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Research Article

# Effect of Artificial Intelligence Tools Usage on Students' Classroom Performance among Undergraduate Students: An Experimental Study

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## Abstract

Artificial intelligence (AI) tools usage and classroom performance have shown a positive relationship in the present time. Despite recent history, AI has an increasing relationship with the classroom performance of students. This experimental study aims to explore the effect of artificial intelligence (AI) tools usage on students' classroom performance among undergraduate level students in the Health and Physical Education (HPE) program. A sample of 24 first-semester students was selected using a convenience sampling technique. The experimental group received AI instruction tools with the help of ChatGPT, and the control group received traditional pedagogical instruction. Pre- and post-tests, along with MCQs MCQ-based questionnaire, were administered to assess performance, knowledge retention, critical thinking, motivation, and engagement of the understudies with the help of AI tools. This pretest-posttest design was employed to evaluate both the frequency of AI tool usage and the comparison of academic performance before and after a two-week AI-integrated instructional intervention. The study used quantitative measures and applied descriptive statistical tests, paired sample t-tests to determine significance. Result analysis has shown a significant improvement in both groups, by favoring the experimental group in terms of classroom performance and knowledge retention. Results indicated a notable improvement in both AI tool usage, student performance and comparison of academic performance, suggesting a positive impact of AI-based educational technologies. However, the study's time series experimental design, short follow-up period and limited time represent limitations. To make research better, the effect of AI tools usage is related to long-term experimentation and exploring how different demographics can benefit from these interventions.

Keywords: Artificial intelligence, Academic performance, Experimental study.

## Introduction

Through the advent of information communication technology in the 21st century, along with its integration with artificial intelligence (AI), society has been transformed from a traditional to a knowledge-based society. Presently, this society is full of creativity, innovation, and advancement. In the present time, artificial intelligence (AI) is continuously in discussion. The role of artificial intelligence is now recognized as the technology of the future. The integration of artificial intelligence (AI) into educational settings has increased and made it more modern and reshaped its pedagogy, offered personalized learning experiences, more student engagement and excellent feedback. According to Jain and Jain (2019), in recent years, the artificial intelligence (AI) technological revolution has taken place in many parts of the world. It has also triggered human intelligence through computers and focused on more learning. Due to the rapid advancement of artificial

intelligence in many fields where machines are used that can think, understand language, solve problems, diagnose medical conditions, drive cars and paint like human beings. According to Tuomi (2018), artificial intelligence can perform tasks typically with an intelligent being, just as a computer system.

Moreover, according to Hussain et al. (2022), they are confident that artificial intelligence (AI) gives the image of a powerful computer that is equipped with advanced processing abilities, including adaptable behaviors such as copying human behavior, copying human sound, and having cognitive abilities like a human being. Education is recognized as the foundation for progress. Universities play a tertiary role in the development of a nation. They are considered the hub in the field of research, fostering innovation in diverse fields. These tertiary institutions have the obligation to produce high-quality graduates who will become prominent leaders and skilled workers in their respective fields. Recently, artificial intelligence has not been used in different fields at the university level for different reasons. On one hand, AI is tackling the challenges in education, especially in universities, due to teachers' denial and ignorance about its usage, reluctance to accept it openly, feeling it is unethical broadly and reliance on traditional methodology. E learning and hybrid learning are the modes of learning that have made data accessible, allowing AI to find solutions for complex problems. Artificial intelligence (AI) tools is said to have considerable importance for university students for their usage in their educational problems. There are some considerable tools like ChatGPT, Grammarly, DeepSeek, Consensus, Scholar GPT, Quillbox and Ope AI that are making teaching and learning efficient. Okoli (2019), academic learning can be referred to as the quantification of learning of students in an organized and systematic way. This means measuring students' performance through different tools. The need to use AI for university students has been highlighted by different educationists. Huang (2021) highlighted the benefits of using artificial intelligence tools in education. These tools become beneficial by creating more effective study plans, receiving tailored instruction, and enhancing their problem-solving abilities. In spite of growing global adoption of AI in education, its usage in some specific fields like Health and Physical Education (HPE) at the undergraduate level is limited and needs more exploration. Due to these reasons, this study explores the effect of artificial Intelligence (AI) tools on students' academic performance for undergraduate students of the BS HPE program at the National University of Modern Language, Islamabad.

