



AI Literacy and its Perceived Effect on the Learning Process of the Students at Higher Education in Lahore

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ABSTRACT

The rapid integration of Artificial Intelligence (AI) into educational contexts has significantly transformed the way students learn, interact, and engage with academic content. The nature of this study was quantitative. The research methodology employed in this study was the positivist research paradigm. In this study, the causal-comparative research design was used. All the undergraduate students of HEC recognized public and private universities of the district Lahore were the targeted population of this study. Multistage random sampling technique was used to select the sample size. A total of 388 students were selected from public and private universities. In this study, two structured questionnaires were used to gather relevant data from students. The first questionnaire was designed to measure the AI literacy of students. This questionnaire included items related to affective, cognitive, and ethical learning of students. The second questionnaire was used to measure the students' learning process. This questionnaire included items related to learning readiness, learning support, and motivational interaction. Both questionnaires were adapted from existing, well-established studies to ensure relevance and accuracy. After adaptation, the instruments were carefully reviewed to match the objectives of the current study and the context of higher education in Lahore. The findings of the study revealed that there was a strong and statistically significant positive relationship between AI literacy and the learning process, indicating that higher levels of AI literacy are associated with more effective learning experiences. Regression analysis confirmed that AI literacy is a strong predictor of the learning process, explaining a substantial proportion of variance in students' learning outcomes.

1. Introduction

In the last few decades, Artificial Intelligence (AI) has been expanded and has now become a prominent feature in daily life. This is found to be applied in different sectors such as health care, business and education. AI in education is no longer merely a tool and has become a force that directly influences students' learning. This transition has put a new concept in the spotlight – AI literacy, which extends beyond the mere use of AI. It involves comprehending, assessing and responsibly leveraging AI (Mertala et al., 2022).

AI involves computer systems that can execute tasks that are usually carried out by humans, like understanding language, solving problems, and recognizing patterns (McCarthy, 2007). This includes sub-areas like machine learning, natural language processing and deep learning (Richter et al., 2019). However, many people are using AI on a daily basis without even realizing

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it, such as when using Google, its suggestions, YouTube suggestions, grammar checkers and chatbots (Celik et al., 2022). An example of those in recent times is ChatGPT, a AI chatbot made by OpenAI in November 2022 and had 100 million customers in simply two months (Milmo, 2023). It allows users to write essays, write coding and converse. However, sometimes AI systems like ChatGPT will provide inaccurate information that may seem accurate, known as “hallucination” (Peng et al., 2023). This makes user AI literacy even more so important.

The fact that there is AI literacy is not a new thing. It is an extension of previous types of literacy. During the 1960's and 1970's computer literacy was being able to use a computer (Lee & Mestre, 1999). In the 1980s and 1990s, ICT skills also grew to encompass competency in the use of the Internet and email (Livingstone, 2008). Digital literacy has been popular since the 2000s, and had to do with acquiring, assessing and producing digital-based information (Eshet, 2004). The next step is to be literate with AI. Long & Magerko (2020) have defined it as the ability to assess and act critically about AI, to make appropriate use of AI, and to benefit from AI in everyday life and work. Ng et al. (2021) state that it can be broken down into four areas: understanding, using, evaluating and using AI ethically. Almatrafi et al. (2024), have segmented it into the four stages of recognizing AI, understanding AI, applying AI, evaluating AI and navigating AI ethically.

Interest in AI is taken to be the students' curiosity and motivation for the topics of AI (Knoth et al., 2024). Expectancy-value theory suggests a person is more likely to do something that they enjoy (Eccles & Wigfield, 2002). AI piques students' curiosity, encourages them to explore the new technology, and helps them persevere when things get tough. Education in AI is more likely to be filled by self-learning students especially in cities like Lahore where formal education in AI is less. However, students who have a minimal level of interest may not gain AI literacy if they have access to it. This study takes the perceived effect of AI in the learning process as the outcome variable in the center. It involves the students' perceptions of the impact of AI tools on their learning such as feeling they understand better, performing better, staying engaged, or there are issues (e.g. dependence, loss of thinking skills) (Becirovic et al., 2025).

