THE JOURNAL OF RESEARCH REVIEW

P-ISSN: 3006-2632	E-ISSN: 3006-2640
Vol. 1. No. 04 (Oct-Dec) 2024	Page 266-273

Relationship Between AI Usage And Students' Performance At Higher Secondary Level

Dr Fahd Naveed Kausar **(Corresponding Author)**	Assistant Professor, School of Education, Minhaj University Lahore, Punjab, Pakistan fahdnaveed1@hotmail.com
Muhammad Jamil Afridi	Lecturer, Institution: The University of Agriculture, Peshawar afridi.jamil@gmail.com
Muhammad Shehzad Khan	PhD Scholar Pakistan study in Pakistan study center University of Peshawar mshehzadkhan1982@gmail.com

Abstract: *AI usage in education has the potential to enhance students' performance by providing personalized learning experiences and real-time feedback tailored to individual needs. These AI-driven tools can improve engagement, motivation, and mastery of subjects, leading to better academic outcomes. The objectives of the study were to identify the level of AI and students' performance, to find out the relationship between AI and students' performance, and to analyze the effect of AI on students' performance at secondary level. The design of the study is correlational. This study was quantitative research. The population was comprised of all public and private higher secondary level of Lahore district. The instrument of the study was questionnaires. The current study was make use of primary data sources. Descriptive and inferential statistics was used. Data analysis was conducted using the Statistical Package for Social Science (SPSS). The 1st research objective was achieve using the mean, and standard deviation; the 2nd research objective was achieve using Pearson r and 3rd objective was regression analysis. The findings of the study was revealed that there was highly significant effect and relationship between AI and students' performance at higher secondary level.*

Keywords: *AI usage, students' performance, higher secondary level*

Introduction

The relationship between artificial intelligence (AI) usage and students' performance has become a subject of growing interest and significance within the field of education. As AI technologies continue to evolve and integrate into various sectors, education systems worldwide are exploring how these innovations can enhance the learning process, improve academic outcomes, and support personalized learning. The application of AI in education can take many forms, including intelligent tutoring systems, adaptive learning platforms, AI-driven assessments, and data-driven insights into student behavior and progress. However, understanding the impact of these tools on students' performance—whether in terms of academic achievement, cognitive development, or social-emotional growth—requires a careful examination of how AI technologies are used, the context in which they are implemented, and the broader educational environment in which students are situated (Luckin, Holmes, Griffiths, & Forcier, 2016). The use of AI in education is not a novel concept, but its rapid development and expansion over the past few years have made it a critical topic of study. AI has the potential to transform traditional teaching and learning paradigms, providing new ways to engage students and support teachers in ways that were previously unimaginable (Holmes, Bialik, & Fadel, 2019). For example, AI systems can now provide real-time feedback to students, adapt lessons to individual learning styles, and even predict

students' academic trajectories by analyzing vast amounts of data. Research has shown that AI tools can increase the efficiency of personalized learning, which in turn has been shown to improve student outcomes, especially in terms of mastering core competencies (Holmes, Bialik, & Fadel, 2019; Baker et al., 2013).

However, the introduction of AI into education also brings about questions of equity, privacy, and the role of human educators. Critics argue that while AI can offer personalized learning experiences, it may inadvertently widen the achievement gap if its benefits are not equitably distributed. Furthermore, there is concern that the increased reliance on AI could lead to a dehumanization of education, with students becoming more dependent on machines than on their interactions with teachers and peers (Williamson & Piattoeva, 2020; Selwyn, 2016). Thus, while AI offers many potential benefits for student performance, it is essential to examine both the advantages and challenges associated with its implementation. One of the key promises of AI in education is its ability to facilitate personalized learning. Traditional classrooms often present challenges in meeting the diverse needs of students, particularly in multi-grade or multilingual settings where students have varying levels of proficiency and learning styles (Baker, Corbett, Koedinger, & Wagner, 2013). AI-based systems can use data analytics to assess individual student needs and provide tailored resources and exercises to help them progress at their own pace. This level of personalization can be especially valuable for students who may need additional support or for those who are ready for more advanced material. According to a study by Kulik (2013), the use of computer-assisted instruction (CAI) has been shown to enhance student achievement across a wide range of subjects by enabling more targeted, individualized learning (Kulik, 2013).

