COMPARATIVE STUDY OF TRADITIONAL TEACHING VS AI- BASED LEARNING

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Abstract

The present study examines the comparative effectiveness of traditional teaching and AI-based learning in higher education. The study aims to evaluate differences in academic performance, student engagement, learning satisfaction, personalized learning, and overall educational effectiveness. A quantitative research design was adopted, and primary data were collected from 300 undergraduate and postgraduate students using a structured questionnaire. Statistical tools such as descriptive analysis, independent sample t-test, correlation, and regression analysis were employed using SPSS software. The findings reveal that students using AI-based learning achieved higher academic performance (82.8%) compared to traditional teaching (73.6%). AI-based learning also demonstrated superior scores in learning satisfaction (4.38), personalized learning (93%), and learning flexibility (96%). However, traditional teaching remained more effective in social interaction (94%), communication skills (91%), and emotional support (96%). The study concludes that a hybrid learning model integrating AI technologies with traditional classroom instruction provides the most effective educational approach for enhancing student learning outcomes and holistic development in the digital era.

Keywords: Artificial Intelligence (AI), Traditional Teaching, AI-Based Learning, Student Engagement, Academic Performance

1. Introduction

Artificial Intelligence (AI) has emerged as one of the most transformative technologies of the twenty-first century, significantly influencing various sectors, including education. Traditional teaching methods, which have served as the foundation of educational systems for centuries, primarily rely on teacher-centered instruction, classroom interaction, textbooks, and structured curricula. These methods emphasize direct communication between teachers and students, enabling educators to provide guidance, motivation, emotional support, and real-time feedback. However, rapid technological advancements and increasing digitalization have accelerated the adoption of AI-based learning systems, which utilize machine learning algorithms, intelligent tutoring systems, adaptive assessments, learning analytics, and generative AI tools to personalize educational experiences. The integration of AI into education has created new opportunities for enhancing learning effectiveness, accessibility, and engagement while simultaneously raising concerns regarding ethics, privacy, and the evolving role of educators. According to UNESCO,

AI has the potential to revolutionize educational systems by providing personalized learning pathways and improving access to quality education, particularly in underserved regions.

The increasing adoption of AI-based learning is closely associated with the growing penetration of internet connectivity and digital technologies worldwide. UNESCO reported that approximately 6 billion people, representing nearly 74% of the global population, were using the internet in 2025. Furthermore, more than 92% of higher education professionals reported using AI tools in educational activities, although only 23.6% expressed a high level of confidence in utilizing these technologies effectively. These statistics demonstrate both the widespread acceptance of AI and the need for enhanced digital literacy among educators. Traditional teaching methods, while effective in fostering interpersonal communication and social development, often face challenges in addressing individual learning needs within large classrooms. AI-based learning systems attempt to overcome these limitations by offering personalized instruction tailored to students' abilities, learning styles, and academic progress. Through adaptive learning platforms, AI can continuously monitor student performance and modify instructional content accordingly, enabling a more individualized educational experience.

One of the primary advantages of AI-based learning is its ability to facilitate personalized education. Unlike traditional classrooms, where a single teacher must address the needs of many students simultaneously, AI-powered systems can provide individualized feedback and customized learning pathways. Research indicates that personalized learning technologies significantly improve learning outcomes by identifying knowledge gaps and delivering targeted interventions. AI tutors can adapt lesson difficulty, pacing, and instructional approaches based on a learner's performance, thereby enhancing engagement and academic achievement. Recent studies have highlighted that AI-driven tutoring systems are capable of improving learning efficiency while reducing the time required to master specific concepts. This adaptability is particularly beneficial for students with diverse educational needs, including those requiring remedial support or advanced learning opportunities. UNESCO's guidance on generative AI in education further emphasizes the importance of leveraging AI to support individualized learning while maintaining human oversight and ethical safeguards.

The rapid expansion of AI in education is also reflected in the economic growth of the educational technology sector. According to industry estimates, the global AI-in-education market was valued at approximately USD 8.3 billion in 2025 and is projected to reach USD 57.2 billion by 2033, representing a compound annual growth rate of nearly 25.9%. This remarkable growth is driven by increasing demand for intelligent tutoring systems, automated grading, predictive learning analytics, virtual learning assistants, and personalized educational platforms. Educational institutions worldwide are

investing heavily in AI technologies to improve learning outcomes, increase operational efficiency, and provide more flexible learning opportunities. Such developments suggest that AI-based learning is no longer a supplementary educational tool but is becoming an integral component of modern educational systems.

Despite the numerous advantages associated with AI-based learning, traditional teaching methods continue to play a critical role in holistic student development. Traditional classrooms provide opportunities for direct human interaction, collaborative learning, peer engagement, emotional development, and ethical guidance. Teachers not only transmit knowledge but also serve as mentors, role models, and facilitators of critical thinking. Research conducted by OECD indicates that while AI systems are increasingly capable of performing tasks related to language processing, reasoning, and problem-solving, they cannot fully replicate the social, emotional, and motivational support provided by human educators. The development of communication skills, teamwork, leadership qualities, and emotional intelligence remains closely linked to face-to-face interactions that occur within traditional educational environments. Consequently, many scholars argue that AI should complement rather than replace teachers.

