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Artificial Intelligence Based Learning and Its Effect on Academic Performance: A Survey of the University of Sargodha

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ABSTRACT

This study looks at how students' academic performance is affected by learning based on AI tools. This study examined how AI tools help students succeed academically. It also explored learners' views on the potential long-term influence of AI in strengthening their problem-solving skills. Quantitative survey data was collected using a standardized questionnaire. A random sample of 387 students was taken. The alternative hypothesis was supported by the correlation and regression analysis, which showed a moderately strong positive correlation between AIBL and academic performance (AP) ($r = 0.532$) and that AIBL also explains academic performance (AP) ($r = 0.330$). Overall, AI-based learning tools were reported to improve grades, increase student independence, enhance understanding, and contribute to long-term academic growth. As becomes clear, there is evidence that with education there has been a paradigm shift, and the quicker educational institutes get on the AI-based tools bandwagon, the better it is for students, who are now accustomed to the convenience of learning anytime, anywhere. It is recommended that universities adopt inclusive policies that ensure wider access to AI tools and provide training to students for their effective use in enhancing

academic and problem-solving capacities.

Keywords: Artificial Intelligence (AI), Learning, Academic Performance, Education, Achievements, Problem-solving, Students and University.

INTRODUCTION

Background of Study

The AI tools can help the students at any time and in any place to enhance their competencies and knowledge. The underprivileged individuals have been resorting to the traditional support and mentoring (Dahri et. al., 2024). Availability and accessibility were among the challenges of this support. The race and the outcome would have been different.

With the increasing availability of digital technologies and services (Berland, 2015), learners become exposed to increasingly personalized learning journeys, which are driven by their speed and their levels of knowledge (Altememy et. al., 2023). Consequentially, this has transformed into the dynamics of traditional, universal educational institutions more towards the level of personalized study routes, rendering things more interesting and, hypothetically, more educationally fruitful.

The COVID-19 epidemic accelerated AI use in education, driven by the widespread shift to virtual learning environments (Baker, 2019). Meanwhile, the students were becoming increasingly familiar with the system of virtual learning, organization of assignments, and support of the studies based on AI. This shift highlighted the significance of studying how AI affects student performance, motivation, engagement, and academic accomplishments. Even though the students were able to adapt to the use of digital tools quite effectively, the rest of them faced barriers such as problem of technological literacy, quality of the internet connection or accessibility of the device, thereby raising the issue of concern regarding equity and digital divide (Kotsiantis et.ial., 2004).

The AI tools are slowly taking over a place in school and university as the education becomes more technological. These tools can be rapidly responsive, flexible to needs of learners of different pace, and capable of enhancing the efficiencies and engaging the learning process. But not every AI tool is effective: some of them have limited educational value and even undermine the learning process.

LITERATURE REVIEW

Over the past two years, AI in education has gained popularity, particularly in exploring its potential to support personalized and digital learning experiences (Vieriu & Petrea, 2025).

The field of education has recently emerged as literature due to the increased concern related to artificial intelligence (AI) as pertinent to the rapid development of computing as well as information communication technology (ICT) (Akoi et. al., 2025; Samo & Shah, 2025). The technology of AI can offer new opportunities,

challenges, and possibilities to teachers to make the teaching better in various domains and even school levels (Zhang & Aslan, 2021).

According to Chen (2020), AI can provide the instructor with any type of academic work, such as the building of the content, computer-born grade, and analytics along with the assessment of student activity.

Artificial intelligence (AI) and chatbots, like ChatGPT, copying human communication and producing human-like content in reaction to natural-language input, could enhance the interactions of learners and subsequent engagements by transforming traditional learning and teaching processes (Crompton, 2024; Dong, 2025).

Besides, Fan & Chen, (2021) mentioned that there is a potential that AI will assist in personalized learning, where course content would be customized to students based on their needs and interests.

According to recent research by Singh, Vasishta, and Singla (2024), artificial intelligence (AI) can enhance learning efficacy and raise academic achievement among Generation Z students. The authors limited the study to students in the northern part of India and discovered high probabilities of applying AI tools to the learning process by students with an understanding of the AI tool usage (AI literacy). Consequently, such students performed better in their learning and achieving greater academic results.

According to Xue, Rashid & Ouyang, (2024) examination of why students embrace AI technologies, especially when it comes to their perceived improvement in academic performance. The model aids in determining the enabling and inhibitory factors in the way students and teachers approach adoption of AI hence essential in implementing the AI in education and enhancing learning results.