AI-driven tools such as intelligent tutoring systems (ITS) exemplify this personalized approach. These systems use algorithms to adapt instruction based on students' responses, offering immediate feedback and explanations to help students understand difficult concepts. Research has shown that ITS can significantly improve students' performance, particularly in subjects like mathematics and science, by providing continuous, tailored support that goes beyond what a teacher could offer in a traditional classroom setting (VanLehn, 2011; Koedinger, Corbett, & Perfetti, 2012). Additionally, adaptive learning technologies have been linked to improvements in student engagement and motivation, as they allow students to take ownership of their learning and progress through materials that are appropriately challenging (Woolf, 2010). However, it is important to acknowledge that personalized learning through AI requires a substantial amount of data to be effective. For AI systems to generate accurate recommendations and adjustments, they must collect and analyze data on students' interactions, performance, and preferences (Siemens, 2013). This raises concerns regarding data privacy and security, especially when it comes to sensitive student information. Balancing the benefits of personalized learning with the need to protect student privacy remains a significant challenge as AI continues to permeate the education sector (Zawacki-Richter et al., 2019).

The impact of AI on academic achievement has been widely debated in the literature. On the one hand, AI has been shown to support improved learning outcomes by providing students with more tailored and efficient learning experiences. A study by Baker et al. (2013) found that students who used adaptive learning systems in a mathematics course performed significantly better than their peers who received traditional instruction, demonstrating the potential for AI to enhance academic achievement (Baker, Corbett, Koedinger, & Wagner, 2013). Furthermore, AI can help teachers identify struggling students more quickly and offer targeted interventions, which may prevent learning gaps from widening (Baker et al., 2013; Nye, Graesser, & Hu, 2014). On the other hand, research also suggests that the effectiveness of AI tools in improving academic performance depends heavily on how they are implemented and integrated into the curriculum. Simply introducing AI technology into classrooms does not guarantee improved student outcomes. For instance, a study by Luckin et al. (2016) emphasized the importance of professional development for teachers to ensure that they are equipped to use AI tools effectively in

conjunction with their pedagogical strategies (Luckin et al., 2016). Teachers play a critical role in facilitating the use of AI and ensuring that it complements rather than replaces traditional teaching methods. The successful integration of AI in education requires careful planning, teacher training, and alignment with curriculum standards (Holmes et al., 2019).

While much of the research on AI in education focuses on academic outcomes, it is equally important to consider the impact of AI on students' social-emotional and cognitive development. AI-based tools can promote critical thinking, problem-solving, and self-regulation by encouraging students to engage with content in interactive and dynamic ways (Woolf, 2010). For example, AI systems that incorporate gamification can increase motivation and foster a sense of accomplishment as students' progress through challenges. Additionally, AI tools that provide immediate feedback can help students develop metacognitive skills, such as reflection and self-assessment, which are essential for lifelong learning (Siemens, 2013). However, there are concerns that excessive reliance on AI could diminish students' social skills and emotional intelligence. Face-to-face interactions with teachers and peers play a crucial role in helping students develop empathy, collaboration, and communication skills (Selwyn, 2016). As AI takes on a more prominent role in education, it is essential to ensure that students continue to have ample opportunities for social interaction and that AI does not replace the human elements of teaching that foster emotional and social development (Williamson & Piattoeva, 2020). The relationship between AI usage and students' performance is complex and multifaceted. While AI has the potential to significantly enhance academic achievement, personalized learning, and cognitive development, its impact is dependent on a range of factors, including how the technology is implemented, how it is integrated into existing educational frameworks, and the degree to which educators are trained to use it effectively. Furthermore, issues related to data privacy, equity, and the potential for AI to disrupt traditional forms of social interaction must be carefully considered. As the field of AI in education continues to grow, ongoing research is essential to understanding how to maximize its benefits while mitigating its challenges (Zawacki-Richter et al., 2019; Holmes et al., 2019).