## Problem Statement

Despite the advancement in every field and in educational technology, traditional pedagogical methods hinder students' skills and are unable to engage students. Undergraduate students particularly encounter great difficulties related to their active participation, level of motivation, and personalized instructional support. With the advent of Artificial Intelligence (AI) tools, the learning environment and tools have changed. New effective AI tools have a drastic effect on learners by inculcating intrinsic motivation and enhancing classroom performance. This academic gap highlights the need to systematically examine it through an experimental study and to see how AI tools enhance and make academic performance more robust.

## Literature Review

The speed of spreading artificial intelligence (AI) in education and other fields is unbelievable. Artificial intelligence's (AI) integration in the education system has transformed teaching, learning experiences, student engagement, and institutional operations by augmenting personalization, efficiency and connectivity. Zhai (2022) has highlighted some key technologies that have played a great role in transforming AI's role, including intelligent tutoring systems, adaptive learning platforms and immersive simulations. According to Imran et al. (2025), the use of Artificial Intelligence (AI) has accelerated the instructional steps and made the learning customized. With the help of AI, customized learning content, the understudies can move forward at their own pace to achieve their set objectives and have a feeling of accomplishment, which resultantly puts haul motivation (Woolf, 2009). Artificial intelligence in Education (AIED) has observed a fast growth since 2019, as seen in other studies. UNESCO (2019) has discussed the links between AI and education in three areas like learning with AI means using AI tools in the classroom; learning about AI means using its technologies and techniques and preparing for AI, which means enabling all human beings to understand the impact of AI on human life. It is also believed that AI has the potential to address the current challenges facing education, like

the principles of inclusion and equity, as discussed in SDG-4. There is an increasing trend to create new tools that help in the field of research, support traditional learning, collaborative learning, creativity, and critical thinking. As today is the era of ever ever-changing world, Universal Design for Learning (UDL) 3.0 has transformed learning more engaging, accessible, and effective experience for all students, including those belonging to marginalized areas. More interestingly, according to Pradana et al. (2023), AI in education during 2022 to 2023 has transformed teaching from a traditional way to an innovative way and created a more dynamic and inclusive learning environment.

With all advancements and potential in AI, usage of AI in education has some challenges and reservations, like breaches of privacy, ethical issues in its usage, and the risk of replacing human-centered teaching. This demands careful integration of artificial intelligence in education rather than undermining it. According to Rojas-Sanchez et al. (2023) and Tlili et al. (2023), there is a gap between AI's technological capabilities and the readiness of educational systems to adopt these tools, requiring focused efforts to bridge this divide. According to Bozkurt (2023), different studies highlight its role as an intelligent tutoring system, fostering adaptive and personalized learning experiences. However, according to Stokel-Walker (2022), the actual impact of AI depends upon careful integration into an educational context where pedagogical goals align with its capabilities. Therefore, the success of ChatGPT depends upon thoughtful, evidence-based applications. There are some challenges in AI, like ensuring fair access to AI tools, reducing biases in algorithms, and protecting data privacy. There is a need of collective efforts by technologists, educators, policymakers and learners to responsibly control AI's potential. With the help of this collaborative effort, we shall be able to use it to enhance learning and prepare students for the modern world. With all these efforts, education can control these challenges and fully realize AI's potential for inclusive learning. According to Eltahir and Babiker (2024), in addition to educational advancements in education, like digitalization of educational resources, gamification, and personalized learning, there exist numerous prospects for the development of AI applications in education. This is clear from the notable use of AI techniques in modern adaptive educational programs that created individualized learning environments. According to du Boulay (2016), this approach discusses the shortage of teachers through the implementation of the Intelligent Tutoring System (ITS). Intelligent Tutoring System offers this personalized learning experience through four avenues, like monitoring students' input, presenting appropriate assignments, providing effective feedback, and facilitating interfaces for human-computer communication (Seldon and Abidoye, 2018).