The following are main research objectives:

1. To evaluate the AI-based learning resources assistance raise students' academic achievement.
2. To investigate how AI-based learning affects students' capacity for problem-solving over the long run.

Hypothesis of the Study

The following are the hypotheses:

H₀ : Students' academic performance in higher grades is not substantially impacted by the usage of artificial intelligence-based learning resources.

H₁: Academic performance of students in higher grades is significantly impacted by the employment of artificial intelligence-based learning resources.

RESEARCH METHODS

This survey research was performed at the University of Sargodha, focusing on a student demographic of over 19,000 individuals. A sample size of 387 was calculated using Cochran's method. Data were gathered using a standardized questionnaire based on a Likert scale, delivered to students chosen by simple random

selection. The questionnaire was designed to assess students' academic performance, gather their demographic details, and explore their use of artificial intelligence-based learning tools.

The research relied on descriptive and inferential statistical analyses. Descriptive analysis depicted the background data and purpose of this research. A statistical measure of comparisons into the correlation between academic performance among the students and AI-based learning materials was done. Spearman correlation established the direction and strength of relationship. Linear regression scrutiny was conducted to evaluate range to which AI-based learning could predict students' academic performance. ANOVA was performed to assess the model's significance, and the coefficients table showed each independent variable's contribution.

RESULTS

This study found:

Background of Respondents

In order to increase understanding into the background feature of the respondents, frequencies and percentages based descriptive tests were applied to demographic data. The following descriptive analysis gives a good picture of the background variables.

Table No. 01 Background of Respondents

S. No	Background	Sorts of Data	Frequencies	Percentages
1	Age	Under 18	22	5.7%
		18-22	217	56.1%
		23-27	113	29.2%
		28 above	35	9.0%
2	Gender	Male	177	45.7%
		Female	210	54.3%
3	Educational level	High school	57	14.7%
		Undergraduate	265	68.5%
		Graduate	62	16.0%
		Other	3	0.8%
4	Field of study	Natural	27	7.0%
		sciences	308	79.6%
		Social sciences	29	7.5%
		Commerce	23	5.9%
		Other		
5	Home Internet Access	Always	286	73.9%
		available	79	20.4%

		Not available	22	5.7%
		Available occasionally		
6	Institution Type	Government	371	95.9%
		Private	13	3.4%
		Virtual	3	0.8%
7	Geographical location	Urban	243	62.8%
		Sub-urban	28	7.2%
		Rural	116	30.0%
8	Average monthly household income	Less than 25k	99	25.6%
		25k-50k	91	23.5%
		51k-1lac	156	40.3%
		More than 1lac	41	10.6%
9	What is your current CGPA	3.5-4.0	117	30.2%
		3.0-3.4	130	33.6%
		2.0-2.9	117	30.2%
		Below 2.0	23	5.9%

The demographic profile of the respondents (n = 387) highlights diverse characteristics across various background variables. Majority (56.1%) of the population of students is in age range of 18- 22 years, a small number (5.7%) are less than 18 years old, and 9.0 percent are 28 and above. Female students slightly outnumber male participants, representing 54.3% of the sample. In terms of educational level, most students (68.5%) are enrolled in undergraduate programs, while 16.0% are graduate-level and 14.7% are high school students. Social sciences dominate as the field of study for 79.6% of respondents.

Access to internet at home is widespread, with 73.9% confirming regular access, while 20.4% have no access, and 5.7% have occasional access. A vast majority (95.9%) belong to public institutions, and 62.8% reside in urban areas, followed by 30.0% in rural regions. Monthly household income shows that 40.3% fall in the 51,000–100,000 PKR range, while 25.6% earn less than 25,000 PKR. Academic performance, measured by CGPA, reveals that 33.6% have a CGPA between 3.0–3.4, while 30.2% fall in both 3.5–4.0 and 2.0–2.9 ranges, respectively.

According to the sample as a whole, the bulk of participants were young, urban, social science undergraduates with regular internet access and strong academic standing. They appear to be in a good position to embrace and gain as of Artificial Intelligence based learning resources in their education, based on their varied but targeted profile. Thus, Strzelecki (2023) and AlShibli et al. (2025) suggested that AI enhances learning outcomes, motivation, and engagement.

