

# LEVERAGING ARTIFICIAL INTELLIGENCE TO ENHANCE LEARNING PROGRESS AND ITS IMPACT ON HIGHER EDUCATION STUDENTS

S. Rajesha<sup>1</sup> and M. Nirmala<sup>2</sup>

<sup>1</sup>Vidya Sanskaar Institute of Science, Commerce and Management, India

<sup>2</sup>Department of Master of Business Administration, Bengaluru City University, India

## Abstract

*This study investigates how Artificial Intelligence (AI) technologies affect higher education students' academic performance and learning outcomes. The study investigates the connection between the use of AI tools and enhancements in deadline management and general academic accomplishment by analysing data from 235 respondents. ANOVA, regression analysis, and Pearson correlation are used in the study to assess the direction and strength of these relationships. Results point to a beneficial relationship between regular use of AI tools and improved academic performance, with notable variations seen according to demographic characteristics including age, gender, and academic program. The study demonstrates how AI may enhance student achievement and facilitate tailored learning, providing insightful information for academic institutions looking to include AI-driven teaching methods into their curricula.*

## Keywords:

*Artificial Intelligence, Academic Performance, Learning Outcomes, Higher Education and Technology in Education*

## 1. INTRODUCTION

With its potential to improve learning outcomes and instructional strategies, artificial intelligence (AI) is quickly becoming a disruptive force in education. Applications like adaptive learning, intelligent assessment, and personalized learning paths have demonstrated substantial promise to enhance student engagement and academic achievement. The integration of AI in higher education is especially exciting. AI-driven technologies such as machine learning and natural language processing aid in the creation of dynamic and customized learning environments, better meeting the diverse needs of students [1].

Similarly, Rane et al. emphasized the role of AI in Education 4.0 and 5.0, highlighting predictive analytics, customized learning, and the importance of data privacy and ethical considerations [11]. AI offers the potential to address challenges in India, such as inadequate educational resources and diverse learning demands [4]. While AI enhances teaching effectiveness, Dubey et al. discussed socioeconomic and infrastructural challenges as significant barriers [4].

The automation of administrative work and the customization of learning, as outlined by Slimi and Mantha, could enhance educational processes considerably [10], [17]. However, issues like data privacy, ethical dilemmas, and the need for trained educators persist. Adewale et al. highlighted the lack of standardized frameworks to evaluate AI's impact on academic performance, particularly in diverse demographic and regional settings [1]. This study aims to explore how AI can improve learning outcomes in higher education, focusing on academic performance, individualized learning, and overcoming adoption barriers. By drawing on previous research, this study evaluates the

benefits and drawbacks of integrating AI into higher education, particularly in contexts such as India.

## 2. REVIEW OF LITERATURE

Recent studies have explored AI's transformative potential in education and the challenges of integrating it across various educational contexts. Wang et al. identified four main applications of AI in education: intelligent assessment, adaptive learning, profiling and prediction, and emerging AI-driven tools. Their systematic review of over 2,200 papers reveals trends in AI research and identifies areas such as generative AI and preschool applications as understudied. Rane et al. explored AI's role in Education 4.0 and 5.0, emphasizing the development of customized and adaptive learning environments using technologies like machine learning and natural language processing. Ethical concerns such as AI bias and data protection were also addressed [11]. In the Indian context, Mantha highlighted AI's potential to improve student engagement and personalized learning, while noting challenges in teacher training and data security [10]. Dubey et al. reviewed AI's applications in Indian education, including its use in administration, teaching, and learning. They pointed out infrastructural and workforce-related challenges hindering AI adoption [4]. Similarly, Saxena discussed how socioeconomic barriers limit AI's potential in improving decision-making and reasoning skills in education [15]. Adewale et al. focused on AI's role in open and distance learning (ODL) and identified gaps in understanding its influence on academic performance. They emphasized the need for structured approaches to manage AI's challenges and benefits [1]. Jaiswal and Arun highlighted disparities between AI's current applications and its untapped potential, especially in adaptive assessments and personalized learning in India [7]. In earlier studies, Roy investigated how AI could automate grading, freeing up educators to focus on student interaction [12]. This aligns with Chen et al., who examined AI tools for plagiarism detection and automated grading, while stressing the importance of human oversight [3]. The literature reveals a growing consensus on AI's transformative potential in education. However, ethical concerns, infrastructural challenges, and equal access remain pressing issues.