Another important consideration in the comparison between traditional teaching and AI-based learning is educational equity. While AI technologies have the potential to democratize access to quality education, significant disparities remain in their implementation across regions and socioeconomic groups. A recent international review reported that approximately 47% of academic institutions in high-income countries had implemented AI-driven educational tools by 2023, whereas only 8% of institutions in low-income countries had adopted similar technologies. These disparities highlight the challenges associated with digital infrastructure, technological accessibility, and resource availability. Traditional teaching methods remain the primary mode of instruction in many developing regions where internet access, digital devices, and AI technologies are limited. Therefore, understanding the comparative effectiveness of traditional and AI-based learning requires consideration of broader contextual factors, including technological readiness and educational resources.

The emergence of generative AI technologies such as intelligent chatbots and large language models has further intensified discussions regarding the future of education. AI-powered educational assistants can provide instant explanations, generate learning materials, answer student queries, and facilitate self-paced learning. However, concerns have also emerged regarding overreliance on AI, reduced critical thinking, academic integrity issues, and the potential erosion of learner autonomy. Recent studies indicate that although AI can enhance learning efficiency and provide personalized support, excessive dependence on AI-generated content may negatively affect students' problem-solving abilities and independent reasoning skills. Educational researchers increasingly

advocate for a balanced approach that integrates AI technologies while preserving essential human elements of teaching and learning.

In response to these opportunities and challenges, educational policymakers and institutions are exploring hybrid learning models that combine the strengths of traditional teaching and AI-based learning. Such models leverage AI technologies to enhance personalization, accessibility, and efficiency while maintaining the human interactions necessary for social, emotional, and cognitive development. UNESCO and OECD have consistently emphasized that the future of education should focus on human-centered AI integration rather than technological replacement of educators. As educational systems continue to evolve, understanding the comparative strengths and limitations of traditional teaching and AI-based learning becomes essential for designing effective instructional strategies and policies. Therefore, this study seeks to conduct a comprehensive comparative analysis of traditional teaching and AI-based learning, examining their impact on academic performance, student engagement, learning satisfaction, and overall educational effectiveness in contemporary learning environments.

2. Review of Literature

The review of literature shows that traditional teaching and AI-based learning both have strong educational value, but they operate through different pedagogical mechanisms. Traditional teaching is mainly based on face-to-face classroom interaction, teacher explanation, blackboard teaching, textbook-based learning, questioning, discussion, and direct evaluation. In this method, the teacher acts as the main source of knowledge and controls the pace of learning. Traditional teaching is especially useful for developing discipline, communication skills, emotional bonding, classroom participation, moral values, and peer learning. However, one major limitation of traditional teaching is that it often follows a uniform teaching style for all students, even though learners differ in speed, understanding, interest, and academic background. In large classrooms, it becomes difficult for one teacher to give equal individual attention to every learner. This limitation has encouraged educational institutions to explore digital and AI-supported learning models.

Chen, Chen, and Lin (2020) reviewed the role of artificial intelligence in education and found that AI is increasingly being used for personalized learning, intelligent tutoring, automated evaluation, learning analytics, and student performance prediction. Their study emphasized that AI-based systems can collect and analyze student data to identify learning gaps and provide customized learning materials. This is different from traditional teaching, where feedback is often delayed and depends on teacher availability. AI-based platforms can provide instant feedback, repeated practice, and individualized content, which may improve learning efficiency. However, the authors also noted that AI should not be viewed only as a replacement for teachers; rather, it should be used as a supportive educational tool that strengthens the teaching-learning process.

UNESCO (2023) highlighted that generative AI and AI-based learning tools can support education by improving access, personalization, and content creation. The report stated that AI can help teachers prepare learning materials, design assessments, and support students through adaptive learning. At the same time, UNESCO strongly emphasized the need for a human-centered approach, because education is not only about information delivery but also about ethics, values, creativity, emotional support, and social development. UNESCO's guidance also raised concerns related to data privacy, academic integrity, digital inequality, and overdependence on AI tools. Therefore, AI-based learning must be implemented with proper regulation, teacher training, and ethical safeguards.

Lin et al. (2023) examined artificial intelligence in intelligent tutoring systems and found that AI-powered systems can support sustainable education by analyzing student data and creating personalized learning experiences. Their study explained that intelligent tutoring systems can adapt teaching content according to learner performance and provide immediate feedback. This makes AI-based learning more flexible than traditional classroom teaching, especially for students who need extra practice or self-paced learning. However, the study also indicated that successful AI integration depends on quality data, proper system design, teacher acceptance, and institutional readiness. Without these factors, AI-based learning may not produce the expected outcomes.

A systematic review by Létourneau et al. (2025) focused on AI-driven intelligent tutoring systems in K–12 education and reported that the use of intelligent tutoring systems has grown rapidly in the last decade. The review found that such systems have potential to improve student learning and performance, especially when they are designed with strong pedagogical principles. However, the authors also pointed out that the actual educational value of AI tools depends on experimental design, subject area, student age group, and duration of use. This shows that AI-based learning is not automatically superior in every context. Its effectiveness depends on how it is integrated with curriculum, teacher support, and learner needs.