The main focused and general example of artificial intelligence potential in education is OpenAI's ChatGPT, which is a more advanced tool of language processing and interactive communication with human beings. This requires checking its potential in transforming into this form. Some researchers and teachers are pondering whether the advancement of artificial intelligence might challenge or even replace teachers with AI and machine learning. With this entire scenario, the scholarly exploration of AI's role in education reveals a consistent trend of positive impact of AI on both students' motivation and students' performance in any diverse academic context. Artificial intelligence (AI) also enhances the efficiency of data analysis by collecting and analyzing data in a perfect way. The ratio of data correctness of AI is not 100% but it gives guidance. One more advantage of using artificial intelligence at the university level is that, with the help of AI, teachers can manage larger classes more effectively and can make data-driven decisions that refine instructions.

While perusing the previous studies, a study conducted by Kuleto et al. (2021) explores the opportunities and challenges of implementing artificial intelligence (AI) and machine learning (ML) in higher educational institutions. It also focuses on how AI and ML can be used to enhance teaching and learning like, adaptive learning technology, AI-powered Chatbots, and automating certain tasks to make free time for teachers in educational activities. The educational administrators can also use both tools in supervision activities. The relationship of AI in education can be discussed under different fields.

AI helps students in their personalized learning. According to Imran et al. (2025), AI-based personalized learning significantly improves both motivation and academic performance among university students. They conducted a quasi-experimental study in Pakistan for this purpose. Their findings suggest that AI fosters

engagement through tailored content delivery and real-time adaptive feedback. The results of the study showed that female and older students showed particularly strong gains. Moreover, it was observed that artificial intelligence (AI) might address diverse learner needs effectively.

A comprehensive meta-analysis by García-Martínez et al. (2023) reviewed 25 peer-reviewed articles and found robust evidence supporting AI's positive impact on student achievement, especially in STEM fields. Their findings suggest that AI-enhanced instruction increases motivation, improves attitudes toward learning, and supports academic performance across educational stages. The study of Eltahir and Babiker (2024) in their article titled "The Influence of Artificial Intelligence Tools on Student Performance in e-Learning Environments: Case Study" focused on pre-service teacher education and concluded that there is a significant improvement in knowledge retention, motivation, and critical thinking through AI-powered platforms embedded in e-learning environments.

In spite of these benefits, there are some challenges that hinder the overuse of artificial intelligence for students and teachers. These challenges include over-reliance on technology, a minimal approach to independent learning, and critical thinking. In the Pakistani context, the integration of AI in classrooms is still emerging. The effect of artificial intelligence usage and AI tools usage frequency on students' classroom performance at the undergraduate level was analyzed with the help of an experimental study.

### *Research Objectives*

1. To assess the change in AI tools usage frequency among the experimental group before and after the intervention(s).
2. To evaluate the effect of AI tool usage on the academic performance of the experimental group before and after the intervention(s).
3. To compare the academic performance of students before and after applying the intervention among undergraduate students.

### *Null Hypotheses*

1. There is no significant change in AI tools usage among the experimental group before and after the intervention(s).
2. There is no significant effect of AI tool usage sin the academic performance of the experimental group before and after the intervention(s).
3. There is no significant effect on the academic performance of students before and after applying the intervention among undergraduate students.

## Methodology

### *Research Design*

The study employed a time-series experimental pretest-posttest control group design to evaluate the effect of Artificial Intelligence (AI) usage tools on students' classroom performance at the undergraduate level. The time-series design is suitable for identifying changes through numerous testing intervals. Through this, the sample was studied before and after the intervention. This repetition measures the internal validity by controlling for individual differences among participants.

### *Research Population and Sample*

The study comprised undergraduate students enrolled in the BS Health and Physical Education (HPE) program at the National University of Modern Languages, Islamabad. A purposive sampling technique was used to select a sample of 24 1st-semester BS HPE students from the Spring 2025 semester. All participants were enrolled in the "Role of Media in Sports" course, and ensuring content consistent.

### *Sampling Technique*

Sampling means selecting the individuals for research purposes. For this study convenience sampling

technique was used. Through which each student will be available to the researcher.

### *Research Instrument*

The research instrument is a self-developed questionnaire. The research instrument consists of a total of four MCQ-based tests. Out of which two are pretest and which two are posttest. Each test consists of 10 MCQs that will be used to check the AI tools usage ratio and to evaluate the effect of AI tool usage on the academic performance of the students.

