Relationship of AI usage with Students' Learning Behaviour at Higher Secondary Level

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Abstract

The use of AI in education significantly influences students' learning behavior by providing personalized learning experiences, enhancing engagement, and fostering self-regulation. AI-powered tools also facilitate adaptive learning, helping students improve their performance by tailoring content to their individual needs. The objectives of the study was to find out the relationship between AI usage and students' learning behaviour (Engagement, Motivation, Persistence, Learning strategies, and Collaboration) at higher secondary level. The design of the study is correlational. 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 (SIS, 2024) and colleges are 63 (CIS, 2024). The total number of private colleges is 234 (HED, 2024). The instrument of the study was questionnaires. Descriptive and inferential statistics were used. Data analysis was conducted using the Statistical Package for Social Science (SPSS). The findings of the study was revealed that there was highly significant relationship between AI usage and students' learning behaviour (Engagement, Motivation, Persistence, Learning strategies, and Collaboration) at higher secondary level.

Keywords:

AI usage, students' learning behaviour, Engagement, Motivation, Persistence, Learning strategies, and Collaboration, higher secondary level.

Introduction

Using technology has become inevitable in today's world. In addition to changing people's lives, technology has changed how we communicate, collaborate, and educate ourselves. Innovations of all kinds are continuously being created to improve the practicality and efficiency of our occupations and leisure activities. A relatively new technological development that is beginning to get attention as a way to mimic human behaviour is artificial intelligence, or AI for short. Learning needs to be creative and innovative in order to meet the changing demands of education. Artificial intelligence (AI) is being used in education to assist in the processing of everyday tasks like instruction and learning. Artificial intelligence (AI) is now recognised in the field of education as a machine-based approach that has the algorithmic capacity to produce predictions, diagnoses, recommendations, and judgements. AI can enhance learning in a variety of situations (Hwang, Xie, Wah, & Gašević, 2020).

Artificial intelligence is changing schooling in a lot of ways. By providing students with quick feedback on their work, providing flexible learning resources, and even predicting possible trouble spots, artificial intelligence (AI) can help students do better academically. This tailored approach may lead to increased motivation and better academic achievement. Artificial intelligence (AI) can analyse data about student behaviour to identify patterns and provide educators with fresh insights. This can help with

difficulties including absenteeism, bullying, and mental health concerns (Guan, Mou, & Jiang, 2020). A new age in education has been brought about by the incorporation of artificial intelligence (AI), which has changed how pupils learn and perform academically. AI-powered platforms boost student motivation and engagement by offering tailored learning experiences that are tailored to each student's needs. AI gives teachers important insights into learning patterns by evaluating enormous datasets created from student interactions, allowing for focused interventions to help problematic pupils (Jin, Im, Yoo, Roll, & Seo, 2023).

Additionally, AI promotes inclusion in educational environments by providing alternate formats for learning materials, which improves accessibility. But there are still issues with AI's ethical ramifications, such as algorithmic prejudice and data privacy. It is crucial to carefully manage these difficulties as AI technologies advance in order to maximise the positive effects of AI in education while maintaining moral principles and encouraging students to develop their critical thinking abilities. Artificial intelligence (AI) is the process of mimicking human thought processes and creating machines that behave similarly to people. The ability of robots to learn independently using preprogrammed data and information is referred to as cognitive tasks (Dekker, Jong, Schippers, Smoulders, Alexiou, & Giesbers, 2020). Understanding artificial intelligence (AI), a field of computer science that aims to make machines as effective as humans at specific tasks, is also feasible. Artificial intelligence is a part of our everyday lives, whether we have used it purposefully or not (Lee, Tzeng, Huang, & Su, 2021). Artificial intelligence has been incorporated into many applications as a benefit. Machines that possess artificial intelligence technology are capable of thinking, weighing their options, and making decisions just like people do. Large-scale research and development is presently being done on artificial intelligence (AI), with the goal of having this technology mimic and eventually replace human labour (Chen, Jensen, Albert, Gupta, & Lee, 2023). According to the definition, artificial intelligence was developed so that programmes and robots might behave like people. Obviously, to make human labour easier. Even a variety of digital platforms have included AI. Artificial Intelligence is utilised to facilitate human tasks. AI has been used by a number of tech businesses, including Google, Amazon, Facebook, and Microsoft (Iftikhar, Kuijpers, Khayyat, Iftikhar, & Desa, 2020).