AI-Based Learning Resources Help Raise Students' Academic Performance

The percentage and frequency show a predominantly good attitude of students towards effects of learning based on AI tools on their study outcomes and learning capability:

Table No. 02: Artificial Intelligence (AI)-Based Learning to improve Students' Academic Performance.

S. No.	Statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1	Since utilizing AI, my grades have improved.	95 (24.5%)	160 (41.3%)	100 (25.8%)	28 (7.2%)	4 (1.0%)
2	My test scores have increased after using AI tools.	50 (12.9%)	151 (39.0%)	133 (34.4%)	49 (12.7%)	4 (1.0%)
3	I perform better in subjects where I use AI tools.	68 (17.6%)	202 (52.2%)	87 (22.5%)	26 (6.7%)	4 (1.0%)
4	I am more confident during exams after using AI-based tools.	54 (14.0%)	228 (58.9%)	75 (19.4%)	26 (6.7%)	4 (1.0%)
5	AI tools help me understand difficult concepts.	71 (18.3%)	233 (60.2%)	68 (17.6%)	14 (3.6%)	1 (0.3%)
6	AI tools help me understand topics better than textbooks.	126 (32.6%)	133 (34.4%)	99 (25.6%)	23 (5.9%)	6 (1.6%)
7	AI-based learning makes me more independent in my studies.	132 (34.1%)	128 (33.1%)	103 (26.6%)	22 (5.7%)	2 (0.5%)
8	AI tools help me to save time on studying.	79 (20.4%)	240 (62.0%)	51 (13.2%)	14 (3.6%)	3 (0.8%)
9	I feel more motivated to study when using AI tools.	170 (43.9%)	141 (36.4%)	50 (12.9%)	24 (6.2%)	2 (0.5%)

For Objective 01, which examines the effectiveness of learning based on AI tools in improving academic performance of students, the highest strong agreement was observed for the statement "I feel more motivated to study when using AI tools,"

with 43.9% Strongly agreeing, followed by "AI-based learning makes me more independent in my studies," where 34.1% Strongly agreed.

The highest overall agreement (combined "Strongly Agree" and "Agree") was recorded for " AI tools help me to save time on studying," with 62.0% agreeing and 20.4% Strongly agreeing, indicating a strong perceived efficiency benefit of AI tools.

The lowest strong agreement appeared in "My test scores have increased after using AI tools," where only 12.9% Strongly agreed, while 34.4% responded undecided ly, suggesting uncertainty or mixed perceptions about direct score improvement.

In terms of disagreement, the highest level was found in the same item (test scores), with 12.7% disagreeing and 1.0% strongly disagreeing. Conversely, the lowest disagreement occurred in "AI tools help me understand difficult concepts," with only 3.6% disagreeing and 0.3% strongly disagreeing, indicating broad consensus on AI's usefulness in concept clarity. Overall, students perceived AI tools as effective in enhancing academic performance, particularly in terms of motivation, independence, and understanding complex topics.

It was also verified that students perceive AI as an aid in learning more about subjects than textbooks, compatible with the results of previous researches that AI can be a supplement to traditionally taught classes due to adopting further appealing (Luckin, & Holmes, 2016) and open education materials (Dahri et al., 2024).

Second goal of research was taken into account in addition to the academic performance, i.e., the long-term effects based on AI learning proceeding the problem-solving capacity of a learner (Jeynes, 2007). The findings indicated that the students experienced greater independence, time-management capacity, information-retention periods, and competence in group work, whilst using the tools provided by AI. AlShibli et al. (2025) merely mentioned is his study that AI can create independence, but they could not offer better evidence because in their research. Hence, it implies that the AI may assist in collaborative learning through supplying prompt solutions, enhancing communication, and allowing groups to be organized, which is a valuable novelty of the contemporary study.

AI-Based Learning Affects Students' Capacity for Problem-Solving Over The Long Run

The next similarities in frequencies and percentages demonstrate the duration effect of the learning with AI on getting the students to improve on their problem-solving skills.