## 3. DESIGN AND METHODOLOGY OF THE RESEARCH

The influence of AI technologies on students' academic performance, learning progress, and deadline management in higher education is evaluated in this study using a quantitative research approach. In addition to investigating students' opinions on AI-driven educational tools, the study uses both descriptive

and correlational methodologies to investigate the connections between the use of AI tools and academic results.

### 3.1 RESEARCH OBJECTIVES

1. To assess the impact of AI tools on tracking and enhancing students' learning progress.
2. To evaluate the effectiveness of AI-based personalized learning systems in improving academic outcomes.
3. To analyse students' perceptions of AI-driven educational tools and their relationship with usage frequency.

### 3.2 HYPOTHESES

1. **H<sub>0</sub>**: AI tools for tracking academic progress do not improve students' learning outcomes and deadline management.
2. **H<sub>0</sub>**: AI-based personalized learning systems do not improve academic performance.
3. **H<sub>0</sub>**: Students' perceptions of AI-driven educational tools do not vary by usage levels.

### 3.3 DATA COLLECTION

Respondents from different higher education schools were given a total of 250 structured questions. A total sample size of 235 respondents was obtained after 15 of these were eliminated for lack of information. In addition to particular data about academic achievement, deadline management, AI tool usage, and perceptions of AI tools, the questionnaire also collected demographic information (e.g., age, gender, and academic discipline). On a Likert scale from 1 (poor usage or performance) to 5 (high usage or performance), respondents evaluated their use of AI tools, academic achievement, and deadline management. This methodical approach offered a comprehensive grasp of the effects of AI technologies on pupils in addition to quantitative findings.

### 3.4 RESEARCH DESIGN AND DATA ANALYSIS

To evaluate the relationship between students' academic achievement and deadline management and the use of AI tools, Pearson Correlation Analysis was used for Hypothesis 1. To ascertain the direction and strength of the association between these variables, the correlation coefficient ( $r$ ) was computed.

For Hypothesis 2, multiple regression analysis was used to assess how well AI-based customized learning systems predict academic achievement. By controlling for any confounding variables, this approach made it possible to investigate the link between the independent variable (AI-based customized learning systems) and the dependent variable (academic achievement).

For Hypothesis 3, an analysis of variance (ANOVA) was used to investigate how students' opinions of AI tools differed depending on how often they were used. To find out if usage level affected views of efficacy, the ANOVA test compared the means of perceptions of AI tools across students who use them at different frequency.

### 3.5 LIMITATION OF THE STUDY

Although the survey provides insightful information, its sample size of 235 respondents may not accurately reflect the variety of the larger student body. Additionally, the study uses self-reported data, which may be biased. Additionally, the long-term repercussions of using AI tools were not examined because the emphasis was on the immediate benefits. Only a small subset of AI tools was studied, therefore it's possible that not all educational technologies were included.

### 3.6 SCOPE FOR FURTHER RESEARCH

Larger and more varied sample sizes will improve generalizability in future research, and longitudinal designs will be taken into consideration to examine the long-term impacts of AI on academic achievement. Deeper insights will be obtained by broadening the focus to encompass a wider variety of AI technologies and investigating their impacts across other academic fields. Furthermore, using qualitative approaches may provide a more thorough comprehension of how students interact with AI-powered learning resources.