Objectives

1- To identify the level of AI and students' performance at secondary level.

2- To find out the relationship between AI and students' performance at secondary level.

3- To analyze the effect of AI on students' performance at secondary level.

Methodology

The design of the study is correlational. This study was quantitative research that helps in evaluating the relationship between Artificial Intelligence (AI) usage, students' learning behavior, and their performance. Positivism is the philosophical paradigm used in quantitative research. The population was comprised of all public and private higher secondary level of Lahore district. The total number of public higher secondary schools is 33 (School Information System, 2024) and colleges are 63 (College Information System, 2024). The total number of private colleges is 234 (Higher Education Department, 2024). Using a stratified sample technique, the researcher first divided the entire population into two strata: public and private. Then, using a cluster sampling technique, the researcher separated the population into three groups based on their locations. From each cluster, 2 higher secondary schools, 4 public colleges, and 10 private colleges was selected according to a simple random sampling technique. From each school and college, 15 students were selected using simple random sampling. Resultantly, the total sample was comprised of 720 students. The instrument of the study was questionnaires. AI usage questionnaire (Sassis, Kefala-Karli, Sassi, & Zervides, 2021), students' performance (Wolf, Jeppesen, Gyrd-Hansen, & Oxholm, 2019) was adapted for data collection. The validity of the research instrument was tested through expert opinion while the instrument's reliability was tested through pilot testing. The students' performance score was 0.871 and the overall AI value was 0.856, whereas the reliability minimum of Cronbach's Alpha is 0.75. Descriptive and inferential statistics were used. Data

analysis was conducted using the Statistical Package for Social Science (SPSS). The 1st research objective was achieve using the mean, and standard deviation; the 2nd research objective was achieve using Pearson r and 3rd objective was regression analysis.

Data analysis

Artificial intelligence

Table 1

Item-wise analysis of Artificial intelligence

Items	N	Mean	S.D.
I am aware of what artificial intelligence (AI) is and how it is used in various applications.	720	1.66	.800
I have used AI-powered educational tools or platforms for learning purposes.	720	1.86	.960
AI technologies help me understand difficult concepts more easily.	720	1.80	.972
AI-powered personalized learning platforms enhance my learning experience.	720	2.00	.970
AI tools provide valuable feedback that helps me improve my academic performance.	720	2.17	1.036
I am concerned about the privacy and security of my data when using AI-powered educational platforms.	720	1.95	1.028
I worry about the potential bias or inaccuracies in AI algorithms affecting my learning outcomes.	720	2.29	1.137
I am concerned that excessive reliance on AI may hinder the development of critical thinking skills.	720	1.91	.911
I believe AI will play an increasingly important role in education in the future.	720	2.30	1.108
I am interested in learning more about how AI can be used to enhance education.	720	1.98	1.057
I am satisfied with the use of AI technologies in my educational experience.	720	2.08	1.045
I believe that AI technologies have positively impacted my learning outcomes.	720	1.96	.967
I prefer learning through AI-powered platforms over traditional teaching methods (e.g., lectures, textbooks).	720	2.19	1.067
AI technologies have made learning resources and materials more accessible to me.	720	2.05	.953
I view AI as a helpful tool that complements and enhances my learning experience.	720	2.00	1.038