Table No. 03: AI-Based Learning on Problem-Solving Abilities

S. No.	Statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1	The learning based on AI makes me extra independent	132 (34.1%)	128 (33.1%)	103 (26.6%)	22 (5.7%)	2 (0.5%)

	in my studies.					
2	I believe AI tools can replace human tutors.	105 (27.1%)	138 (35.7%)	112 (28.9%)	25 (6.5%)	7 (1.8%)
3	I receive immediate feedback from AI tools.	158 (40.8%)	112 (28.9%)	100 (25.8%)	16 (4.1%)	1 (0.3%)
4	My instructors support AI-based learning.	122 (31.5%)	161 (41.6%)	68 (17.6%)	32 (8.3%)	4 (1.0%)
5	I can retain information longer with the help of AI.	128 (33.1%)	159 (41.1%)	78 (20.2%)	22 (5.7%)	—
6	I make fewer academic mistakes after using AI tools.	122 (31.5%)	133 (34.4%)	102 (26.4%)	28 (7.2%)	2 (0.5%)
7	Using AI helps me manage my study time better.	106 (27.4%)	184 (47.5%)	68 (17.6%)	21 (5.4%)	8 (2.1%)
8	I perform better in group tasks when I use AI support.	71 (18.3%)	213 (55.0%)	80 (20.7%)	20 (5.2%)	3 (0.8%)

In above table, highest strong agreement was seen in the statement "I receive immediate feedback from AI tools," with 40.8% strongly agreeing, reflecting students' appreciation for real-time responses in learning.

The highest overall agreement (combined "Strongly Agree" and "Agree") was found in "I perform better in group tasks when I use AI support," with 55.0% agreeing and 18.3% Strongly agreeing, indicating that students perceive AI as helpful in collaborative and problem-solving contexts.

The lowest strong agreement appeared for "I perform better in group tasks when I use AI support," despite its high general agreement, with only 18.3% Strongly agreeing, suggesting students may still be adjusting to AI's role in teamwork.

In terms of disagreement, the highest combined disagreement was in "I believe AI tools can replace human tutors," with 6.5% disagreeing and 1.8% strongly disagreeing, showing skepticism about AI fully replacing human guidance.

The lowest disagreement was recorded for "I receive immediate feedback from AI tools," with only 4.1% disagreeing and 0.3% strongly disagreeing, reflecting strong student consensus on this benefit.

Additionally, items like "Using AI helps me manage my study time better" and "I can retain information longer with the help of AI" also showed high agreement (47.5% and 41.1% respectively), supporting the view that AI contributes to effective long-term learning and cognitive retention.

On the whole, students see AI as a beneficial aid in becoming independent, improving time management, reducing academic errors, and enhancing problem-solving within both individual and group contexts.

Hence, results strengthen fact that AI tools can also be used more effectively to improve future abilities of students in academic performance, motivation, and confidence, as well as long-term problem-solving and collaborative abilities. This demonstrates that AI in learning can become a game changer and not just because it will make learning more productive, but will also train students to work in teams and self-train on practical issues they face (Marengo, 2024). The finding that students believe AI can have an individual utility, and use it in pair work, adds a new piece of knowledge to the existing one and indicates that usage of AI solutions can subsidize to the growth of learners academically and personally to a larger extent than recorded before (Pacheco-Mendoza et. al., 2023). These insights show that educational establishments should consider implementing AI solutions wisely, achieving access, supervision, and education to ensure their positive impact and solve problems, such as excessive dependency and inequitable distribution (Dahri et al., 2024).

Hypothesis Testing

The correlation, regression, ANOVA and coefficient tests were used to test the hypotheses to identify the nature of predicting Academic Performance (AP) on AI-Based Learning, and the Spearman Correlation Coefficient to establish the level and nature of relationship between them.

Correlation

The statistical analyses conducted in this study provide important new information about the relationship between youth Academic Performance (AP) and AI-Based Learning (AIBL).

Table No. 04: Correlations

			AI-Based Learning (AIBL)	Academic Performance	
Spearman's correlation	rank	AIBL	Correlation Coefficient	1.000	0.532
			Significance (2-tailed)	.	0.000
			Number	387	387

	AP	Correlation Coefficient	0.532**	1.000
		Significance (2-tailed)	0.000	.
		Number	387	387

According to results students' academic success and AI-based learning methods are positively correlated. With a correlation value of 0.532, students' academic performance also improves when they use Artificial Intelligence learning tools. This connection is meaningful and moderate. The result is statistically significant and was not the result of chance, as is shown by the value of significance of 0.000. The study indicates that students who utilize AI-focused learning strategies tend to achieve higher grades, indicating that AI enhances their academic motivation.

Regression

Regression statistical approach tested the hypothesized relationship between usage of AI in education and student performance, as outlined in the stated null and alternative hypotheses.