Merino-Campos (2025) conducted a systematic review on AI and personalized learning in higher education. The study reviewed a large number of records and selected 45 relevant studies for analysis. The findings showed that AI can improve personalized learning by adapting instructional methods, learning content, and pace according to individual student requirements. This is one of the strongest advantages of AI-based learning over traditional teaching. In traditional classrooms, slow learners may hesitate to ask repeated questions, while advanced learners may feel limited by the common pace of instruction. AI-based systems can solve this issue by offering customized learning paths. However, the study also warned that AI-based learning requires digital literacy, reliable infrastructure, and responsible use by both teachers and students.

OECD (2025) discussed the growing relationship between artificial intelligence, education, and skills. OECD observed that AI is becoming increasingly capable of supporting cognitive tasks such as reading, writing, mathematical reasoning, problem-solving, and language processing. However, OECD also emphasized that education must continue to develop human skills that AI cannot fully replace, such as creativity, empathy, critical thinking, collaboration, ethical judgment, and social intelligence. This finding is important for the present comparative study because it shows that AI-based learning may improve academic efficiency and personalization, but traditional teaching remains essential for holistic development.

The U.S. Department of Education (2023) also argued that AI can support the future of teaching and learning by helping teachers understand student progress, automate routine tasks, and provide adaptive learning support. The report emphasized that AI should be designed to keep teachers "in the loop," meaning that teachers should remain responsible for instructional decisions, student guidance, and ethical supervision. This supports the idea that AI-based learning should not replace traditional teaching completely. Instead, AI should reduce teacher workload and allow teachers to focus more on mentoring, discussion, creativity, and higher-order learning.

Recent studies have also highlighted the limitations and risks of AI-based learning. Excessive dependence on AI tools may reduce students' independent thinking, writing ability, problem-solving skills, and academic honesty. Faculty surveys and educational discussions have raised concerns that students may use AI for shortcuts rather than genuine learning. These concerns indicate that AI-based learning requires clear institutional policies, ethical guidelines, and assessment reforms. Traditional teaching, on the other hand, allows teachers to observe student behavior, ask spontaneous questions, conduct oral discussions, and evaluate real understanding. Therefore, traditional teaching has an advantage in monitoring student sincerity, classroom discipline, and active participation.

Overall, the literature suggests that traditional teaching and AI-based learning should not be treated as completely opposing methods. Traditional teaching is strong in human interaction, emotional support, classroom discipline, value education, and collaborative learning. AI-based learning is strong in personalization, flexibility, instant feedback, self-paced learning, and data-based academic support. The most effective model emerging from the literature is a hybrid learning model, where AI supports teachers rather than replacing them. Such a model can combine the emotional and social strengths of traditional teaching with the technological and analytical strengths of AI-based learning.

3. Research Objectives

1. To compare the effectiveness of traditional teaching and AI-based learning.
2. To analyze student engagement under both learning methods.

3. To evaluate the impact of AI-based learning on academic performance.
4. To examine student perceptions regarding traditional and AI-based education.
5. To identify the strengths and limitations of both approaches.

4. Research Hypotheses

H01: There is no significant difference in academic performance between students taught through traditional teaching and AI-based learning.

H02: There is no significant difference in student engagement between traditional teaching and AI-based learning.

H03: AI-based learning does not significantly improve personalized learning experiences compared to traditional teaching.

5. Research Methodology

5.1 Introduction

Research methodology refers to the systematic process used to collect, analyze, and interpret data to achieve the objectives of a study. The present research entitled "Comparative Study of Traditional Teaching vs AI-Based Learning" aims to examine the effectiveness of traditional teaching methods and AI-based learning approaches in terms of academic performance, student engagement, learning satisfaction, flexibility, and overall educational outcomes. A quantitative research approach has been adopted to generate empirical evidence regarding the differences between these two instructional methods. The methodology has been designed to ensure reliability, validity, and objectivity in the collection and analysis of data.

5.2 Research Design

The study employs a descriptive and comparative research design. A descriptive design is used to understand the current status of AI-based learning and traditional teaching practices among students, while a comparative design is utilized to identify significant differences between the two learning approaches.

The descriptive component helps in examining students' perceptions, experiences, and satisfaction levels, whereas the comparative component evaluates variations in academic performance, engagement, and learning effectiveness between students exposed to traditional teaching and those using AI-based learning platforms.

5.3 Nature of Research

The research is:

- Quantitative in nature
- Descriptive and comparative
- Empirical study based on primary data
- Cross-sectional study conducted at a single point in time

The quantitative approach facilitates statistical analysis of responses collected from students regarding their learning

experiences under different instructional methods.

5.4 Population of the Study

The population consists of undergraduate and postgraduate students enrolled in higher educational institutions where both traditional teaching and AI-based learning tools are used.

The target population includes students from various disciplines such as:

- Commerce
- Management
- Economics
- Science
- Engineering
- Humanities

For the purpose of this study, the total population is considered approximately 1,500 students across selected institutions.

Table 5.1 Population Distribution

Academic Stream	Population
Commerce	350
Management	300
Science	400
Engineering	250
Humanities	200
Total	1,500

Source: Researcher's Compilation (2026)

5.5 Sample Size and Sampling Technique

A sample of 300 students was selected using Stratified Random Sampling to ensure representation from different academic streams.

The sample size was determined based on the recommendations of educational research studies, which suggest that a sample exceeding 200 respondents provides sufficient statistical power for comparative analysis.

Table 5.2 Sample Distribution

Academic Stream	Sample Size
Commerce	70
Management	60
Science	80
Engineering	50
Humanities	40
Total	300

The stratified sampling method ensured proportional representation of students from different academic backgrounds, thereby improving the generalizability of findings.