There are three aspects of the learning process – cognitive, affective and behavioural. These findings reveal that generally, students with high AI literacy have more effective and productive use of AI compared to those with low AI literacy who are more likely to use AI as a short cut resulting in limited learning (OECD, 2026). AI literacy has been investigated in various educational levels. Casal-Otero et al. (2023) and Sanusi et al. (2022) emphasized the importance of understanding the functioning of AI and the need for students to work together and collaborate with AI tools, respectively, in the school context.

Ng et al. (2023) suggested a more holistic framework that will be integrated with emotional, ethical and cognitive components for the inclusion of school students. Even AI literacy was researched in the early childhood education context by Su et al. (2023). It is shown to be extremely important for students in a wide range of subjects – not only technology – with support from higher education (Laupichler et al., 2022). Literature on AI literacy in other micro settings such as engineering (Cantú-Ortiz et al., 2020), medicine (Karaca et al., 2021; Wartman & Combs, 2019), nursing (Swan, 2021) and communication (Dergaa et al., 2023) also indicates that there are different measures of AI literacy in each domain. Pinski et al. (2023) detected how people interact with AI is influenced by an increase in AI literacy, and Becirovic et al. (2025) detected that the learning experience of students with higher levels of AI literacy is better. Self-efficacy, interest, and attitudes were also shown to be important factors that influence AI literacy as confirmed by Bewersdorff et al. (2025) and Knoth et al. (2024).

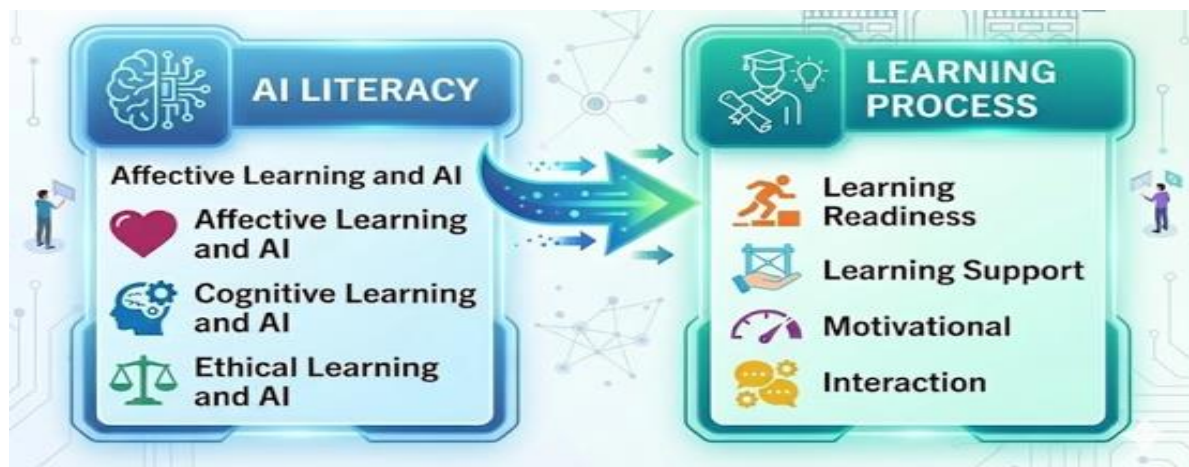
This investigation thus has a clear and consequential gap. Although some South Asian literature has emerged that conceptualizes and measures AI literacy, there is relatively little empirical studies that investigates the perceived impact on students' learning process when learning with AI by undergraduate students in South Asian higher education, and even fewer studies have disaggregated AI literacy into affective, cognitive, and ethical components to see which one is more important. The study provides a locally relevant evidence base for policy makers and educators as well as a component-level understanding of AI literacy that has a broader theoretical value in addressing a gap in the specific context of public and private universities in Lahore.