Table No. 05: Regression Analysis

Model	R	R-Squared Score	Adjusted R ²	SSE**
01	0.574*	0.330	0.328	5.20739

*. Predictors (Constant) are AI-Based Learning

** Standard Error of the Estimate

A moderate positive association ($R = 0.574$) exists between AI-based learning aids and student achievement. The R-squared score of 0.330 suggests that AI learning tools explain 33% of students' academic progress. The model fits well after adjusting for predictors, as shown by the corrected R-squared (0.328). The regression line is 5.20739, the shows estimate standard error it suggests reasonable prediction accuracy.

ANOVA

ANOVA was applied to decide the overall regression model meaningfully explains the variation in students' academic performance based on their use of AI-based learning tools.

Table 06: ANOVA

Model	SS*	Degree of Freedom	MS**	F-value	p-value***

Regression	5134.55	1	5134.55	189.34	0.000 ^b
Residual	10440.006	385	27.117		

a. Dependent Variable (DV): Academic Performance (AP)

b. Predictor: AI-Based Learning (AIBL)

*Sum of Squares

**Mean Square

***significance

The findings show a significant regression model ($F = 189.34$) ($p < 0.001$). This suggests the model fits well and AI-based learning technologies explain student academic performance inequalities. The low p-value demonstrates that these findings are not random, proving that AI technologies can predict educational outcomes.

Coefficients

The coefficients analysis examined the association between students' academic performance and AI-based learning tools, emphasizing on its direction (positive or negative) and strength (magnitude).

Table 07: Coefficients^a Summary

Model	(B)*	SE**	(Beta)***	T-value	(p-value)****
(Constant)	10.102	1.472		6.860	0.000
AIBL	0.514	0.037	0.574	13.760	0.000

a. Dependent Variable: Academic Performance

* Unstandardized Coefficients

** Standard Error

*** Standardized Coefficients

****significance

This is shown in the regression coefficients that validate that AI-based learning (AIBL) positively and significantly affect the student performance. Unstandardized coefficient (B) 0.514 indicates that score of AI-based learning increases, the academic performance score would increase by 0.514 unit considering other factors to remain constant. The standardized beta coefficient (0.574) denotes that the association among AIBL and academic performance is moderate or a strong positive association.

Academic Performance is strongly linked to AI-based learning tools (t-value = 13.760 and p-value = 0.000). Hence, baseline academic performance score without AI-based learning aids (i.e., when the AIBL score is zero) is $B = 10.102$.

The findings also show trends in the literature regarding how AI-based learning tools help students save time, improve their exam preparation, and enable

more personalized learning (Bond, 2024; Altemy et al., 2023).

This study illustrates that AI-driven learning improves academic achievement, fosters student engagement in their education, and aids in achieving educational goals. According to Shete et al., (2024) AI maximizes their benefits, and Lee et al., (2022) underscores the importance of adequate training, equitable access (Huang et al., 2022). Same as Pertiwi et al., (2024) stated that the thoughtful application of Artificial Intelligence skills within teaching and learning frameworks.

Haque (2022), put in words that Universities have been fighting the necessity to take a jump into the process of digitization of education because of these challenges of technical challenges and lack of expertise. Haque more understandable that an educational paradigm shift has already taken place and the sooner educational organizations enter into learning using AI-tools bandwagon, the better it is to the students, who have now adapted to the delight of learning anytime, anywhere. The students are more skillful and autonomous in using search engines and quick to realize that they can be leaders in the digital age and have found out that there is no border to learning, place and time. We are now entering an era where there will be creation of a generation of self-learning and online businessmen.

CONCLUSION

This study indicates the great and beneficial influence of learning instruments operated by AI, on the students learning outcomes and general educational experience. In addition to raising grades, AI makes students more confident and independent, better at managing time and working with others, which are qualities critical to solving problems in the real world. The close relationship between AI application and academic performance reflects the fact that it is effective in increasing learning personality, efficiency, and fun. The full potential of this aspect can be realized only when universities ensure equal access to AI technologies and ensure that they know how to actively use them. Applying AI is a revolutionary instrument which enables students to survive in the ever-changing academic world, not necessarily as an addition to conventional education.

RECOMMENDATIONS

This study proposes the primary policy recommendations as discussed below:

1. Apply AI Training into the Curriculum

It is recommended that universities offer AI training programs to help students develop proficiency in these skills. It will enable students to use AI in a responsible manner, not to depend on them too much, and know its limitations and advantages.