Artificial intelligence, or AI, is the technology that enables machines to learn and understand logic in a similar way to humans. It is said that this technology can help make the incredibly complicated human existence a little simpler (Wang, Sun, & Chen, 2023). Intelligent algorithms, iterative processing, and several data sources are all combined to create artificial intelligence (AI). As a result, patterns or other aspects in the data can be automatically recognised by the software. Another way to describe AI is as a very vast field of study (Zsóka, & Ásványi, 2023). The term artificial intelligence (AI) refers to a broad range of concepts, methods, tools, and specialisations, including computer vision, machine learning, neural networks, cognitive computing, and scientific language processing (Chai, Wang, & Xu, 2020). The use of artificial intelligence (AI) technology is spreading throughout many sectors of the economy, including education. Particularly in the fields of science, technology, engineering, and mathematics, artificial intelligence (AI) has completely changed education (Zhai et al., 2021). Artificial intelligence, however, will also change schooling as a whole. One technical development that has received attention recently is artificial intelligence (AI). Many professional activities are made easier by technology, particularly those in the education industry. AI is also useful in the realm of education (Purnama, Fransiska, Muhdi, Muflihah, & Meisarah, 2023).

Understanding students' learning behavior is crucial for educators aiming to optimize educational experiences and outcomes. At its core, learning behavior encompasses the various ways in which students engage with and approach the learning process (Mailizar, Burg, & Maulina, 2021). This includes their level of engagement, motivation, persistence, and the strategies they employ to comprehend and retain

information. Observing students' learning behavior can provide insights into their individual learning styles, preferences, strengths, and areas for improvement. Some students may thrive in collaborative settings, while others may prefer independent study (Fitria, 2021). Additionally, factors such as cultural background, socioeconomic status, and prior educational experiences can influence learning behavior. By recognizing and responding to students' diverse learning behaviors (Berkat, Alexandro, & Basrowi, 2024), educators can tailor instruction, provide targeted support, and create learning environments that foster growth and achievement (Matute-Bianchi, 2022). Effective teaching strategies, such as differentiated instruction and personalized learning approaches, can help accommodate the varying needs and preferences of students, ultimately promoting deeper engagement, higher motivation, and improved learning outcomes (Huang, Lu, & Yang, 2023).

Student performance refers to the measurable outcomes of their academic endeavors, reflecting their mastery of knowledge, skills, and competencies within a given subject or curriculum (Wang, Liu, & Tu, 2021). These outcomes are typically assessed through a variety of means, including tests, quizzes, projects, presentations, and examinations. Performance indicators may encompass factors such as grades, test scores, completion rates, and proficiency levels (Martínez, Batanero, Cerero, & León, 2023). However, performance goes beyond mere grades; it encompasses the ability to apply knowledge and skills in real-world contexts, think critically, solve problems creatively, and communicate effectively. Student performance is influenced by a myriad of factors, including individual aptitude, effort, motivation, learning environment, instructional quality, and support systems (Dornbusch, Ritter, Leiderman, Roberts, & Fraleigh, 2016). Educators play a pivotal role in facilitating and supporting student performance through effective teaching practices, differentiated instruction, personalized learning approaches, and targeted interventions to address areas of weakness (Utami, & Winarni, 2023).

The word artificial intelligence instantly conjures up visions of supercomputers. With the addition of sensors and other features, these robots can display adaptive behaviour and have enormous computing power, giving them functional and cognitive capacities comparable to those of humans. As Chen, Chen, and Lin (2020) point out, these characteristics even improve supercomputers' capacity for human-to-human communication. Actually, a lot of films have been made to showcase artificial intelligence's powers. The control of temperature, music, and air quality in smart buildings according to the estimated emotions of the residents is one instance of this (Jiao, Ouyang, Zhang, & Alavi, 2022). Beyond the conventional understanding of AI as a supercomputer, the application of AI in education has grown to include embedded computer systems (Chen, Chen, & Lin, 2020). Students' learning behaviour and performance are greatly impacted by the use of artificial intelligence (AI) in higher secondary education. AI-powered solutions, such intelligent tutoring programs and personalised learning platforms, adapt instructional materials to the needs of specific students, creating a more stimulating and productive learning environment. These resources can be tailored to each learner's speed and learning preferences, giving prompt feedback and pinpointing areas in which pupils need to grow. Students' academic performance improves as a result of their increased motivation and attentiveness. Furthermore, teachers can create more effective teaching tactics by better understanding students' learning habits and difficulties thanks to AI's capacity to analyse enormous volumes of data. Students' academic performance is improved by this incorporation of AI into the learning process, which also gets them ready for the technology-driven future.