1.1. Theoretical Framework

This study is anchored in Activity Theory (AT), originally developed by Vygotsky and subsequently extended by Leont'ev. Activity Theory offers a powerful lens for describing the complex, mediated interactions between human beings and their environment. It holds that human activity is inherently social and collective, and that it is organized around several interlocking elements: the Subject, the Object, mediating Artifacts (or tools), Rules, the Community, and the Division of Labour. Subject" is what or whom is or will be studied, "object" is the aim or product wanted. An artifact is in the middle between a subject and an object. In terms of the wider context of this activity, rules are set to regulate the behavior of the community, roles are determined and responsibilities are divided by the different means of division of labor, and the community is used to link the subject to the other participants involved in the activity (Liaw et al., 2010; Nikou, 2024; Pettersson, 2021). Demographic characteristics, student skill and stress are other factors which are identified as contributing factors for student satisfactory academic performance besides the characteristics of students. This study focuses on the issue of the University students; the

issue of this work is satisfactory academic performance. Variables displayed above is the kind of variables that will affect the response of the subject (Student) during the learning process in relation to certain characteristics of students.

1.2. Conceptual Framework



The conceptual framework of this study positions AI literacy as the independent (predictor) variable and the learning process as the dependent (outcome) variable. AI literacy is operationalized through three dimensions: affective learning and AI, cognitive learning and AI, and ethical learning and AI. The learning process is operationalized through three corresponding dimensions: learning readiness, learning support, and motivational interaction. The framework proposes that each component of AI literacy exerts a positive influence on each dimension of the learning process, and that AI literacy as a whole significantly predicts the overall learning process.

1.3. Significance of the Study

This research has many levels of significance. The study is significant because learning is rapidly changing in the field of higher education with the advent of the new technology of Artificial Intelligence. This study bridges this lacuna in the literature with regard to AI literacy and the overall student learning experience of the students of Higher education institutions of Lahore using secondary data from only a few secondary contexts which are rarely explored in the literature. The study makes a contribution of empirically valid knowledge in a field that is very much still conceptually dominated, being mostly review-based. Measuring its affective, cognitive and ethical components and correlating these with the learning readiness, participation in learning support and motivation of the learner, it reveals which aspect of AI is the most effective for learning and which is the most effective to focus on when providing support and motivation for learning, with affective being the strongest predictor.

In theory, it extends the concept of AI literacy by proposing it as a multi-dimensional construct and offers evidence at the level of the individual dimensions regarding which dimension has the strongest influence on learning outcomes, an area that is little explored. The study highlights the affective dimension as the strongest and the ethical dimension as the weakest lever observed, directly tackling areas in which instructional power is required. The results provide policy-level evidence to the importance of formally embedding AI literacy into the curriculum of higher education, instead of allowing students to discover it themselves through informal and unguided experimentation.

1.4. Research Objectives

The objectives of the study were:

- To find the relationship between AI literacy and the learning process of university students.
- To investigate the effect of AI literacy on the learning process of university students.

1.5. Research Questions

Based on the above objectives, the study sought to answer the following research questions:

- Is there any statistically significant relationship between AI literacy and the learning process of students?
- Is there any statistically significant effect of AI literacy on the learning process of university students?

2. Literature Review

This section describes the findings of international and local studies on important topics like AI literacy skills, ethical use of AI, student engagement, and AI technologies in learning environments.

2.1. AI Literacy

Artificial Intelligence (AI) technology is an interdisciplinary technology, combining intelligence, machine learning, facial recognition, human-robot interaction and data storage and decision making (Zhang & Lu, 2021). It is an intricate field where the purpose of the computer system is to mimic human ability of understanding and simulation of human interaction and behavior to be able to think, act and communicate like humans (Haleem et al., 2022).

The lives and learning experiences of the people have thoroughly been changed by AI technology, and the applications of AI have even extended into various industries, like education, healthcare and finance. Everyone needs to be introduced to AI literacy (Zhao et al., 2022), and they must also learn to introduce students to it, as the introduction of AI literacy must be done in a way that ensures students' proper integration and a respectful, fair working/living environment. Wisdom of AI literacy is nowadays one of the crucial areas of literacy education in the digital era. AI literacy can be broken down into several skills which allow to critically evaluate AI technologies, communicate with them, collaborate with them, and use them in online and offline settings (Long & Magerko, 2020).