The above table illustrates the AI description on the basis of mean and standard deviation. According to the respondents responses, I am aware of what artificial intelligence (AI) is and how it is used in various applications (M=1.66; SD=0.80), I have used AI-powered educational tools or platforms for learning purposes (M=1.86; SD=0.96), AI technologies help me understand difficult concepts more easily (M=1.80; SD=0.97), AI-powered personalized learning platforms enhance my learning experience (M=2.00; SD=0.97), AI tools provide valuable feedback that helps me improve my academic performance (M=2.17; SD=1.03), I am concerned about the privacy and security of my data when using AI-powered educational platforms (M=1.95; SD=1.02), I worry about the potential bias or inaccuracies in AI algorithms affecting my learning outcomes (M=2.29; SD=1.13), I am concerned that excessive reliance on AI may hinder the development of critical thinking skills (M=1.91; SD=0.91), I believe AI will play an increasingly important role in education in the future (M=2.30; SD=1.10), I am interested in learning more about how AI can be used to enhance education (M=1.98; SD=0.05), I am satisfied with the use of AI technologies in my educational experience (M=2.08; SD=1.04), I believe that AI technologies have positively impacted my learning outcomes (M=1.96; SD=0.96), I prefer learning through AI-powered platforms over traditional teaching methods (e.g., lectures, textbooks) (M=2.19; SD=1.06), AI technologies have made learning resources and materials more accessible to me (M=2.05; SD=0.95), and I view AI as a helpful tool that complements and enhances my learning experience (M=2.00; SD=1.03). The degree of agreement was reflected in the responses from all respondents combined.

Students' Performance

Table 2

Item wise analysis of students' performance

Items	N	Mean	S.D.
I prepared myself for each of my classes.	720	1.52	.736
I listen intently and pay attention during every conversation.	720	1.72	.988
My goal is to achieve high marks in every subject.	720	1.80	.840
I take an active part in every conversation.	720	1.92	.874
I am more focused when I observe technical issues.	720	1.91	.871
Because homework and extracurricular activities help me get better at every topic, I like them.	720	1.96	1.067
I work harder when I have challenging assignments.	720	1.92	.994
For me, solving puzzles is a useful pastime.	720	2.07	1.039
I take an active part in the class discussion.	720	1.92	.989
To earn good grades, I put a lot of effort into my projects, tests, and assignments.	720	1.84	.938
I make it a point to respond to the tutorial questions ahead of time.	720	2.22	.977
Prior to class, I always study the tutorials' questions.	720	2.28	1.062
I always have my pupils review and study my lessons together.	720	2.19	1.152
I never study or rewrite my lectures in a class; instead, I do it by myself.	720	2.41	1.376
My teacher helps me when I need it.	720	1.90	.954
I used to take part in extracurricular activities at school, such as athletics, games, and debate competitions.	720	2.05	1.040
I replicate my buddies' assignments.	720	2.91	1.459
Only during exam times do I study.	720	2.79	1.491
Teachers cover a lot of ground quickly, which has an impact on my marks.	720	2.49	1.333
Studying with my classmates improved my understanding and gave me new knowledge.	720	1.95	1.084

The performance description of the pupils is shown in the above table. The responses from the respondents show that: I prepared for all of my subjects (M=1.52; SD=0.73); I listened and paid attention during every discussion (M=1.72; SD=0.98); I want to get good grades in all of my subjects (M=1.80; SD=0.84); I actively participate in all of the discussions (M=1.92; SD=0.87); I gain focus when I see technical problems (M=1.91; SD=0.87); I enjoy homework and activities because they help me improve my skills in every subject (M=1.96; SD=1.06); I work harder on difficult assignments (M=1.92; SD=0.99); I find that solving problems is a useful hobby (M=2.07; SD=1.03); and I actively participate in the classroom discussions (M=1.92; SD=0.98), In order to achieve good grades, I work hard on my assignments, projects, and tests (M=1.84; SD=0.93), I always try to answer the tutorial questions before class (M=2.22; SD=0.97), I always read the tutorials' questions before the class (M=2.28; SD=1.06), I always study and revise my lessons in a group of students (M=2.19; SD=1.15), I always study and revise my lessons alone (M=2.41; SD=1.37), I get help from my teacher when I need it (M=1.90; SD=0.95), I used to participate in school co-curricular activities like debate competitions, sports, and other activities (M=2.05; SD=1.04), I copy my friends' assignments (M=2.91; SD=1.45), and I only study when there is a test (M=2.79; SD=1.49), Teachers cover a lot of ground in a short amount of time, which has an impact on my grades (M=2.49; SD=1.33). When I studied with my classmates, I learnt more and developed my comprehension (M=1.95; SD=1.08). The degree of agreement was reflected in the responses from all respondents combined.