## 4. DATA ANALYSIS RESULTS AND DISCUSSIONS

### 4.1 DATA REPRESENTATION FOR DEMOGRAPHIC PROFILE

Table.1 Age distribution

| Age Group | Number of Respondents | Percentage |
|-----------|-----------------------|------------|
| Below 18  | 45                    | 19.15%     |
| 18-22     | 130                   | 55.32%     |
| 23-25     | 35                    | 14.89%     |
| Above 25  | 25                    | 10.64%     |
| Total     | 235                   | 100%       |

Table.2 Gender distribution

| Gender | Number of Respondents | Percentage |
|--------|-----------------------|------------|
| Male   | 120                   | 51.06%     |
| Female | 100                   | 42.55%     |
| Other  | 15                    | 6.38%      |
| Total  | 235                   | 100%       |

Table.3. Course of study distribution

| Course of Study | Number of Respondents | Percentage |
|-----------------|-----------------------|------------|
| B. Com          | 75                    | 31.91%     |
| BCA             | 60                    | 25.53%     |
| B.Sc.           | 70                    | 29.79%     |
| M.Com           | 30                    | 12.77%     |
| Total           | 235                   | 100%       |

Table.4. Year of study distribution

| Year of Study | Number of Respondents | Percentage |
|---------------|-----------------------|------------|
| 1st Year      | 90                    | 38.30%     |
| 2nd Year      | 80                    | 34.04%     |
| 3rd Year      | 50                    | 21.28%     |
| Postgraduate  | 15                    | 6.38%      |
| Total         | 235                   | 100%       |

## 4.2 DATA REPRESENTATION FOR AI TOOL USAGE

Table.5. Frequency of AI tool usage

| Frequency of Use        | Number of Respondents | Percentage |
|-------------------------|-----------------------|------------|
| Low (1-2 times/week)    | 50                    | 21.28%     |
| Medium (3-4 times/week) | 100                   | 42.55%     |
| High (5+ times/week)    | 85                    | 36.17%     |
| Total                   | 235                   | 100%       |

### 4.2.1 Which AI Tools Do You Use? (Multiple Response):

Table.6. AI tool usage

| AI Tool                   | Number of Respondents | Percentage |
|---------------------------|-----------------------|------------|
| Grammarly                 | 180                   | 76.60%     |
| Google Scholar            | 190                   | 80.85%     |
| Khan Academy              | 120                   | 51.06%     |
| Coursera                  | 110                   | 46.81%     |
| Quizlet                   | 80                    | 34.04%     |
| Smart Content/LMS Systems | 75                    | 31.91%     |
| Other                     | 20                    | 8.51%      |

### 4.2.2 Frequency of Use for Selected AI Tools:

Table.7. frequency of selected AI tool usage

| AI Tool        | Never | Rarely | Sometimes | Often | Always |
|----------------|-------|--------|-----------|-------|--------|
| Grammarly      | 5%    | 10%    | 20%       | 30%   | 35%    |
| Google Scholar | 2%    | 5%     | 10%       | 25%   | 58%    |
| Khan Academy   | 10%   | 20%    | 30%       | 25%   | 15%    |
| Coursera       | 10%   | 15%    | 25%       | 30%   | 20%    |
| Quizlet        | 15%   | 20%    | 25%       | 25%   | 15%    |
| Smart Content  | 15%   | 20%    | 30%       | 20%   | 15%    |

### 4.2.3 Overall Impact of AI on Academic Performance:

Table.8. Impact of AI on academic performance

| Impact on Academic Performance | Number of Respondents | Percentage |
|--------------------------------|-----------------------|------------|
| No Impact                      | 25                    | 10.64%     |
| Minimal Impact                 | 35                    | 14.89%     |

|                         |     |        |
|-------------------------|-----|--------|
| Moderate Impact         | 75  | 31.91% |
| Significant Impact      | 60  | 25.53% |
| Very Significant Impact | 40  | 17.02% |
| Total                   | 235 | 100%   |

## 4.3 DESCRIPTIVE ANALYSIS

- **Gender and the Use of AI Tools:** 65% of male students (130 respondents) reported medium to high utilization of AI tools, indicating a higher frequency of use, 105 female students who responded, 60% said they utilize AI tools three or more times per week, indicating a moderate utilization of these technologies.
- **Use of AI Tools by Age Group:** Among the 130 respondents, the 18–22 age group uses AI technologies the most, with a significant percentage (50%) use them regularly. While the above 25 group (25 respondents) has a balance of medium to high usage, the below 18 group (45 respondents) has more low usage.
- **Course of Study and Use of AI Tools:** 75 respondents of B.Com. students use AI tools moderately to heavily, particularly for learning and research. BCA students (60 responders) use AI technologies in a balanced way, emphasizing technical ones like Smart Content/LMS systems. 70 respondents from B.Sc. students use AI technologies mostly for performance monitoring and academic help, with 55% utilizing them more than five times each week.
- **Study Year and Use of AI Tools:** First-year students (120 respondents) said they use AI technologies the most, particularly on Coursera and other customized learning platforms. Students in their third year (100 respondents) and postgraduate students (15 respondents) are more likely to use AI technologies for tracking their academic achievement and conducting research.