AI recognition and understanding, use and application, assessment and creation, and understanding of AI ethics are some of the important elements of AI literacy (Kong et al., 2021; Ng et al., 2021a). In addition, ethical awareness and ethical application of AI (Long & Magerko, 2020) are also included in AI literacy. Kong et al. (2023a) recently suggested that AI literacy is a 3D construct (cognitive, affective, and sociocultural) and the attitudes held by students towards AI technologies should be perceived as a whole entity, rather than as just AI literacy.

2.2. The Goal of AI Literacy

In order to fully grasp the objectives of AI-literacy, three fundamental concepts of literacy underpinning the objectives of AI need to be explored: functional literacy, social literacy and technical/technology literacy. All of these frameworks add different but complementary aspects to the concept of AI literacy. The simplest of the three is functional literacy, which is defined as the ability to read, write and perform simple arithmetic to be able to meet their daily social and economic needs. According to UNESCO (2021), there are about 750 million adults in the world who are functionally illiterate, reflecting the fact that access to even basic literacy continues to be a challenge all over the world.

The aim of AI literacy is even bigger; it's to get to everyone. Laupichler et al. (2022) and Long and Magerko (2020) name two typologies: the non-expert AI users who use AI in their personal or civic life and have no professional responsibility for developing or deploying AI; and the expert AI users who engage with AI in an organizational or professional context. AI literacy is a prerequisite for both groups, and different skills are needed for each. However, non-expert users need to have the fundamental skills to recognise and evaluate the performance of AI systems, protect their data, and participate in meaningful discussions regarding AI governance within the public sphere.

Expert users (e.g. educators, health professionals, managers and public sector officials) require more complex skills, including the ability to assess the capabilities and limitations of AI and to clearly communicate with non-specialist audiences about how this technology can be used in their specific fields and with particular target groups. Expert users also need more complex skills, such as assessing the capabilities and limitations of AI, and being able to communicate clearly with non-specialist audiences about how AI can be used in their specific fields and with particular audiences and groups. (Cetindamar et al., 2022; Jorzik et al., 2023). A comprehensive AI literacy agenda must also be differentiated and stratified: learning opportunities must be tailored to each group, and there must be a shared core of critical, ethical and reflective learning about AI in all AI literacy agendas.

2.3. The Need for AI Literacy

The need for AI literacy as a unique and pressing educational need is supported by several related arguments, which are grounded in the unique nature of AI as a technology and the particular issues and dangers that AI presents to society and individuals. Overall, it can be argued that the ability to be 'AI literate' is not simply another skill on the list of all the other skills that we need to learn, but a critical competency to effectively, safely and equitably participate in today's social life. The initial and most basic argument is that AI systems have unique characteristics, different from previous iterations of digital technologies.

In contrast to previous applications of human-technology interaction, Berente et al. (2021) identify three characteristics of AI: learning, autonomy (the capacity to act somewhat independently, with less direct human teaching and/or monitoring), and

inscrutability (the opacity of the process: users, and sometimes developers, do not know how or why certain outputs are generated).

These properties are important to the dynamics of people and technologies. Non-technological definition of technology literacy was once perceived as transparent and predictable with respect to the systems of technology, such that the user (in theory) could determine what the tool does and why. This opacity presents a challenge as well as a need for critical appraisal of the output of AI, a key component of AI literacy, which is more difficult than critical appraisal of previous technologies. The second argument has to do with the omnipresent nature of AI in the present-day life and work. AI is not just confined to specialized technical areas, but also integrated into the tools, platforms and processes that define the daily life of the society in almost all areas of life (Pan, 2016). The third one is related to inequity in AI literacy and social equity. The availability and skills within the technologies of AI are not evenly spread within populations, and as mentioned earlier are a product of, and a reinforcement of, inequalities of class, education, geography and access to digital technologies (Selwyn, 2004; Lutz, 2019).

2.4. Learning Process

There are multiple environmental influences that could affect the mind. Learning does not equal social norms and backgrounds. The research has shown that students' learning is affected by their own biological context; most of the teachers and other people who participate in the learning process influence students' learning. This phenomenon is the one Pask (2021) has generated in his study. Others, such as Rahal (2010) and Qureshi et al. (2023) were able to find individuality as one of the key aspects of defining learning outcomes.