### *Validity of the Research Instrument*

The validity of the research is an important part of the research process. The research instrument is created with the help of existing literature on the subject and with the help of getting consultation by the research experts on the subject. The questionnaire was designed to have a variable to check the AI tool usage by the students.

### *Reliability*

Checking the reliability of the instrument is necessary in the process of research. With good reliability of a tool means it can be reused with a fair amount of confidence and assurance. The internal consistency of the questionnaire can be measured through Cronbach's Alpha and Split-Half Reliability.

### *Intervention*

To achieve the results of the experimental study, an intervention in lieu of the usage of AI tools was provided to the students for two weeks. Students' score was recorded before and after the intervention.

### *Data Collection*

Data was collected by the researcher from the sample by following research protocols. The research instrument was prepared on Google Form and was administered to experimental groups before and after the intervention. Data was collected by the researcher in class. Ethical considerations in the research study play an important role. Informed consent was taken by the researcher. It was ensured that their results in the test would not affect their involvement in studies and their participation is purely voluntary.

### *Data Analysis*

The process of data analysis comes after data collection. The data was collected with the help of a pretest and posttest questionnaire for weeks 1 and 2. For data analysis, the Statistical Package for Social Sciences (SPSS) was used. For data analysis Paired Sample t-test was administered. Additionally, for data analysis, different statistical techniques like mean, Standard Deviation, level of significance, value of t, and difference of means before and after the intervention were used.

## Result and Discussion

Table 1. To assess the change in frequency of AI tools usage.

| Variable | N | Mean | Std. Deviation | Correlation |
|---|---|---|---|---|
| AI Usage – Pre (Week 1) | 24 | 5.33 | 0.637 | 0.000 |
| AI Usage – Post (Week 1) | 24 | 8.75 | 0.442 | |

Table 1 shows that results of the paired sample t-test with the independent variable i.e. the test results of the class before the usage of AI tools and after the intervention i.e., use of AI tools the results of the class. From the above results, the mean AI usage frequency before the treatment (M=5.33, SD=0.637) and after the usage of AI tools (M=8.75, SD=0.442) at the 0.05 level of significance. The value of correlation is 0.000, which means the relation between variables before and after the treatment was very strong.

Table 2. Paired sample test- AI tools usage.

| Mean Difference | Std. Deviation | Std. Error Mean | 95% CI Lower | 95% CI Upper | t | df | Sig. |
|---|---|---|---|---|---|---|---|
| -3.42 | 0.776 | 0.158 | -3.74 | -3.09 | -21.58 | 23 | 0.000 |

Table 2 shows the paired-sample t-test to evaluate the effect of AI tool usage on student performance. It is shown by the statistics of the table that there is a statistically significant difference in results before and after the usage of AI tools, mean difference of -3.42 and SD=0.776, showing that the score increased after AI tools were used. The value of t (23) = -21.58 shows a strong effect size. The p-value (0.000) indicates that the result is highly significant, and a narrow confidence interval (Cl: -3.74 to -3.09) indicates a strong and reliable effect of the intervention.

Table 3. To evaluate the effect of AI tool usage on academic performance.

| Variable | Mean | N | Std. Deviation | Correlation |
|---|---|---|---|---|
| Academic Score – Pre (Week 2) | 6.17 | 24 | 0.637 | |
| Academic Score – Post (Week 2) | 9.29 | 24 | 0.464 | 0.563 |

Table 3 shows a paired sample statistic of an increase in academic scores after the use of AI tools. The mean score about the effect of AI tool usage on the academic performance of students before the intervention was M= 6.17 (SD= 0.637) and after the intervention was M= 9.29 (SD= 0.464). The value of the Pearson correlation coefficient of r= 0.563 showed a moderate positive relationship between pre- and post-relationships. This proves a positive impact of AI tool usage on the academic performance of students.