Table 3

Relationship between AI and Students' performance

		AI	Students' performance
AI	Pearson Correlation	1	.418**
	Sig. (2-tailed)		.000
	N	720	720
Students' performance	Pearson Correlation	.418**	1
	Sig. (2-tailed)	.000	
	N	720	720

The study's primary variables and their correlations are displayed in Table. The results indicate that there is a moderately positive and statistically significant correlation (r=.418, p>.000) between students' performance and AI. This demonstrates a middling correlation between AI and academic achievement.

Table 4

Effect of AI on students' performance

R	R Square	Adjusted R Square	Std. Error of the Estimate
.418[a]	.175	.174	.47176
a. Predictors: (Constant), AI			

Table 5

Effect of AI on students' performance

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
	1.387	.068	.418	12.34	.000
Artificial intelligence	.403	.033			

a. Dependent Variable: SP

The above table illustrates the effect of AI on students' performance. The B-value 0.418, t-value 12.334, p>0.000 which shows that there was highly significant effect of AI on students' performance at higher secondary level.

Discussion

Artificial intelligence (AI) exists at varying levels of complexity, ranging from narrow or weak AI, which is designed to perform specific tasks, to general or strong AI, which aims to replicate human-like cognitive abilities across a wide range of activities (Russell & Norvig, 2016). Currently, most AI applications fall within the narrow category, such as machine learning algorithms, which are trained to recognize patterns in data and make predictions based on those patterns (Jordan & Mitchell, 2015). Within this scope, deep learning models, a subset of machine learning, have gained prominence for their ability to process large datasets and perform complex tasks like image recognition and natural language processing (LeCun, Bengio, & Hinton, 2015). While AI has made significant strides in specialized areas, the quest for artificial general intelligence (AGI), which would demonstrate human-like reasoning and adaptability, remains a long-term goal (Goertzel & Pennachin, 2007). However, even in its current form, AI is increasingly being integrated into various industries, from healthcare to education, and is driving innovations that significantly enhance human productivity and decision-making (Brynjolfsson & McAfee, 2014). Despite its potential, the ethical and societal implications of advanced AI technologies continue to be a subject of intense debate (Binns, 2018).

Students' performance is a multifaceted concept that encompasses various academic, cognitive, and social-emotional outcomes. Academic performance typically refers to how well students achieve in subjects like mathematics, reading, and science, often measured through standardized assessments or grades (Baker, 2013). However, student performance is not solely defined by test scores; factors such as critical thinking, problem-solving abilities, and motivation also play a significant role in a student's overall success (Zimmerman, 2002). Moreover, cognitive development, including skills like memory retention and comprehension, is closely tied to performance outcomes, with research showing that

engaged students perform better in tasks requiring complex thinking (Pintrich & De Groot, 1990). Social-emotional factors, including self-regulation and emotional intelligence, also contribute significantly to students' ability to perform academically (Durlak et al., 2011). Performance varies across different contexts and can be influenced by external factors such as teacher quality, parental involvement, and the availability of resources (Hattie, 2009). Understanding these diverse aspects of performance is critical for fostering environments that support students' full potential.

The relationship between AI and students' performance is becoming increasingly significant as AI technologies are integrated into educational environments. AI tools, such as intelligent tutoring systems and adaptive learning platforms, have been shown to enhance students' academic performance by providing personalized learning experiences tailored to individual needs (Baker et al., 2013; Koedinger et al., 2012). These systems use data-driven algorithms to identify areas where students are struggling and offer targeted support, which can lead to improved understanding and retention of material (VanLehn, 2011). Additionally, AI can help teachers monitor student progress in real time, enabling timely interventions that can positively impact student outcomes (Siemens, 2013). However, the effectiveness of AI in improving student performance depends on how well it is integrated into the educational context and how it complements traditional teaching methods (Holmes et al., 2019). Despite its potential, concerns about equity, data privacy, and over-reliance on technology continue to shape discussions around AI's role in education (Williamson & Piattoeva, 2020).

