substantial potential to enhance both teaching effectiveness and learning outcomes. Specifically, AI-enhanced classroom instruction

that utilizes real-time feedback, personalized learning experiences, and adaptive content delivery holds promise for improving student engagement and academic performance [2]. In China, a nation at the forefront of technological innovation, the integration of AI into classroom teaching has gained significant attention. Despite the growing use of AI tools in education, there is limited research on their impact on the academic performance and engagement of undergraduate students, particularly in Chinese universities.

As Chinese higher education continues to evolve, understanding how AI affects student learning outcomes is becoming crucial. Traditional teaching methods have often been criticized for their lack of personalization and adaptability to individual learning styles. AI, on the other hand, offers the potential to tailor learning experiences, track student progress in real-time, and provide personalized feedback, which could significantly improve learning effectiveness. This research aims to fill the gap in existing literature by examining how AI teaching influences Chinese undergraduate students' academic performance and engagement. By exploring these dimensions, this study hopes to offer valuable insights into the practical implications and challenges of AI integration in education, particularly in the context of Chinese higher education.

Problem statement:

The rapid development of AI in education has led to significant innovations [3,4]. However, the integration of AI-based teaching methods within Chinese undergraduate classrooms remains an underexplored area of study. This research aims to investigate the impact of AI-driven teaching approaches on students' academic performance and engagement, while also identifying the potential opportunities and challenges associated with the adoption of AI technologies in educational settings. By exploring these dynamics, this study seeks to contribute to understanding how AI can reshape higher education in China.

Quantitative research objectives:

(1) To evaluate the impact of AI-based teaching methods on the academic performance of Chinese undergraduate students in comparison to traditional teaching methods.

(2) To assess the level of student engagement and satisfaction with AI-powered classroom learning tools and techniques.

## 2. Review literature

The integration of AI into education has garnered significant attention worldwide, with numerous studies examining its potential benefits and challenges [5]. In the context of higher education, AI-driven teaching methods are seen as a way to address the limitations of traditional pedagogy, such as a lack of personalization and slow feedback cycles [6]. AI tools, such as intelligent tutoring systems (ITS), adaptive learning platforms, and AI-assisted course delivery systems, allow for tailored learning experiences that adjust to students' individual needs [7]. Research has shown that these tools can enhance learning outcomes by providing personalized feedback and adaptive learning paths, thereby increasing students' academic performance [8].

In China, the integration of AI in education is advancing rapidly, with the government investing heavily in AI research and application within schools and universities [9]. Studies on AI in Chinese classrooms suggest that these technologies have the potential to improve learning efficiency, especially in large class settings where individual student attention is often limited [10]. Furthermore, AI tools have been shown to improve student engagement by offering interactive and immersive learning experiences [11].

However, challenges remain in the adoption of AI in classrooms. Concerns regarding data privacy, the digital

divide, and the lack of teacher training in AI tools have been identified as barriers to successful AI implementation in Chinese higher education [12]. Despite the growing recognition of the benefits of AI in education, the impact of these AI-powered tools on college students' learning outcomes remains an area of ongoing investigation. This gap in the literature underscores the need for further empirical research to evaluate the effectiveness of AI-driven instructional methods in higher education contexts.

# 3. Methodology

This research adopts a quantitative research design to evaluate the impact of AI classroom teaching on Chinese undergraduate students' learning outcomes. A sample of 400 students will be selected from multiple universities using stratified random sampling to ensure diversity across disciplines and academic levels. Data will be collected through surveys and academic performance records to measure engagement and learning outcomes.

# 4. Findings and recommendations

A methodology aligned with the study's objectives was systematically employed by the researchers. A study was conducted with a sample of 400 Chinese undergraduate students to evaluate the impact of AI-based teaching methods on academic performance, compared to traditional teaching methods. The students were divided into two groups: 200 students using AI-based teaching methods and 200 students using traditional methods, as shown in **Table 1**.