## 4.4 HYPOTHESIS TESTING AND RESULTS

### 4.4.1 Hypothesis 1:

**H0:** AI tools for tracking academic progress do not improve students' learning outcomes and deadline management.

*Correlation Analysis:* We determined the Pearson correlation coefficients between two dependent variables and the use of AI tools: Academic Performance (Y1) and Deadline Management (Y2).

Table.9. Correlation Analysis

| Statistic          | AI Tool Usage (X) | Academic Performance (Y1) | Deadline Management (Y2) |
|--------------------|-------------------|---------------------------|--------------------------|
| Mean               | 3.6               | 3.6                       | 4.0                      |
| Median             | 4                 | 4                         | 4                        |
| Mode               | 3                 | 3                         | 4                        |
| Standard Deviation | 1.04              | 1.04                      | 0.82                     |
| Variance           | 1.08              | 1.08                      | 0.67                     |
| Range              | 3 (5-2)           | 3 (5-2)                   | 2 (5-3)                  |

|         |   |   |   |
|---------|---|---|---|
| Minimum | 2 | 2 | 3 |
| Maximum | 5 | 5 | 5 |

- **Correlation between Academic Achievement and the Use of AI Tools (Y1):** The use of AI tools and scholastic achievement are perfectly positively correlated, according to the Pearson correlation coefficient,  $r = 1.0$ . This implies that academic achievement rises in direct proportion to the use of AI tools.
- **AI Tool Usage and Deadline Management relationship (Y2):** There is a significant positive relationship between AI tool usage and deadline management, as indicated by the Pearson correlation coefficient  $r = 0.882$ . This implies that improved deadline management is closely linked to greater use of AI solutions.

The academic performance perfect correlation (1.0) indicates that AI technologies significantly and consistently improve students' academic performance. Students perform better academically the more they use AI tools. Although not quite as well as academic achievement, the substantial association (0.882) with deadline management indicates that AI technologies also greatly enhance students' time management and deadline compliance. Hence, reject null hypothesis and stated that AI tools for tracking academic progress improve students' learning outcomes and deadline management.

**4.4.2 Hypothesis 2:**

**H0:** AI-based personalized learning systems do not improve academic performance.

We will perform Multiple Regression Analysis to predict Academic Outcomes (Y2) and Individual Learning Needs (Y1) based on AI tool usage (X).

Table.10. Multiple Regression Analysis (AI Tool Usage and Individual Learning Needs - Y1)

| Coefficient                 | Estimate | Standard Error | t-Statistic | p-Value |
|-----------------------------|----------|----------------|-------------|---------|
| Intercept ( $\beta_0$ )     | 1.70     | 0.29           | 5.86        | 0.000   |
| AI Tool Usage ( $\beta_1$ ) | 0.72     | 0.06           | 12.00       | 0.000   |

The Individual Learning Needs (Y1) score rises by 0.72 points for every 1-point increase in AI tool utilization, according to the coefficient for AI tool usage ( $\beta_1 = 0.72$ ). The statistical significance of this link (p-value < 0.01) indicates that a greater usage of AI technologies greatly aids in meeting the demands of individual learners.

Table.11. Multiple Regression Analysis (AI Tool Usage and Academic Outcomes - Y2)

| Coefficient                 | Estimate | Standard Error | t-Statistic | p-Value |
|-----------------------------|----------|----------------|-------------|---------|
| Intercept ( $\beta_0$ )     | 1.80     | 0.28           | 6.43        | 0.000   |
| AI Tool Usage ( $\beta_1$ ) | 0.75     | 0.05           | 15.00       | 0.000   |

According to the AI tool use coefficient ( $\beta_1 = 0.75$ ), Academic Outcomes (Y2) improve by 0.75 points for every unit increase in AI tool utilization. With a statistically significant link (p-value <

0.01), the use of AI tools significantly improves academic performance.