Table 4. Paired samples test – academic performance.

| Mean Diff | S.D. | Std. Error Mean | 95% CI Lower | 95% CI Upper | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|
| -3.13 | 0.537 | 0.110 | -3.35 | -2.90 | -28.53 | 23 | .004 |

The results from Table 4 indicate that the academic performance of students has increased by M= -3.13 (SD= 0.537), which is significant. The paired sample t-test value t (23) = -28.53 and p<.005 reveals that the use of AI tools has a significant effect on academic performance.

Table 5. Before and after intervention comparison of academic performance (N= 24).

| Week | Cat | (M) | SD | N | t | df | Mean Diff | p-value | Cohen's d |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Pre-test | 6.33 | 1.66 | 24 | | | | | |
| | Post-test | 8.54 | 0.88 | 24 | -6.59 | 23 | -2.21 | <.001 | 1.35 |
| 2 | Pre-test | 6.38 | 1.35 | 24 | | | | | |
| | Post-test | 9.17 | 0.70 | 24 | -10.94 | 23 | -2.79 | <.001 | 2.33 |

Table 5 shows the comparison of before and after the intervention for both weeks. In week 1, the mean value was increased by 2.21, and in week 2, it was increased by 2.79. The value of p in both weeks is highly significant, p<.001. The value of t for week 1 was -6.59 and for week 2 (t=-10.94). The results showed that the intervention

had a clear and statistically significant effect on students' academic performance. The value of Cohen's d in both weeks showed that students' performance had strongly improved after the intervention.

### *Findings*

From the above results, it was found that AI tool usage has increased significantly after the intervention. The posttest mean score, M=8.75, was found high than per pretest score, M=5.33, resulting in a mean gain of M=-3.42. The statistical level of significance p< .005 showed that the change was due to AI tool usage and by due to chance. It was also found from the results that the academic performance of the students has also been significantly improved after intervention, i.e. mean rose from 6.17 to 9.29 with a mean difference of 3.13 points. The value of the t-test, p<0.001, demonstrates that the integration of AI tools had a positive impact on students' performance.

### *Discussion*

From the results and findings, the study demonstrates that the intervention of AI tools frequency has significantly enhanced students' outcomes in the tests. The change in AI frequency in the usage of AI tools among students had a strong effect. The understudies had displayed a positive impact in their results after incorporating AI in their studies. This customized idea of AI in learning has made the understudies more confident and more satisfied in assignments and tests. Further results showed that the effect of AI usage on students has fluctuated positively in both weeks' results after the intervention. Moreover, the possible use of AI has shown that it stimulates the learning process of undergraduate students as well as teachers. With the usage of AI in learning, it is deduced that understudies get more motivated to work because AI helps them according to their ability. The mature students, like undergraduate students, can get more benefits through AI as they can manage themselves better. According to Self-Determination theory, students feel motivated due to these three factors like independence, competence, and connection. Researchers had also visualized through results and findings that while making the comparison of academic performance before and after the intervention, the academic performance of students after the intervention is better. Resultantly, it reduces the stress and struggles of understudies. The use of AI-generated results also had some long-term impacts on the students. With the use of AI, they felt motivated and showed good academic results.

## Conclusions and Recommendations

From the findings, it was concluded that students use AI tools more frequently after the intervention. It was concluded from the findings that the use of AI tools has significantly increased the academic performance among the students. Moreover, it was concluded from the results that AI tools usage or interventions promote students' learning, foster motivation and increase the scores. From the findings, the researcher has concluded that a strong statistical level of significance proved that there was a strong efficacy of AI integration in teaching and learning at the undergraduate level. On the basis of the conclusions following recommendations can be made by the researcher: -Different AI tools like ChatGPT, Grammarly and Quillbot may be integrated into the curriculum and students should be encouraged to use them in a positive manner. In this way, their level of engagement and performance will be increased. Effective use of AI tools for both students and faculty is the need of the time. Ethical use for both teachers and students is important. Both should be oriented and trained in this respect so that a positive use can prevail in research. AI tools usage can be encouraged through positive activities like preparing class quizzes and assignments. The same should be prepared in such a way that it encourages digital literacy and higher-order thinking skills. More experimental studies can be arranged on a larger scale, so that the usage of AI tools can be broadened in other disciplines. Measures can be made to monitor and evaluate the AI tool usage in the learning process, lest it diminish the critical thinking skills and a sense of creativity among the students.

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