The effect of AI on students' performance is a growing area of interest in educational research, with evidence suggesting both positive and mixed outcomes. AI-driven tools, such as intelligent tutoring systems (ITS) and adaptive learning platforms, have demonstrated significant improvements in students' academic performance by providing personalized learning experiences that cater to individual needs (Baker et al., 2013; Koedinger et al., 2012). These systems allow for real-time feedback and targeted interventions, helping students to master difficult concepts and progress at their own pace, which can lead to higher achievement levels (VanLehn, 2011). Studies have also shown that AI enhances motivation and engagement by making learning more interactive and relevant to students (Woolf, 2010). However, the impact of AI on student performance varies depending on factors such as the quality of the AI tools, the integration with traditional teaching methods, and the context in which they are used (Holmes et al., 2019). Furthermore, concerns about privacy, equity, and the potential for over-reliance on technology are important factors to consider when evaluating the long-term effects of AI on education (Williamson & Piattoeva, 2020).

Conclusion

In conclusion, the integration of AI into education has the potential to significantly impact students' performance, offering opportunities for personalized learning, real-time feedback, and improved academic outcomes. AI-driven tools, such as intelligent tutoring systems and adaptive learning platforms, have shown promise in enhancing student engagement, motivation, and achievement across a variety of subjects. However, the effectiveness of AI depends on factors such as the quality of the tools, proper integration into existing educational frameworks, and the role of educators in supporting AI initiatives. While AI presents numerous benefits, challenges related to equity, data privacy, and over-reliance on technology must be carefully addressed. Future research and thoughtful implementation will be key to ensuring that AI supports, rather than supplants, the human elements of teaching and learning, ultimately fostering better outcomes for all students.

References

Baker, R. S. (2013). Predicting learning from the patterns of help-seeking in intelligent tutoring systems. *User Modeling and User-Adapted Interaction, 23*(3), 293-318.

Baker, R. S., Corbett, A. T., Koedinger, K. R., & Wagner, A. Z. (2013). Predicting learning from the patterns of help-seeking in intelligent tutoring systems. *User Modeling and User-Adapted Interaction, 23*(3), 293-318.

Brynjolfsson, E., & McAfee, A. (2014). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. W.W. Norton & Company.

Binns, R. (2018). The ethical implications of artificial intelligence in education. *Journal of Educational Technology & Society, 21*(3), 88-100.

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions. *Child Development, 82*(1), 405-432.

Goertzel, B., & Pennachin, C. (2007). *Artificial general intelligence*. Springer.

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. Routledge.

Jordan, M. I., & Mitchell, T. M. (2015). Machine learning: Trends, perspectives, and prospects. *Science, 349*(6245), 255-260.

Koedinger, K. R., Corbett, A. T., & Perfetti, C. A. (2012). The knowledge-learning-instruction framework: Bridging the science-practice divide to enhance robust student learning. *Cognitive Science, 36*(5), 757-798.

Kulik, C. L. C. (2013). Effects of using instructional technology in elementary and secondary schools: What controlled evaluation studies say. *Journal of Educational Computing Research, 49*(3), 345-364.

LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. *Nature, 521*(7553), 436-444.

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson Education.

Nye, B. D., Graesser, A. C., & Hu, X. (2014). Intelligent tutoring systems. In *The Cambridge Handbook of Computing Education Research* (pp. 423-448).

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82*(1), 33-40.

Russell, S., & Norvig, P. (2016). *Artificial intelligence: A modern approach* (3rd ed.). Prentice Hall.

Selwyn, N. (2016). *Education and technology: Key issues and debates*. Bloomsbury Publishing.

Siemens, G. (2013). Learning analytics: The emergence of a discipline. *American Behavioral Scientist, 57*(10), 1380-1400.

VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. *Educational Psychologist, 46*(4), 197-221.

Williamson, B., & Piattoeva, N. (2020). Education governance and datafication: New policy paradigms and the role of AI. *Journal of Education Policy, 35*(4), 510-525.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice, 41*(2), 64-70.