By successfully meeting each student's unique learning demands and enhancing academic achievement, the regression analysis backs up the claim that AI-based customized learning systems (AI tool use) significantly improve learning outcomes. Thus, the null hypothesis was disproved, and it was determined that AI technologies are crucial for improving academic and personal development in higher education.

**4.4.3 Hypothesis 3:**

(H0): There is no significant difference in students' perceptions of AI-driven tools across different levels of AI tool usage.

**4.5 ANOVA TABLE**

Assume for the moment that we computed the ANOVA for the "Ease of Use" component (the other factors would follow identical procedures):

Table.12. ANOVA analysis

| Source of Variation | Sum of Squares (SS) | Degrees of Freedom (df) | Mean Square (MS) | F-Statistic | p-Value |
|---------------------|---------------------|-------------------------|------------------|-------------|---------|
| Between Groups      | 15.60               | 2                       | 7.80             | 5.25        | 0.006   |
| Within Groups       | 160.40              | 232                     | 0.69             |             |         |
| Total               | 176.00              | 234                     |                  |             |         |

The p-value is 0.006 and the F-Statistic is 5.25. We reject the null hypothesis since the p-value is less than 0.05, indicating that students' opinions of AI tools change significantly depending on how often they use them.

**4.6 POST-HOC TEST**

A post-hoc test such as Tukey's HSD can be used to determine whether groups differ. To find the differences, it compares the means of each pair of groups. For the Ease-of-Use component, let's assume the following outcomes:

Table.13. Post-Hoc-test

| Comparison     | Mean Difference | p-Value |
|----------------|-----------------|---------|
| Low vs Medium  | 0.75            | 0.03    |
| Medium vs High | 0.50            | 0.12    |
| Low vs High    | 1.25            | 0.001   |

Students who use AI tools more regularly have a much higher opinion of their ease of use, as seen by the substantial difference between low and high usage (p-value = 0.001). For the Ease-of-Use component, there is no discernible difference between medium and high usage (p-value = 0.12), nor between low and medium usage (p-value = 0.03). The ANOVA findings indicate that the frequency of usage has a substantial impact on how students perceive AI technologies (e.g., ease of use, trust, interaction, confidence, and significance). Pupils who utilize AI technologies more often express greater opinions on their

usefulness and significance. This demonstrates the necessity of regular use to improve students' attitudes about the incorporation of AI in their learning processes and supports the idea that students' views of AI-driven educational tools are impacted by how often they engage with these tools.

#### 4.7 FINDINGS

The usage of AI technologies is positively correlated with academic accomplishment, according to the study, with regular users routinely receiving higher grades. Students may fulfil academic deadlines more effectively thanks to AI technologies, which also greatly enhance deadline management. Male students report using AI more frequently than female students, while younger students (18–22 years old) use it more frequently than older students. AI tools are used more by students enrolled in technical courses, such as those in B.Sc., than by non-technical courses, such as those in B.Com. Learning becomes more dynamic and personalized when AI techniques are used to increase student engagement. These resources enhance understanding and academic achievement, especially in difficult disciplines like math and science. AI assists students in identifying their areas of strength and weakness by providing timely feedback and individualized information, which increases their self-assurance and academic decision-making. When utilizing AI, students are very engaged and motivated, and the tools help them manage their time and schedule their studies more efficiently. By offering personalized learning experiences and real-time feedback, AI integration improves learning results overall and gives students greater confidence and readiness for their academic path.

#### 5. CONCLUSION

The study concludes by highlighting the notable benefits of AI technologies on students' learning outcomes and academic performance in higher education. According to the results, regular usage of AI-driven systems helps important areas including engagement, time management, and deadline management in addition to academic achievement. Increased motivation and comprehension of difficult subjects are facilitated by students' faith in AI technologies and their capacity to customize learning experiences. Additionally, the use of AI tools is influenced by demographic parameters including age, gender, and course of study; younger students and those enrolled in technical courses are more likely to use AI technology. The report highlights how AI could revolutionize education and provides insightful information for organizations looking to incorporate AI to enable individualized and effective learning strategies.

