

Analyzing the Effect of AI Tools on Academic Performance of Students

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Abstract:

Artificial Intelligence (AI) has emerged as a transformative technology in education, offering personalized learning experiences, intelligent tutoring systems, automated assessments, and real-time academic support. This study examines the effect of AI tools on the academic performance of students by analyzing factors such as learning engagement, assignment completion, attendance, assessment scores, and frequency of AI tool usage. Educational data are collected and preprocessed to identify patterns associated with student achievement. Data mining and analytical techniques are employed to evaluate the relationship between AI-assisted learning and academic outcomes. The findings indicate that the effective use of AI tools can enhance student understanding, improve learning efficiency, and contribute positively to academic performance. The study highlights the potential of AI-driven educational technologies in supporting student success and informed decision-making in educational institutions.

Keywords — Artificial Intelligence, Student Performance, Educational Data Mining, Academic Achievement, Learning Analytics, AI Tools.

I. INTRODUCTION

Artificial Intelligence (AI) has become one of the most influential technologies in modern education, transforming the way students learn and interact with educational resources. AI-powered tools such as intelligent tutoring systems, virtual assistants, adaptive learning platforms, automated grading systems, and generative AI applications provide personalized learning experiences and immediate feedback to students. These technologies help learners understand complex concepts, improve problem-solving skills, and enhance academic engagement.

The integration of AI in education has significantly increased in recent years due to advancements in

machine learning, data analytics, and cloud computing. Educational institutions are increasingly adopting AI-based solutions to support teaching and learning processes, monitor student progress, and identify students who may require additional academic assistance. By analyzing large volumes of educational data, AI systems can provide valuable insights into student learning behavior and performance patterns.

Academic performance is influenced by several factors, including attendance, study habits, learning engagement, assessment results, and access to educational resources. The use of AI tools has introduced new opportunities for students to access personalized learning support and improve their academic outcomes. However, the extent to which

AI tools contribute to student performance remains an important area of research.

This study aims to analyze the effect of AI tools on the academic performance of students by examining factors such as AI tool usage, assignment completion, learning engagement, attendance, and assessment scores. Data mining and analytical techniques are employed to identify relationships between these factors and academic achievement. The findings of this study can assist educators and institutions in understanding the role of AI in education and developing strategies to enhance student success through effective use of AI technologies.

II. LITERATURE REVIEW

Holmes et al. [1] highlighted the role of AI in providing personalized learning experiences, automated assessment, and intelligent tutoring systems that enhance student engagement and academic achievement. Similarly, Zawacki-Richter et al. [2] conducted a systematic review of AI applications in higher education and found that AI technologies support adaptive learning environments and improve learning efficiency.

Luckin et al. [3] emphasized that AI-powered educational tools can provide individualized feedback and learning support, enabling students to achieve better academic outcomes. Chen et al. [4] investigated the effectiveness of intelligent tutoring systems and reported that students using AI-based learning platforms performed better in assessments than those following traditional learning methods.

Khosravi et al. [5] explored the use of learning analytics and predictive models in education, demonstrating that AI can identify students at risk of poor academic performance and facilitate timely interventions. Baker and Inventado [6] discussed educational data mining techniques and showed that AI-based analysis can uncover valuable patterns in student learning behavior, helping educators make informed decisions.

Yang et al. [7] examined adaptive learning systems and found that personalized AI-driven learning environments significantly improve student engagement, motivation, and academic success. Alam [8] analyzed the integration of AI in higher education and concluded that AI tools enhance teaching effectiveness, student participation, and learning outcomes.

Kasneji et al. [9] investigated the impact of generative AI tools such as ChatGPT in education and observed that these technologies can improve creativity, problem-solving skills, and conceptual understanding when used appropriately. Ouyang and Jiao [10] reviewed various AI applications in education and reported that intelligent learning systems contribute positively to personalized instruction and academic achievement.

III. METHODOLOGY

This study analyzes the effect of Artificial Intelligence (AI) tools on the academic performance of students. The methodology consists of data collection, preprocessing, analysis, and evaluation of factors influencing student achievement.

A. Data Collection

Student-related data were collected from educational records and learning management systems. The dataset includes attributes such as attendance, assignment completion, assessment scores, learning engagement, AI tool usage frequency, and final academic performance. These factors were selected because they directly influence student learning outcomes.

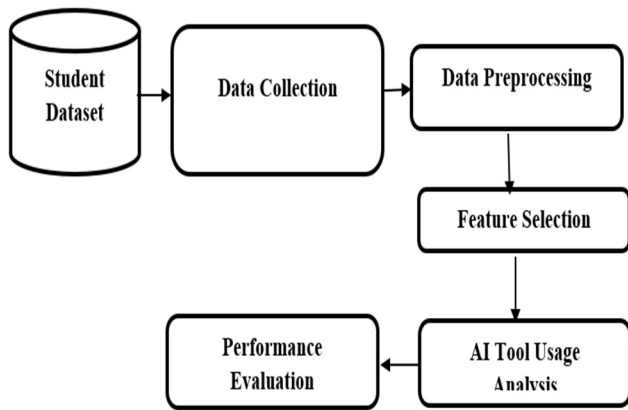


Figure 1. Proposed Methodology for AI-Based Student Performance Analysis

B. Data Preprocessing

The collected data were cleaned and prepared for analysis. Missing values, duplicate records, and inconsistencies were removed to improve data quality. Numerical values were normalized and categorical attributes were transformed into suitable formats for analysis. The preprocessing stage ensured that the dataset was accurate and reliable.