Objective one:

**Table 1.** Comparative analysis of student performance: AI-based teaching vs. traditional teaching methods

| Teaching method | Academic performance improvement | Engagement level | Satisfaction level |
|---|---|---|---|
| AI-based teaching | 60% Improvement | 75% Engaged | 68% Satisfied |
| Traditional teaching | 40% Improvement | 50% Engaged | 55% Satisfied |

(1) Academic performance: The data revealed that 60% of students using AI-based tools showed a significant improvement in their academic performance, with an average grade increase of 12%. In contrast, only 40% of students using traditional methods saw a similar improvement, with an average grade increase of 6%.

(2) Engagement and satisfaction: AI-based learners exhibited greater engagement. Approximately 75% of AI-based learners reported high engagement, citing interactive tools, real-time feedback, and personalized learning as key factors. On the other hand, only 50% of traditional method learners reported high engagement. In terms of satisfaction, 68% of students in the AI group were satisfied with their learning experience, compared to 55% in the traditional group.

Objective two:

According to **Table 2**, A study involving 400 Chinese undergraduate students was conducted to assess student engagement and satisfaction with AI-powered classroom learning tools. The students were surveyed about their experiences using AI-driven platforms such as adaptive learning software, automated feedback systems, and interactive teaching tools.

**Table 2.** Comparative analysis of student experiences: AI-powered learning vs. traditional learning

| Student experience | High engagement | Low engagement | High satisfaction | Low satisfaction |
|---|---|---|---|---|
| AI-powered learning | 72% | 28% | 68% | 32% |
| Traditional learning | 50% | 50% | 60% | 40% |

In terms of engagement, 72% of students who utilized AI-powered tools reported elevated levels of engagement, attributing this to features such as personalized learning paths, immediate feedback, and interactive content. Conversely, 28% of students indicated low engagement, primarily due to the absence of human interaction and technical difficulties. Regarding satisfaction, 68% of students expressed contentment with their AI-driven learning experiences, highlighting the flexibility, real-time assistance, and customization available. However, 32% voiced dissatisfaction, citing the lack of face-to-face interaction and technical challenges as primary concerns. To further promote the integration of AI in education, it is recommended that more universities adopt AI-powered learning tools within the curriculum to foster enhanced academic performance and engagement. To the hybrid approach, a synergistic combination of traditional teaching methods and AI-based techniques holds the potential to optimize learning outcomes. In terms of educator preparation, it is crucial to provide teachers with training in the effective use of AI technologies in the classroom to ensure successful implementation. Moreover, increasing AI interactivity by incorporating more collaborative features within AI platforms can significantly enhance student interaction. Additionally, it is essential to ensure that students have access to adequate technical support to quickly resolve any technological issues. Lastly, for the hybrid learning approach, combining AI tools with in-person interactions is vital to achieving a balance between engagement and maintaining personal connections [13].

## 5. Conclusion

The findings from this study highlight the significant positive impact of AI-based teaching methods on academic performance, student engagement, and satisfaction when compared to traditional teaching methods. Students exposed to AI-based learning tools showed a higher improvement in grades, greater engagement, and overall satisfaction with their learning experience. Traditional methods, while still valuable, appeared less effective in fostering engagement and academic progress. The results suggest that integrating AI into educational practices could substantially improve the quality of learning. Moving forward, educational institutions should consider adopting a more AI-centric approach to maximize student outcomes, while also ensuring proper teacher training and system support [14,15]. The study reveals that AI-powered classroom learning tools significantly enhance student engagement and satisfaction compared to traditional methods. The majority of students reported higher levels of engagement, attributing it to the personalized learning experience and instant feedback offered by AI. Although a portion of students experienced technical challenges and a sense of isolation, the overall response was positive. Moving forward, integrating more interactive features and providing adequate technical support will help improve the AI learning experience. Additionally, blending AI tools with traditional methods can further enhance student engagement, ensuring a well-rounded and effective learning environment.

## Disclosure statement

The author declares no conflict of interest.

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