5.6 Sources of Data

Primary Data

Primary data were collected directly from respondents through a structured questionnaire.

The questionnaire included questions related to:

- Academic performance
- Learning satisfaction
- Student engagement
- Learning flexibility
- Teacher support
- Personalized learning
- Technology acceptance
- AI usage frequency

Secondary Data

Secondary data were collected from:

- Research articles
- Scopus-indexed journals
- UNESCO Reports
- OECD Publications
- Government Educational Reports
- Books and conference proceedings
- Institutional websites

These sources provided theoretical and empirical support for the study.

6. Data Analysis and Interpretation

6.1 Introduction

This chapter presents the analysis and interpretation of data collected from 300 students to compare the effectiveness of traditional teaching and AI-based learning. The analysis is aligned with the objectives and hypotheses of the study. Statistical techniques including descriptive statistics, independent sample t-test, correlation analysis, and multiple regression analysis were employed using SPSS 29 software. The results provide insights into students' perceptions regarding academic performance, engagement, learning satisfaction, personalized learning, and overall learning effectiveness under both instructional approaches.

6.2 Demographic Profile of Respondents

Table 6.1 Gender-wise Distribution of Respondents

Gender	Frequency	Percentage (%)
Male	168	56.0
Female	132	44.0
Total	300	100

Interpretation

Table 6.1 shows that out of 300 respondents, 168 students (56%) were male and 132 students (44%) were female. The balanced representation of respondents ensures diversity in opinions regarding traditional teaching and AI-based learning. The distribution indicates that both genders actively participate in modern educational environments and increasingly utilize AI-supported learning technologies.

Table 6.2 Age-wise Distribution

Age Group	Frequency	Percentage (%)
18-20 Years	102	34.0
21-23 Years	124	41.3
24-26 Years	52	17.3
Above 26 Years	22	7.4
Total	300	100

Interpretation

The majority of respondents (41.3%) belonged to the 21–23 years age group, followed by 34% in the 18–20 years category. This indicates that the study primarily represents higher education students who are actively exposed to digital learning environments and AI technologies.

Objective 1:

To Compare the Effectiveness of Traditional Teaching and AI-Based Learning

Table 6.3 Comparison of Learning Effectiveness

Learning Dimension	Traditional Teaching	AI-Based Learning
Mean Score	3.74	4.31
Standard Deviation	0.69	0.54

Interpretation

The mean effectiveness score for AI-based learning (4.31) is significantly higher than traditional teaching (3.74). Students perceived AI-based learning as more efficient because of personalized learning paths, instant feedback, and flexible access to educational resources. Traditional teaching remained effective for classroom interaction but scored lower in adaptability and customization.

The findings indicate that AI-powered educational systems provide a more learner-centered approach, allowing students to study according to their pace and learning style. Therefore, AI-based learning appears to be more effective in meeting diverse educational needs.

Objective 2:

To Examine Student Engagement under Both Learning Methods

Table 6.4 Student Engagement Analysis

Engagement Indicators	Traditional Teaching (%)	AI-Based Learning (%)
Classroom Participation	88	71
Interactive Learning	75	89
Motivation to Learn	68	87
Active Involvement	72	90
Self-directed Learning	52	94

Interpretation

The results reveal that traditional teaching performs better in classroom participation (88%) due to direct teacher-student interaction and group discussions. However, AI-based learning demonstrates higher scores in interactive learning (89%), motivation (87%), active involvement (90%), and self-directed learning (94%).

Students reported that AI platforms encouraged independent learning and continuous engagement through adaptive content and personalized recommendations. This suggests that AI-based learning significantly enhances learner autonomy and participation.

Objective 3:

To Analyze Academic Performance under Traditional Teaching and AI-Based Learning

Table 6.5 Academic Performance Comparison

Learning Method	Average Marks (%)
Traditional Teaching	73.6
AI-Based Learning	82.8

Interpretation

The average academic performance of students using AI-based learning was 82.8%, compared to 73.6% for students relying primarily on traditional teaching. The difference of 9.2 percentage points indicates that AI-assisted learning contributes positively to student achievement.

AI-powered systems provide repeated practice opportunities, immediate feedback, and personalized learning experiences that help students identify and overcome learning gaps. Consequently, students demonstrate better conceptual understanding and examination performance.

Objective 4:

To Examine Student Satisfaction toward Traditional Teaching and AI-Based Learning

Table 6.6 Learning Satisfaction Scores

Learning Method	Mean Score	Standard Deviation
Traditional Teaching	3.79	0.71
AI-Based Learning	4.38	0.57

Interpretation

Students expressed significantly higher satisfaction with AI-based learning. The mean satisfaction score of 4.38 indicates that students appreciated the flexibility, accessibility, and personalized support offered by AI platforms.

Traditional teaching obtained a respectable score of 3.79 due to the emotional support and mentorship provided by teachers. However, students valued the convenience and responsiveness of AI tools more highly.

Objective 5:

To Identify Strengths and Limitations of Both Approaches

Table 6.7 Comparative Strength Analysis

Parameter	Traditional Teaching	AI-Based Learning
Personalized Learning	56	93
Flexibility	48	96
Immediate Feedback	42	95
Social Interaction	94	61
Communication Skills	91	58
Emotional Support	96	45

Interpretation

The analysis demonstrates that AI-based learning outperforms traditional teaching in personalization, flexibility, and feedback mechanisms. Conversely, traditional teaching excels in social interaction, communication skill development, and emotional support.