Other researchers (e.g., Felder, 1993) have found that an instructor's teaching style and instruction is correlated with a tone the instructor sets before instruction is given. The students' negative attitude is caused by such events. Pupils must be introduced to the idea that they are able to achieve what they can and that this is not constrained by the context in which they are learning. If there are different colour orientations then, it is important to present different colour orientations to the learners in different background (Tabbasam et al., 2023; Tabassum et al., 2024). There has been a considerable amount of work that has been done regarding assessment of teaching approaches and systems, but the context of this work has been neglected in the classroom.

As much as the learning about a specific subject area is important so too is how the learning takes place. The learning process is associated with the style of teaching (as emphasized by Karatas and Yalin, 2021), and the mental potentials of the parties involved in learning (teachers and learners). Besides, Amjad, et al., (2023a, 2023b, 2023c) show the learning style that students are exposed to can significantly influence learning outcomes. This was the position of Dunn (1983) that content is not as important as the approach in the teaching process. Instructional Strategy that enhances learning. In that regard, the passion of the teacher towards learners' needs and understanding of his learners would be the best in the learning process. Tomlinson (2014) discussed the issue of differentiated teaching. He came up with two easily identifiable factors with respect to differentiation – socio-economic status and interest, intelligence and styles of learning. Different researchers have explored different learning approaches and teaching styles, to enhance understanding of the process of learning.

The analysis of learning style was used to get data relating to the needs of students in learning process which is related to their attitude towards the learning process as Kolb (1984) learning style. There is a wealth of literature available that demonstrates a need for knowledge of learning styles in teaching. Amin et al (2024) and Ong et al (2024) had conducted their study in order to find out that if there is any relationship between student's learning style and student's learning achievement. During the literature review, some researchers carried out their research from the correlation relationship between learning style and student achievement. (Ha, 2021; Mubeen, 2018; Rogowski et al., 2020).

3. Research Methodology

3.1. Research Paradigm and Design

This study was quantitative in nature in which the positivist research paradigm was applied. Whereas Causal comparative research design was used in this study for getting results. This design is appropriate because it allows the examination of relationships and effects between naturally occurring variables without experimental manipulation.

3.2. Population and Sampling

The target population comprised all undergraduate students enrolled in Higher Education Commission (HEC) recognized public and private universities in the district of Lahore. A multistage random sampling technique was used to select participants, ensuring representation across university sectors. The final sample consisted of 388 undergraduate students drawn from both public and private universities, a size consistent with the requirements for correlational and regression analysis and sufficient to support stable parameter estimates.

3.3. Instrumentation

Two adapted structured questionnaires were used to gather data. The first measured students' AI literacy through items assessing affective, cognitive, and ethical learning in relation to AI. The second measured the students' learning process through items assessing learning readiness, learning support, and motivational interaction. Both instruments were adapted from existing, well-established studies to ensure relevance and accuracy, and were subsequently reviewed to align with the objectives of the current study and the context of higher education in Lahore. The structure of the two instruments is summarized in Table 1.

Table 1. Structure of the Research Instruments

Instrument	Construct	Dimension / Factor	Focus of Items
Questionnaire 1	AI Literacy	Affective Learning & AI Cognitive Learning & AI Ethical Learning & AI	Curiosity, confidence, attitude toward AI Understanding of AI, concepts and limits Responsibility, integrity, societal impact
Questionnaire 2	Learning Process	Learning Readiness Learning Support Motivational Interaction	Preparedness and willingness to learn Perceived academic / instructional support Active, sustained, motivated engagement

3.4. Data Analysis

Data were analyzed using inferential statistics. Pearson product-moment correlation was used to answer the first research question concerning the relationship between AI literacy and the learning process. Simple and multiple linear regression analyses were used to answer the second research question concerning the effect of AI literacy, and of its individual components, on the learning process. Statistical significance was evaluated at the 0.01 and 0.05 levels.

4. Data Analysis and Results

4.1. Correlation Analysis

Research Question 1: Is there any statistically significant relationship between AI literacy and the learning process of students?