Objectives

1- To identify the level of AI usage, students' learning behaviour (Engagement, Motivation, Persistence, Learning strategies, and Collaboration) at higher secondary level.

2- To find out the relationship between AI usage and students' learning behaviour (Engagement, Motivation, Persistence, Learning strategies, and Collaboration) at higher 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), and students' behaviour questionnaire (Yunus, Ang, & Hashim, 2021) 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. Cronbach's Alpha was computed to assess the dependability of the tool. The students' learning behaviour score was 0.871 and the overall AI value was 0.856, whereas the reliability minimum of Cronbach's Alpha is 0.75. This demonstrated the instrument's dependability. The current study was make use of primary data sources. The answers to the research questions and the final accomplishment of the research objectives was found via the use of descriptive and inferential statistics. Data analysis was conducted using the Statistical Package for Social Science (SPSS). The first research objective answer was found using the mean, and standard deviation; the second research objective was found using Pearson r.

Data analysis

Table 1

Sample description based on mean and standard deviation

Items	N	Mean	S.D.
AI	720	2.0151	.53817
Students learning behavior	720	1.9153	.49811
1- Engagement	720	1.8653	.72968
2- Motivation	720	1.8731	.66431
3- Persistence	720	1.9940	.75232
4- Learning strategies	720	1.8901	.66668
5- Collaboration	720	1.9543	.86913

The sample description based on mean and standard deviation is shown in the above table. The AI (M=2.01; SD=0.53), students' learning behavior (M=1.91; SD=0.49), engagement (M=1.86; SD=0.72), motivation (M=1.87; SD=0.66), persistence (M=1.99; SD=0.75), learning strategies (M=1.89; SD=0.66), and collaboration (M=1.95; SD=0.86). Overall respondents' responses reflected toward the level of agreement.

Artificial intelligence

Table 2

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.

Engagement

Table 3

Item wise analysis of learning behaviour factor engagement

Items	N	Mean	S.D.
I actively participate in class discussions and activities.	720	1.77	1.010
I complete assigned tasks and homework on time.	720	1.77	.982
I seek out additional resources to deepen my understanding of the subject matter.	720	2.06	1.034

The above table illustrates the students' learning behaviour factor engagement description. According to the respondents responses, I actively participate in class discussions and activities (M=1.77; SD=1.01), I complete assigned tasks and homework on time (M=1.77; SD=0.92) and I seek out additional resources to deepen my understanding of the subject matter (M=2.06; SD=1.03). Overall respondents' responses reflected toward the level of agreement.

Motivation

Table 4

Item wise analysis of learning behaviour factor motivation

Items	N	Mean	S.D.
I am motivated to learn and improve my skills.	720	1.77	.817
I set goals for myself and work towards achieving them.	720	1.85	.888
I am enthusiastic about challenging tasks and new learning experiences.	720	1.99	.993

The above table illustrates the students' learning behaviour factor motivation description. According to the respondents' responses, I am motivated to learn and improve my skills (M=1.77; SD=0.81), I set goals for myself and work towards achieving them (M=1.85; SD=0.88), I am enthusiastic about challenging tasks and new learning experiences (M=1.99; SD=0.99). Overall respondents' responses reflected toward the level of agreement.

Persistence

Table 5

Item wise analysis of learning behaviour factor persistence

Items	N	Mean	S.D.
I persevere when faced with difficult or complex tasks.	720	1.96	.988
I am resilient in the face of setbacks or obstacles.	720	2.09	.974

I consistently put forth effort to achieve my academic goals.	720	1.92	1.044

The above table illustrates the students' learning behaviour factor persistence description. According to the respondents' responses, I persevere when faced with difficult or complex tasks (M=1.96; SD=0.98), I am resilient in the face of setbacks or obstacles (M=2.09; SD=0.97), and I consistently put forth effort to achieve my academic goals (M=1.92; SD=1.04). Overall respondents' responses reflected toward the level of agreement.

Learning Strategies

Table 6

Item wise analysis of learning behaviour factor learning strategies

Items	N	Mean	S.D.
I use a variety of study techniques to enhance my understanding.	720	1.81	.873
I organize my study materials and prioritize tasks effectively.	720	1.95	.846
I seek help from teachers or peers when I encounter difficulties.	720	1.91	1.044

The above table illustrates the students' learning behaviour factor learning strategies description. According to the respondents' responses, I use a variety of study techniques to enhance my understanding (M=1.81; SD=0.87), I organize my study materials and prioritize tasks effectively (M=1.95; SD=0.84), and I seek help from teachers or peers when I encounter difficulties (M=1.91; SD=1.044). Overall respondents' responses reflected toward the level of agreement.