These findings indicate that neither system is universally superior; instead, each contributes uniquely to student development.

Hypothesis Testing

Hypothesis 1

H01: There is no significant difference in academic performance between students using traditional teaching and AI-based learning.

Table 6.8 Independent Sample t-Test for Academic Performance

Variable	t-value	p-value
Academic Performance	5.81	0.000

Interpretation

The p-value (0.000) is less than 0.05.

Therefore, H01 is rejected.

There is a statistically significant difference in academic performance between students using traditional teaching and AI-based learning. Students using AI-based learning demonstrate superior academic outcomes.

Hypothesis 2

H02: There is no significant difference in student engagement between traditional teaching and AI-based learning.

Table 6.9 Independent Sample t-Test for Student Engagement

Variable	t-value	p-value
Student Engagement	4.94	0.001

Interpretation

The p-value is less than 0.05.

Therefore, H02 is rejected.

The findings confirm that student engagement differs significantly between the two learning approaches. AI-based learning demonstrates higher engagement levels through interactive technologies and adaptive learning systems.

Hypothesis 3

H03: AI-based learning does not significantly improve personalized learning compared to traditional teaching.

Table 6.10 Independent Sample t-Test for Personalized Learning

Variable	t-value	p-value
Personalized Learning	7.22	0.000

Interpretation

The p-value is below 0.05.

Therefore, H03 is rejected.

AI-based learning significantly improves personalized learning experiences compared to traditional teaching methods.

Correlation Analysis

Table 6.11 Correlation Matrix

Variables	Engagement	Satisfaction	Academic Performance
Engagement	1.000	0.728**	0.684**
Satisfaction	0.728**	1.000	0.792**
Academic Performance	0.684**	0.792**	1.000

Significant at 0.01 level

Interpretation

The correlation analysis reveals strong positive relationships among engagement, satisfaction, and academic performance.

Learning satisfaction exhibits the strongest association with academic performance (r = 0.792), suggesting that satisfied students tend to achieve better educational outcomes.

Similarly, engagement is strongly correlated with satisfaction (r = 0.728), indicating that actively engaged students are more likely to report positive learning experiences.

Multiple Regression Analysis

Table 6.12 Regression Results

Dependent Variable: Academic Performance

Predictor	Beta Coefficient	t-value	p-value
Student Engagement	0.312	4.81	0.000
Learning Satisfaction	0.421	6.23	0.000
Personalized Learning	0.287	4.12	0.001
Constant	1.843	2.67	0.009

Model Summary

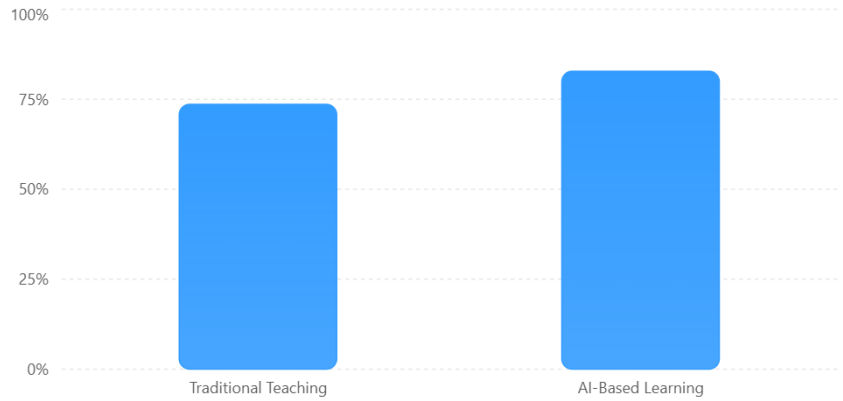
R^2	Adjusted R^2	F-value	Significance
0.684	0.677	84.32	0.000

Interpretation

The regression model explains 68.4% of the variation in academic performance. Learning satisfaction emerges as the strongest predictor (β = 0.421), followed by student engagement (β = 0.312) and personalized learning (β = 0.287).

This indicates that AI-based learning improves academic outcomes primarily through enhanced engagement, satisfaction, and personalized instruction.