Table 2 presents the correlation matrix among the dimensions of AI literacy and the learning process. The overall results indicate a statistically significant positive relationship among all major constructs at the 0.01 and 0.05 levels of significance.

Table 2. Correlations among Factors of AI Literacy (AIL) and Learning Process (LP)

Variable	1	2	3	4	5	6	7	8
1. Affective Learning & AI	*							
2. Cognitive Learning & AI	.275**	*						
3. Ethical Learning & AI	.281**	.350**	*					
4. Learning Readiness	.260**	.190**	.118*	*				
5. Learning Support	.406**	.415**	.397**	.058	*			
6. Motivational Interaction	.515**	.292**	.450**	.105*	.212**	*		
7. AI Literacy (overall)	.722**	.680**	.783**	.255**	.552**	.586**	*	
8. Learning Process (overall)	.623**	.476**	.541**	.359**	.747**	.756**	.752**	*

Note. ** Correlation is significant at the 0.01 level (2-tailed). * Significant at the 0.05 level (2-tailed).

The correlation between AI literacy and the learning process was positive and significant ($r = .752$, $p < .01$), suggesting that the higher the AI literacy, the more effective or enhanced the learning process the student experiences. The three sub-dimensions of AI literacy affective ($r = .623$), cognitive ($r = .476$), and ethical ($r = .541$) all showed moderate to high positive correlations with the learning process, further supporting the impact of AI literacy on students' learning and engagement. Figure 1 illustrates these relationships.

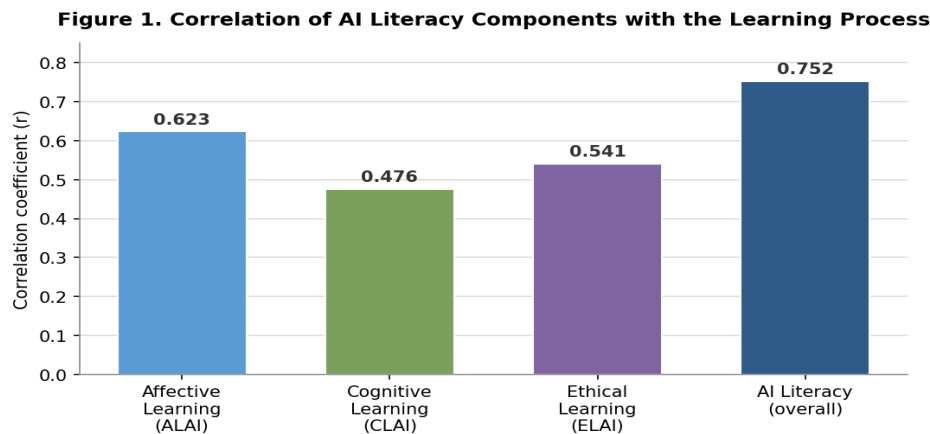


Figure 1. Correlation of AI literacy components with the learning process.

Examining the relationship between the components of AI literacy and the dimensions of the learning process, all three components affective (ALAI), cognitive (CLAI), and ethical (ELAI) showed significant positive relationships of varying strength with learning readiness (LR), learning support (LS), and motivational interaction (MI). Motivational interaction displayed the strongest and most consistent relationships with the AI literacy components, particularly with affective learning ($r = .515$, $p < .01$) and ethical learning ($r = .450$, $p < .01$). This suggests that students who demonstrate greater emotional involvement and ethical awareness in using AI are more likely to be motivated and interactive in their learning. Cognitive learning also related positively to motivational interaction ($r = .292$, $p < .01$), though less strongly. These patterns are visualized in Figure 2.