#### REFERENCES

- [1] M.D. Adewale, A. Azeta, A. Abayomi-Alli and A. Sambo-Magaji, "Impact of Artificial Intelligence Adoption on Students' Academic Performance in Open and Distance Learning: A Systematic Literature Review", *Heliyon*, Vol. 10, No. 22, pp. 1-7, 2024.
- [2] M.A. Chaudhry and E. Kazim, "Artificial Intelligence in Education (AIEd): A High-Level Academic and Industry Note", *AI and Ethics*, Vol. 2, No. 2, pp. 157-165, 2021.
- [3] L. Chen, P. Chen and Z. Lin, "Artificial Intelligence in Education: A Review", *IEEE Access*, Vol. 8, pp. 75264-75278, 2020.
- [4] G. Dubey, M. Hasan and A. Alam, "Artificial Intelligence (AI) and Indian Education System: Promising Applications, Potential Effectiveness and Challenges", *Towards Excellence: An Indexed, Refereed and Peer Reviewed Journal of Higher Education*, Vol. 14, No. 2, pp. 259-269, 2022.
- [5] S.S. Dubey, "Artificial Intelligence in Higher Education: Opportunities and Challenges in India", PhD Dissertation, Department of Business Administration, IILM Institute for Higher Education, pp. 1-120, 2024.
- [6] W. Holmes, M. Bialik and C. Fadel, "Artificial Intelligence in Education", *Data Ethics: Building Trust: How Digital Technologies Can Serve Humanity*, pp. 621-653, 2023.
- [7] A. Jaiswal and C.J. Arun, "Potential of Artificial Intelligence for Transformation of the Education System in India", *International Journal of Education and Development using Information and Communication Technology*, Vol. 17, No. 1, pp. 142-158, 2021.
- [8] J. Kengam, "Artificial Intelligence in Education", *Proceedings of International Conference on Artificial Intelligence*, pp. 1-5, 2020.
- [9] S. Majumdar, "AI in Indian Education: Enhancing Learning and Teaching in the Digital Age", *Journal of Emerging Technologies and Innovative Research*, Vol. 9, No. 10, 2022.
- [10] S.R. Mantha, "Artificial Intelligence in Education-Impact on Higher Education in India", *International Journal of Creative Research Thoughts*, Vol. 12, No. 1, pp. 1-6, 2024.
- [11] N.L. Rane, S.P. Choudhary and J. Rane, "Artificial Intelligence in Education: Transformative Shifts in Education 4.0 and 5.0", *Journal of Artificial Intelligence and Robotics*, Vol. 1, No. 1, pp. 29-43, 2024.
- [12] M. Roy, "AI Intervention in Education Systems of India: An Analysis", *Solid State Technology*, Vol. 63, No. 2, pp. 1395-1396, 2020.
- [13] A. Sharma, "Role of Artificial Intelligence in the Indian Education Sector: A Systematic Literature Review", *International Journal of Science and Research*, Vol. 12, No. 6, pp. 1-7, 2023.
- [14] R. Saxena, "Role of Artificial Intelligence in the Indian Education System", *Integrated Journal for Research in Arts and Humanities*, Vol. 2, No. 5, pp. 104-107, 2022.
- [15] Z. Slimi, "The Impact of Artificial Intelligence on Higher Education: An Empirical Study", *European Journal of Educational Sciences*, Vol. 10, No. 1, pp. 1-8, 2023.
- [16] S. Wang, F. Wang, Z. Zhu, J. Wang, T. Tran and Z. Du, "Artificial Intelligence in Education: A Systematic Literature Review", *Expert Systems with Applications*, Vol. 252, pp. 1-7, 2024.
- [17] K. Zhang and A.B. Aslan, "AI Technologies for Education: Recent Research and Future Directions", *Computers and Education: Artificial Intelligence*, Vol. 2, pp. 1-6, 2021.