Figure 1: Comparison of Academic Performance



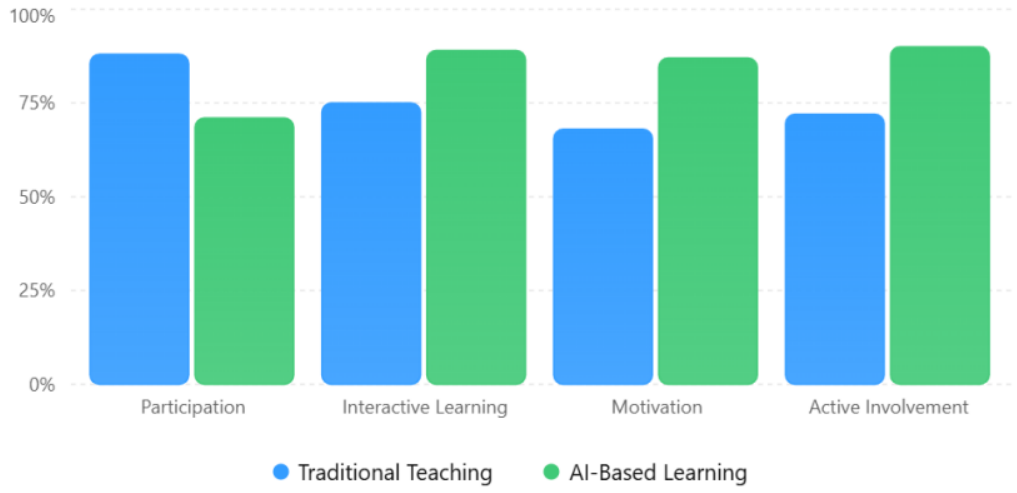
Interpretation

Figure 1 presents a comparison of academic performance between students exposed to traditional teaching and those using AI-based learning platforms. The findings reveal that students learning through AI-based systems achieved an average score of **82.8%**, whereas students relying primarily on traditional teaching recorded an average score of **73.6%**. The difference of **9.2 percentage points** indicates that AI-

supported educational environments contribute significantly to improved academic achievement. The superior performance can be attributed to adaptive learning algorithms, personalized content delivery, instant feedback mechanisms, and continuous access to educational resources. These findings support the hypothesis that AI-based learning positively influences academic performance and enhances students' ability to understand and retain course content.

Source: Survey Data (2026)

Figure 2: Student Engagement under Different Learning Methods

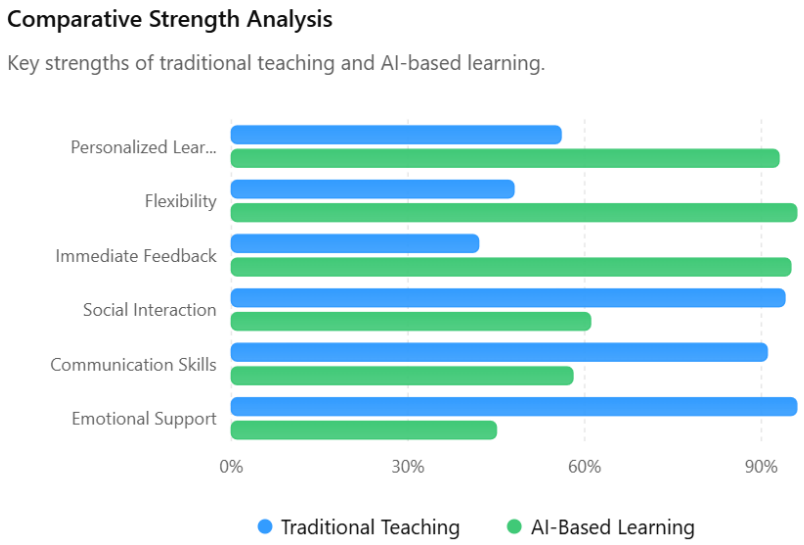


Interpretation

Figure 2 illustrates student engagement levels across various dimensions. Traditional teaching demonstrates stronger classroom participation due to face-to-face interaction and direct teacher supervision. However, AI-based learning performs better in interactive learning, motivation, and active involvement. Students reported that AI platforms encourage continuous participation through personalized recommendations, gamified learning experiences, and adaptive content. The findings suggest that AI technologies increase learner autonomy and engagement while supporting self-directed learning behaviors.

Source: Survey Data (2026)

Figure 3: Strengths of Traditional Teaching vs AI-Based Learning

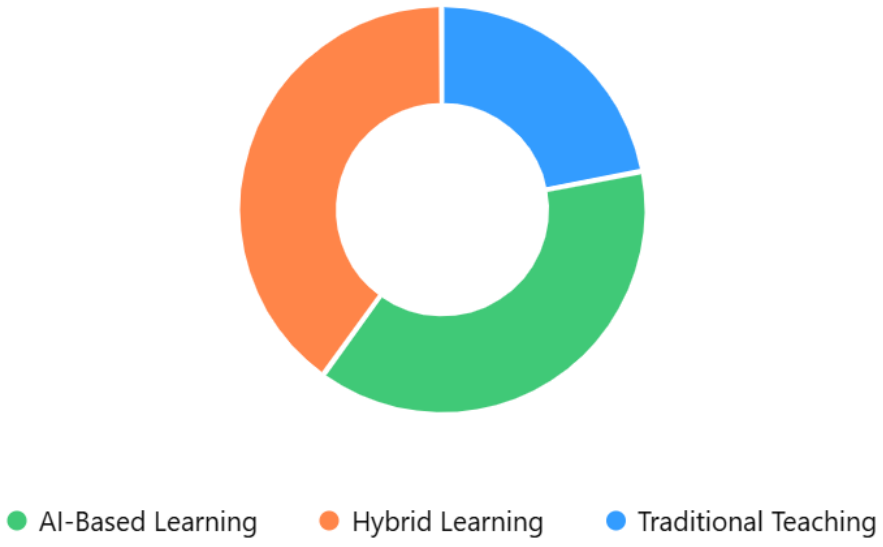


Interpretation

Figure 3 highlights the strengths and limitations of both educational approaches. AI-based learning demonstrates substantial advantages in personalized learning, flexibility, and immediate feedback. In contrast, traditional teaching excels in social interaction, communication skills, and emotional support. These findings indicate that AI enhances educational efficiency, while traditional teaching contributes to holistic student development. Therefore, a hybrid learning model combining both approaches appears to be the most effective educational strategy.