Collaboration

Table 7

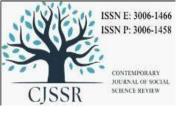*Item wise analysis of learning behaviour factor collaboration*

Items	N	Mean	S.D.
I enjoy working with classmates on group projects or assignments.	720	1.68	1.023
I actively contribute ideas and perspectives during group activities.	720	2.05	1.202
I value collaboration as a way to enhance learning and problem-solving.	720	2.13	1.213

The above table illustrates the students' learning behaviour factor collaboration description. According to the respondents' responses, I enjoy working with classmates on group projects or assignments (M=1.68; SD=1.02), I actively contribute ideas and perspectives during group activities (M=2.05; SD=1.20), and I value collaboration as a way to enhance learning and problem-solving (M=2.13; SD=1.21). Overall respondents' responses reflected toward the level of agreement.

Table 9

Relationship between AI and Students' learning behaviour

		AI	Students' learning behaviour
AI	Pearson Correlation	1	.529**
	Sig. (2-tailed)		.000
	N	720	720

Students' learning behaviour	Pearson Correlation	.529**	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 connection (r=.529, p>.000) between students' learning behaviours and AI. This demonstrates a middling correlation between AI and students' learning habits.

Table 10

Relationship between AI and Students' learning behaviour factor engagement

		AI	Engagement
AI	Pearson Correlation	1	.379**
	Sig. (2-tailed)		.000
	N	720	720
Engagement	Pearson Correlation	.379**	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 connection (r=.529, p>.000) between students' learning behaviours and AI. This demonstrates a middling correlation between AI and students' learning habits.

Table 11

Relationship between AI and Students' learning behaviour factor motivation

		AI	Motivation
AI	Pearson Correlation	1	.391**
	Sig. (2-tailed)		.000
	N	720	720
Motivation	Pearson Correlation	.391**	1
	Sig. (2-tailed)	.000	
	N	720	720

The study's primary variables are correlated, and the results are displayed in Table. The Pearson product correlation between AI and students' motivation for learning behaviour component was found to be moderately positive and statistically significant (r=.391, p>.000). This demonstrates the tenuous link between AI and the motivational component of students' learning behaviours.

Table 12

Relationship between AI and Students' learning behaviour factor persistence

		AI	Persistence
AI	Pearson Correlation	1	.427**
	Sig. (2-tailed)		.000
	N	720	720

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Persistence	Pearson Correlation	.427**	1
	Sig. (2-tailed)	.000	
	N	720	720

The Pearson product correlation between AI and students' learning behaviour factor persistence was found to be moderately positive and statistically significant (r=.427, p>.000). The correlation of the key variables employed in this study is displayed in Table. This demonstrates a modest correlation between AI and students' persistence as learning behaviours.

Table 13
Relationship between AI and Students' learning behaviour factor learning strategies

		AI	Learning strategies
AI	Pearson Correlation	1	.436**
	Sig. (2-tailed)		.000
	N	720	720
Learning strategies	Pearson Correlation	.436**	1
	Sig. (2-tailed)	.000	
	N	720	720

The Pearson product correlation between AI and students' learning behaviour factor learning techniques was found to be moderately positive and statistically significant (r=.436, p>.000). The correlation of the key variables employed in this study is displayed in Table. This demonstrates a moderate association between AI and the learning methodologies and behaviour factors of students.

Table 14
Relationship between AI and Students' learning behaviour factor collaboration

		AI	Collaboration
AI	Pearson Correlation	1	.195**
	Sig. (2-tailed)		.000
	N	720	720
Collaboration	Pearson Correlation	.195**	1
	Sig. (2-tailed)	.000	
	N	720	720

The study's primary variables have a connection that is displayed in Table. The Pearson product correlation between AI and students' learning behaviour factor collaboration was found to be statistically significant (r=.195, p>.000) and very weakly positive. This demonstrates the extremely weak correlation between AI and the collaborative learning behaviour of students.