C. Feature Selection

Relevant features affecting student performance were identified. Attributes such as attendance percentage, assignment completion rate, assessment marks, learning participation, and AI tool utilization were selected as key indicators for evaluating academic performance.

D. Data Analysis

The preprocessed dataset was analyzed to examine the relationship between AI tool usage and student academic achievement. Statistical and data mining techniques were employed to identify patterns and trends among the selected attributes. The analysis focused on determining whether the use of AI tools contributes positively to learning outcomes.

E. Performance Evaluation

Student performance was evaluated based on academic scores and learning engagement indicators. Comparisons were made between students with different levels of AI tool usage to assess the effectiveness of AI-assisted learning. The results were interpreted to determine the impact of AI technologies on academic success.

IV. EXPERIMENTAL RESULT

The experimental study was conducted to analyze the influence of Artificial Intelligence (AI) tools on student academic performance. Data related to attendance, assignment completion, assessment scores, learning engagement, and AI tool usage were collected and evaluated. Students were categorized into three groups based on their level of AI tool utilization: Low, Medium, and High. The performance of each group was compared to determine the effectiveness of AI-assisted learning in improving academic outcomes. The analysis aimed to identify whether increased usage of AI tools contributes to better learning engagement and higher academic achievement. Table 1 presents the relationship between AI tool usage and student academic performance.

Table 1. Performance Analysis Based on AI Tool Usage

AI Tool Usage Level	Average Attendance (%)	Assignment Completion (%)	Assessment Score (%)	Academic Performance
Low	72	68	65	Average
Medium	81	79	76	Good
High	90	92	88	Excellent

The analysis reveals a positive relationship between AI tool usage and academic achievement. Students with high AI tool utilization achieved an average assessment score of 88%, while students with low AI usage obtained only 65%. Similarly, assignment completion and attendance rates increased with

greater engagement in AI-assisted learning activities.

The findings suggest that AI tools provide personalized learning support, immediate feedback, and access to educational resources that enhance student understanding and participation. As a result, students using AI technologies exhibited improved academic outcomes, higher engagement levels, and better overall performance.

The experimental results demonstrate that AI-assisted learning contributes positively to student success. Increased utilization of AI tools was associated with higher assessment scores, improved assignment completion rates, and better attendance. These results confirm that AI technologies can serve as effective educational support systems for enhancing academic performance and learning efficiency.

Figure 2 illustrates the comparison of student academic performance based on different levels of AI tool usage. The graph clearly shows that students with higher utilization of AI-assisted learning tools achieved better attendance, assignment completion rates, and assessment scores compared to students with lower AI usage.

A steady increase in performance indicators can be observed from the low-usage group to the high-usage group, indicating a positive correlation between AI tool adoption and academic achievement. These results suggest that AI-based educational technologies enhance learning engagement, support personalized learning, and contribute significantly to improved academic outcomes.

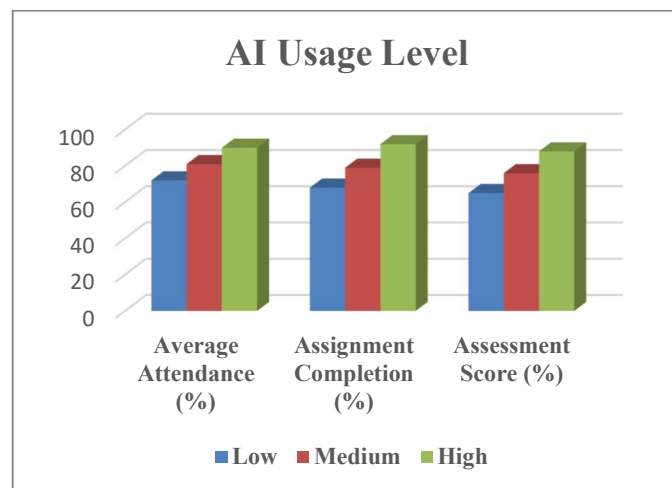


Figure. 2. Comparison of Academic Performance Based on AI Tool Usage Levels

V. CONCLUSIONS

Artificial Intelligence has emerged as a powerful tool for enhancing the quality of education and improving student academic performance. This study examined the effect of AI tools on student learning by considering factors such as learning engagement, assignment completion, assessment performance, attendance, and AI tool usage. The analysis indicates that AI-powered educational technologies provide personalized learning experiences, immediate feedback, and adaptive support that contribute positively to student achievement.

The findings suggest that students who effectively utilize AI-based learning tools demonstrate improved understanding of concepts, greater academic engagement, and better performance in assessments. AI technologies also assist educators in monitoring student progress and identifying learners who may require additional support. As educational institutions continue to adopt AI-driven solutions, the potential for improving teaching effectiveness and learning outcomes is expected to increase.

Future research can focus on evaluating the long-term impact of AI tools across different educational

levels and disciplines, as well as exploring advanced machine learning techniques for predicting and enhancing student success. Overall, the study concludes that the effective integration of Artificial Intelligence in education can significantly contribute to improved academic performance and a more personalized learning environment.

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