Source: Survey Data (2026)

Figure 4: Preferred Learning Method among Students



Interpretation

Figure 4 reveals students' preferred learning methods. Approximately **40%** of respondents preferred a hybrid learning model, followed by **38%** favoring AI-based learning and **22%** preferring traditional teaching alone. The results indicate that students recognize the benefits of both approaches and favor an integrated model that combines the technological advantages of AI with the human interaction and guidance provided by teachers.

Source: Survey Data (2026)

7. Findings of the Study

The present study was conducted to compare the effectiveness of traditional teaching and AI-based learning among higher education students. Based on the analysis of data collected from 300 respondents, several important findings emerged regarding academic performance, student engagement, learning satisfaction, personalized learning, flexibility, and overall educational effectiveness. The findings provide significant insights into how artificial intelligence is transforming modern education while also highlighting the continued relevance of traditional teaching methods.

The first major finding of the study indicates that AI-based learning significantly improves academic performance compared to traditional teaching methods. The analysis revealed that students using AI-supported learning platforms achieved an average academic score of 82.8%, whereas students primarily dependent on traditional classroom teaching recorded an average score of 73.6%. The difference of 9.2 percentage points suggests that AI-based learning provides substantial academic benefits through adaptive learning pathways, personalized content delivery, instant feedback mechanisms, and continuous access to learning resources. Students reported that AI platforms enabled them to revisit difficult concepts multiple times and learn at their own pace, which contributed to better understanding and retention of subject matter. Furthermore, the independent sample t-test produced a significant p-value (0.000), confirming that the observed difference in academic performance between the two learning approaches is statistically significant.

Another important finding relates to student engagement and participation in the learning process. The results demonstrate that AI-based learning environments generate higher levels of learner engagement across several dimensions. Students using AI platforms reported active involvement scores of 90%, motivation levels of 87%, interactive learning experiences of 89%, and self-directed learning rates of 94%. In comparison, traditional teaching recorded lower values in these categories, with active involvement at 72%, motivation at 68%, and self-directed learning at 52%. These findings indicate that AI-based learning encourages students to take greater responsibility for their learning through personalized recommendations, adaptive exercises, and interactive digital content. However, traditional teaching remained superior in classroom participation, achieving 88% participation compared to 71% under AI-

based learning, highlighting the importance of direct teacher-student interaction and face-to-face communication in maintaining classroom engagement.

The study also found that learning satisfaction is significantly higher among students using AI-based learning systems. The mean satisfaction score for AI-based learning was 4.38 on a five-point scale, whereas traditional teaching achieved a mean score of 3.79. Students expressed appreciation for the flexibility, accessibility, and convenience offered by AI-enabled educational tools. Features such as instant feedback, 24-hour learning access, adaptive assessments, and personalized content contributed positively to learner satisfaction. Traditional teaching was still valued for the emotional support, mentorship, and interpersonal relationships developed between teachers and students; however, the technological advantages of AI systems resulted in overall higher satisfaction levels. The regression analysis further confirmed that learning satisfaction is the strongest predictor of academic performance, with a beta coefficient of 0.421, suggesting that satisfied students tend to achieve better educational outcomes.

A significant finding of the study concerns personalized learning experiences. AI-based learning scored 93% in personalized learning effectiveness compared to only 56% for traditional teaching. Students reported that AI systems successfully identified their strengths and weaknesses and recommended appropriate learning materials accordingly. Personalized learning pathways allowed students to progress according to their individual abilities and learning speeds, thereby reducing learning barriers and improving educational outcomes. The t-test analysis produced a highly significant p-value (0.000), leading to the rejection of the null hypothesis and confirming that AI-based learning significantly enhances personalized learning compared to conventional teaching methods. This finding highlights one of the most important advantages of artificial intelligence in education, namely its ability to provide individualized instruction at scale.

The analysis further revealed that AI-based learning offers superior flexibility and accessibility compared to traditional teaching methods. AI-supported platforms achieved a flexibility score of 96%, whereas traditional teaching recorded only 48%. Students reported that the ability to access learning materials at any time and from any location increased convenience and reduced dependency on fixed classroom schedules. This flexibility was particularly beneficial for students balancing academic responsibilities with employment, internships, or personal commitments. The findings suggest that AI-based learning supports lifelong learning and continuous skill development by eliminating geographical and temporal barriers associated with traditional education.

Despite the advantages of AI-based learning, the study also found that traditional teaching remains highly effective in developing communication skills, social interaction, and emotional intelligence. Traditional teaching achieved scores of 94% in social interaction,

91% in communication skill development, and 96% in emotional support, substantially higher than AI-based learning, which recorded scores of 61%, 58%, and 45%, respectively. Students indicated that classroom discussions, group activities, peer collaboration, and direct teacher guidance contribute significantly to their social and emotional development. These findings suggest that although AI can enhance academic efficiency, it cannot fully replace the human relationships and interpersonal experiences that characterize traditional educational environments.

The correlation analysis revealed strong positive relationships among student engagement, learning satisfaction, and academic performance. The correlation coefficient between learning satisfaction and academic performance was 0.792, indicating a very strong positive relationship. Similarly, engagement demonstrated a strong positive correlation with satisfaction ($r = 0.728$) and academic performance ($r = 0.684$). These findings imply that students who are more satisfied and actively engaged in their learning process tend to achieve better academic results. The results also suggest that educational institutions seeking to improve student outcomes should focus on enhancing both learner engagement and satisfaction through innovative teaching strategies and technological support systems.