2. Support Teachers AI-tools Adoption

The policies must also endeavor to train the instructors on how they can apply the usage of Artificial Intelligence in their instructing procedures. The researchers are sure that teachers will have to be convinced to intelligently integrate the usage of the tools based on Artificial Intelligence with the methods of the traditional learning process, so that essential thinking, imagination and the personal interaction continue being the focus of the teaching process.

3.Track and Analyze the Application of AI in Learning

Organizations ought to provide committees or task forces to keep track of the influence of AI tools in student results, with privacy data safety, and ethical information technology use. Periodic review and feedback may assist in enhancing the use of AI and overcoming issues arising.

4.Encourage Teamwork and Self Study

The educational policies must promote activities and assessments in the classroom and learning that integrate AI in group projects and self-designed tasks to solve problems, training students to operate in the real world.

5.Establish National Guidelines of AI in Education

On a national scale, the ministries of Education should develop the detailed standards of introducing AI to the higher education, including data security, equity, accessibility, and quality of the AI platforms.

REFERENCES

- Akoi, Shwana, Ismael, Ferman, & Naseri, Tina (2025). Artificial Intelligence and the Future of Education: The impact of ChatGPT on Students' academic achievement. *Qalaai Zanist Scientific Journal*, vol. 10(1), pp. 1169–1193. LFU. <https://doi.org/10.25212/lfu.qzj.10.1.41>
- AlShibli et. al., A. (2025). Exploring the Impact of Artificial Intelligence on Student Academic Performance. *Artificial Intelligence & Robotics Development Journal*, vol. 5(3), p.383-395. DOI: 10.52098/airdj.20233343
- Altememy et. al., (2023). The Influence of the Artificial Intelligence Capabilities of Higher Education Institutions in Iraq On Students' Academic Performance: The Role Of Ai-Based Technology Application As A Mediator. *Eurasian Journal of Educational Research*, vol. 104(104), pp. 267-282. EJER. DOI: 10.14689/ejer.2023.104.015
- Baker, T. & Smith, L. (2019). Education Rebooted? Exploring the Future of Artificial Intelligence in Schools and Colleges. NESTA. <https://www.nesta.org.uk/report/education-rebooted/>
- Berland, M., Wilensky, U (2015). Comparing Virtual and Physical Robotics Environments for Supporting Complex Systems and Computational Thinking. *J Sci Educ Technol*, Vol. 24, pp. 628–647. <https://doi.org/10.1007/s10956-015-9552-x>

- Bond, M., Khosravi, H., De Laat, M. et al, (2024). A Meta Systematic Review of Artificial Intelligence In Higher Education: A Call For Increased Ethics, Collaboration, And Rigour. *International Journal of Education Technology High Education*, Vol. 21(4). <https://doi.org/10.1186/s41239-023-00436-z>.
- Chen et. al., (2020). Application and Theory Gaps during the Rise of Artificial Intelligence in Education. *Computers and Education: Artificial Intelligence*, Vol. 1(100002). ISSN 2666-920X.
- Crompton, H., Jones, M. V., & Burke, D. (2022). Affordances and Challenges of Artificial Intelligence in K-12 Education: A Systematic Review. *Journal of Research on Technology in Education*, vol. 56(3), p. 248–268. Taylor & Francis. <https://doi.org/10.1080/15391523.2022.2121344>.
- Dahri et. al., (2024). Investigating AI-Based Academic Support Acceptance And Its Impact On Students' Performance In Malaysian And Pakistani Higher Education Institutions. *Education And Information Technologies*, Vol. 29(14), p. 18695-18744. Springer Nature Link. <https://doi.org/10.1007/s10639-024-12599-x>.
- Dong, L., Tang, X., & Wang, X. (2025). Examining the Effect of Artificial Intelligence in Relation to Students' Academic Achievement in the Classroom. *Journal on Computers and Education: Artificial Intelligence*, vol. 8(100400). Elsevier: ScienceDirect. DOI: 10.1016/j.caeai.2025.100400
- Fan, X., & Chen, M. (2001). Parental Involvement And Students Academic Achievement: A Meta-Analysis. *Educational Psychology Review*, Vol. 13(1), p. 1–22. Springer Nature Link. <https://doi.org/10.1023/A:1009048817385>
- Haque, Manzoor-ul (2022). *Assorted Thoughts: Crisp and Hot* (2nd ed.). Raleigh; US: Lulu.com. ISBN: 978-1-7165-3880-3, EBook 978-1-6671-8284-1.
- Huang et. al., (2022). Exploring Acceptance Of An Intelligent Tutoring System With A Pedagogical Agent Among HS Students. *University Access Information Society*, Vol. 21, p. 381–392. Springer Nature Link. <https://doi.org/10.1007/s10209-021-00835-x>
- Jeynes, W. H. (2007). The Relationship Between Parental Involvement and Urban Secondary School Student Academic Achievement: A Meta-Analysis. *Urban Education*, 42(1), 82-110. Sage Publications. <https://doi.org/10.1177/0042085906293818>.
- Kotsiantis, S., Pierrakeas, C., & Pintelas, P. (2004). Predicting Students' Performance In Distance Learning Using Machine Learning Techniques. *Applied Artificial Intelligence*, vol. 18(5), pp. 411–426. Taylor & Francis. <https://doi.org/10.1080/08839510490442058>
- Lee, Y.-F., Hwang, G.-J., & Chen, P.-Y. (2022). Impacts of an AI-based chatbot on college students' after-class review, academic performance, self-efficacy, learning attitude, and motivation. *Educational Technology Research and Development*, Vol. 70(5), pp. 1843–1865. Springer Nature Link. <https://doi.org/10.1007/s11423-022-10142-8>.
- Luckin, R, & Holmes, W, (2016). *Intelligence Unleashed: An argument for AI in*