Discussion

The findings reveal a moderately positive and statistically significant relationship between students' learning behaviors and the use of artificial intelligence (r = .529, p < .001). This suggests that as AI technologies are integrated into educational practices, students' engagement, motivation, and learning

strategies improve. AI's ability to personalize learning experiences and provide timely feedback likely contributes to this connection (Jin et al., 2023; Hwang et al., 2020). By analyzing behavioral patterns, AI empowers educators to tailor instruction to individual student needs, enhancing their overall academic experience (Mailizar et al., 2021; Yunus, Ang, & Hashim, 2021). This highlights AI's potential as a transformative tool in optimizing learning behaviors and outcomes.

The results indicate a moderately positive and statistically significant correlation between students' learning behaviors and the use of artificial intelligence (r = .529, p < .001). This relationship underscores AI's role in enhancing students' engagement, motivation, and adaptability in learning processes. AI-driven tools, such as intelligent tutoring systems and personalized learning platforms, support learners by catering to individual needs and providing real-time feedback (Jin et al., 2023; Hwang et al., 2020). Such tools encourage proactive learning behaviors, fostering persistence and deeper understanding (Mailizar et al., 2021). These findings emphasize AI's potential to transform educational practices by positively influencing how students approach learning.

The Pearson correlation analysis revealed a moderately positive and statistically significant relationship between AI and students' motivation as a component of learning behavior (r =.391, p < .001). This suggests that integrating AI technologies in education enhances students' motivation by fostering engagement through tailored learning experiences and real-time feedback (Jin et al., 2023; Hwang et al., 2020). AI-powered tools, such as adaptive learning platforms, make learning more interactive and relevant, thereby encouraging sustained effort and interest (Mailizar et al., 2021). These findings highlight the role of AI in creating motivating educational environments that inspire students to actively participate in their learning journeys.

The Pearson correlation analysis showed a moderately positive and statistically significant relationship between AI and the persistence factor of students' learning behavior (r=.427, p < .001). This indicates that AI-driven tools, such as intelligent tutoring systems and personalized platforms, help students stay focused and committed to their tasks (Yunus, Ang, & Hashim, 2021; Purnama et al., 2023). By offering continuous support and actionable feedback, AI fosters a structured learning environment that encourages students to persevere even in challenging situations (Lee et al., 2021). These findings highlight AI's role in promoting persistence, a key determinant of academic success (Sassis et al., 2021).

The Pearson correlation analysis revealed a moderately positive and statistically significant relationship between AI and the learning techniques factor of students' learning behavior (r = .436, p < .001). This demonstrates that AI technologies play a vital role in enhancing students' use of effective learning strategies. AI-powered tools, such as personalized learning platforms and intelligent tutoring systems, provide tailored content and adaptive feedback that help students develop better techniques for understanding and retaining information (Dekker et al., 2020; Wang et al., 2023). These tools encourage metacognitive practices, such as self-monitoring and strategic planning, which are crucial for academic success (Chen et al., 2023; Zhai et al., 2021). The findings highlight AI's potential to transform learning by supporting the adoption of improved techniques.

The Pearson correlation analysis revealed a statistically significant but very weakly positive relationship between AI and the collaboration factor of students' learning behavior (r =.195, p<.001). This suggests that while AI has some influence on fostering collaborative behaviors, its impact in this area is relatively limited. AI tools, such as collaborative learning platforms and virtual environments, can facilitate teamwork by enabling communication and shared problem-solving (Fitria, 2021; Yunus, Ang, & Hashim,

2021). However, the weak correlation may indicate that interpersonal factors or traditional methods of collaboration still play a more dominant role in fostering teamwork among students (Purnama et al., 2023). These findings highlight the need for further refinement of AI tools to enhance their effectiveness in promoting collaboration.

Conclusion

The findings of this study suggest that artificial intelligence (AI) has a significant and positive impact on various aspects of students' learning behaviors, including motivation, persistence, learning techniques, and collaboration. The moderately positive correlations between AI and learning behaviors such as motivation (r=.391), persistence (r=.427), and learning techniques (r=.436) indicate that AI enhances students' engagement, effort, and strategic approaches to learning. AI tools, such as personalized learning platforms and intelligent tutoring systems, provide tailored feedback and adaptive resources, contributing to a more engaging and productive learning experience. However, the relationship between AI and collaboration (r =.195) was found to be very weak, suggesting that traditional collaboration methods remain more influential in fostering teamwork among students. Overall, AI has proven to be an effective tool in supporting students' learning behaviors, but its role in promoting collaboration requires further exploration and development. These findings emphasize the transformative potential of AI in education while highlighting the need for continuous refinement to maximize its impact on student learning outcomes.

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