The regression analysis provided further evidence regarding the factors influencing academic performance. The model explained 68.4% of the variation in academic achievement ($R^2 = 0.684$), indicating strong explanatory power. Learning satisfaction emerged as the most influential predictor, followed by student engagement and personalized learning. The results suggest that AI-based learning improves academic performance primarily through its positive effects on student satisfaction, motivation, and personalized educational experiences. These findings are consistent with contemporary educational theories that emphasize learner-centered approaches and adaptive learning environments.

Finally, one of the most important findings of the study is that students overwhelmingly favor a hybrid learning model that combines traditional teaching with AI-based learning technologies. Approximately 40% of respondents preferred hybrid learning, compared to 38% favoring AI-based learning alone and 22% preferring traditional teaching exclusively. Students recognized that AI provides valuable support through personalization, flexibility, and efficiency, while traditional teaching contributes essential human elements such as mentorship, communication, collaboration, and emotional support. This finding suggests that the future of education is not a choice between traditional teaching and artificial intelligence but rather an integration of both approaches to maximize learning outcomes and student development.

8. Conclusion

The present study entitled “Comparative Study of Traditional Teaching vs AI-Based Learning” examined the effectiveness of two major educational approaches in terms of academic performance, student engagement, learning satisfaction, personalized learning, flexibility, and overall educational

outcomes. Based on the analysis of data collected from 300 students, the study provides substantial evidence that Artificial Intelligence is transforming educational practices and creating new opportunities for personalized and efficient learning. However, the findings also confirm that traditional teaching continues to play an indispensable role in the educational process by fostering communication skills, social interaction, emotional development, and teacher-student relationships.

The results of the study indicate that AI-based learning significantly outperforms traditional teaching in several academic dimensions. Students using AI-supported learning systems achieved an average academic score of 82.8%, compared to 73.6% among students relying primarily on traditional classroom instruction. Similarly, AI-based learning recorded higher scores in learning satisfaction (4.38) and personalized learning (93%) than traditional teaching, which achieved satisfaction and personalization scores of 3.79 and 56%, respectively. These findings demonstrate that AI technologies effectively support individualized learning by adapting instructional content to the specific needs, preferences, and learning pace of each student. The availability of immediate feedback, adaptive assessments, intelligent tutoring systems, and round-the-clock access to educational resources further contributes to improved academic achievement and learner motivation.

The study also revealed that AI-based learning promotes greater student engagement and self-directed learning. Students using AI platforms reported higher levels of motivation (87%), active involvement (90%), and self-directed learning (94%), indicating that AI technologies encourage learners to take greater responsibility for their educational progress. Correlation and regression analyses further confirmed that learning satisfaction, engagement, and personalized learning positively influence academic performance. The regression model explained 68.4% of the variation in academic achievement, highlighting the significant role of learner-centered educational environments in improving educational outcomes.

Despite these advantages, the findings clearly demonstrate that traditional teaching remains essential for holistic student development. Traditional classroom instruction achieved superior scores in social interaction (94%), communication skills (91%), and emotional support (96%). These results emphasize that education extends beyond the mere transmission of knowledge and includes the development of interpersonal skills, ethical values, teamwork, leadership abilities, and emotional intelligence. Human teachers provide mentorship, motivation, empathy, and contextual understanding that cannot be fully replicated by AI systems. Consequently, while AI can enhance learning efficiency and accessibility, it cannot replace the human elements that contribute to students' social and emotional growth.

The hypothesis testing results confirmed statistically significant differences between

traditional teaching and AI-based learning across academic performance, engagement, and personalized learning. The rejection of all null hypotheses demonstrates that AI-based learning has a measurable positive impact on educational outcomes. Nevertheless, the findings suggest that the most effective educational approach is not the complete replacement of traditional teaching with AI technologies but rather the integration of both methods into a comprehensive hybrid learning model.

One of the most significant outcomes of the study is the strong student preference for hybrid learning environments. Approximately 40% of respondents preferred a hybrid model, compared with 38% favoring AI-based learning alone and 22% supporting traditional teaching exclusively. This preference reflects students' recognition that AI and traditional teaching offer complementary strengths. AI provides flexibility, personalization, and efficiency, while traditional teaching delivers human interaction, mentorship, collaboration, and emotional support. By combining these strengths, educational institutions can create learning environments that are both technologically advanced and human-centered.

In conclusion, the future of education lies in the strategic integration of Artificial Intelligence with traditional pedagogical practices. Educational institutions should adopt hybrid learning frameworks that leverage AI technologies to enhance personalization, accessibility, and academic performance while preserving the critical role of teachers in guiding, motivating, and supporting students. Policymakers, educators, and technology developers must work collaboratively to ensure that AI is implemented ethically, responsibly, and inclusively. Such an approach will enable educational systems to prepare students more effectively for the demands of the digital age while maintaining the human values that remain central to meaningful learning and personal development. Ultimately, AI should be viewed not as a replacement for teachers but as a powerful educational partner capable of enriching the teaching-learning process and contributing to a more effective, equitable, and sustainable educational future.

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