- Education. UCL Knowledge Lab: London, UK. ISBN: 9780992424886.
- Marengo et. al., (2024). The Educational Value Of Artificial Intelligence In Higher Education: A 10-Year Systematic Literature Review. *Interactive Technology and Smart Education*, Vol. 21(4), pp. 625-644. ISSN: 1741-5659
- Pacheco-Mendoza et. al., (2023). Artificial Intelligence In Higher Education: A Predictive Model For Academic Performance. *Education Sciences*, vol. 13(10), p. 990. <https://doi.org/10.3390/educsci13100990>.
- Pertiwi et. al., (2024). Evaluating the Impact of Artificial Intelligence-Based Learning Methods on Students' Motivation and Academic Achievement. *International Journal of Post Axial: Futuristic Teaching and Learning*, p. 49-58. <https://doi.org/10.59944/postaxial.v2i1.279>
- Samo, N. A., & Shah, S. S. (2025). The Effect of AI-Based Learning Tools on AP of SS Students: A Quantitative Study from Shaheed Benazir Abad. *Journal of Political Stability Archive*, Vol. 3(2), pp. 899-915. <https://doi.org/10.63468/jpsa.3.2.51>
- Shete, S. G., Koshti, P., & Pujari, V. I. (2024). The Impact of AI-Powered Personalization on Academic Performance in Students. In *2024 5th International Conference on Recent Trends in Computer Science and Technology (ICRTCST)*, pp. 295-301. IEEE. DOI: 10.1109/ICRTCST61793.2024.10578480
- Singh, E., Vasishta, P. and Singla, A. (2025), AI-enhanced education: exploring the impact of AI literacy on generation Z's academic performance in Northern India. *Quality Assurance in Education*, Vol. 33 No. 2, pp. 185-202. Emerald Publishing Limited. <https://doi.org/10.1108/QAE-02-2024-0037>
- Strzelecki, A. (2023). To use or not to use ChatGPT in higher education? A study of students' acceptance and use of technology. *Interactive Learning Environments*, 32(9), pp. 5142-5155. <https://doi.org/10.1080/10494820.2023.2209881>.
- Vieriu, A. M., & Petrea, G. (2025). The Impact of AI on Students' Acad. Development. *Educ Sciences*, vol. 15(3), pp. 343. <https://doi.org/10.3390/educsci15030343>.
- Xue, L., Rashid, A. M., & Ouyang, S. (2024). The Unified Theory of Acceptance and Use of Technology (UTAUT) in Higher Education: A Systematic Review, vol. 14(1). SAGE Publication. <https://doi.org/10.1177/21582440241229570>.
- Zhang, K., & Aslan, A. B. (2021). AI Technologies For Education: Recent Research & Future Directions. *Computers And Education: Artificial Intelligence*, vol. 2(100025), pp. 1-11. Elsevier. <https://doi.org/10.1016/j.caeai.2021.100025>.