Figure 2. AI Literacy Components vs. Learning-Process Dimensions

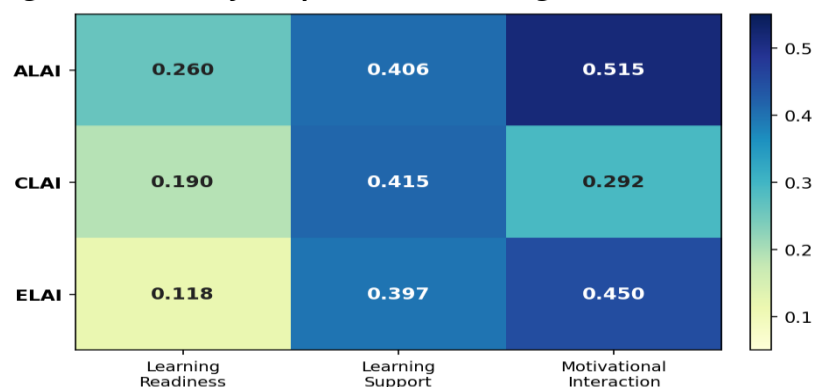


Figure 2. Correlations between AI literacy components and learning-process dimensions

For learning support, all three AI literacy components showed moderate, statistically significant relationships cognitive ($r = .415$, $p < .01$), affective ($r = .406$, $p < .01$), and ethical ($r = .397$, $p < .01$) indicating that students with higher AI literacy tend to perceive greater academic and instructional support. Learning readiness, by contrast, exhibited relatively low correlations with the AI literacy components, the strongest being with affective learning ($r = .260$, $p < .01$), followed by cognitive ($r = .190$, $p < .01$) and ethical ($r = .118$, $p < .05$). Overall, AI literacy constructs were more strongly associated with motivational interaction and learning support than with learning readiness, suggesting that AI literacy influences motivation and support during learning more than it influences preparatory readiness.

4.2. Regression Analysis

Research Question 2: Is there any statistically significant effect of AI literacy on the learning process of university students?

To examine the effect of AI literacy on the learning process, a simple linear regression was performed. The results, presented in Table 3, indicate a significant and strong positive effect of AI literacy on the learning process.

Table 3. Effect of AI Literacy (AIL) on the Learning Process (LP)

Model	B	SE	β	t	p
(Constant)	0.314	0.162		1.939	.053
AI Literacy (AIL)	0.825	0.041	.752	22.438	< .001

Note. $r = .752$; $r^2 = .566$; $F(1, 386) = 503.475$, $p < .001$. Dependent variable: Learning Process.

The unstandardized coefficient ($B = 0.825$, $p < .001$) indicates that an increase in AI literacy is accompanied by a significant increase in the learning process score. The standardized coefficient ($\beta = .752$) confirms a strong positive predictive effect. The coefficient of determination ($r^2 = .566$) shows that AI literacy explains 56.6% of the variance in the learning process, and the overall model was statistically significant, $F(1, 386) = 503.475$, $p < .001$, indicating an excellent model fit. The constant term ($B = 0.314$, $p = .053$) was not statistically significant, suggesting that in the absence of AI literacy the baseline learning-process level is not meaningfully different from zero at conventional thresholds.

A multiple regression analysis was then conducted to examine the effect of the individual AI literacy components on the learning process. The results are presented in Table 4.

Table 4. Effect of AI Literacy Components on the Learning Process (LP)

Model	B	SE	β	t	p
(Constant)	0.259	0.161		1.610	.108
Affective Learning & AI	0.444	0.033	.467	13.273	< .001
Cognitive Learning & AI	0.182	0.028	.233	6.470	< .001
Ethical Learning & AI	0.309	0.034	.328	9.097	< .001

Note. $r = .761$; $r^2 = .580$; $F(3, 384) = 176.404$, $p < .001$. Dependent variable: Learning Process.

All three predictors significantly and positively predicted the learning process. Affective learning emerged as the strongest predictor ($B = 0.444$, $\beta = .467$, $p < .001$), indicating that students' emotional interest, curiosity, and positive attitudes toward AI most strongly influence their learning readiness, support, and motivational engagement. Ethical learning was the second strongest predictor ($B = 0.309$, $\beta = .328$, $p < .001$), suggesting that greater ethical awareness is associated with a more organised and responsible learning experience. Cognitive learning, while significant, exerted a comparatively weaker effect ($B = 0.182$, $\beta = .233$, $p < .001$). Together, the three components explained 58.0% of the variance in the learning process ($r^2 = .580$), and the model was significant, $F(3, 384) = 176.404$, $p < .001$. Figures 3 and 4 summarise these results.

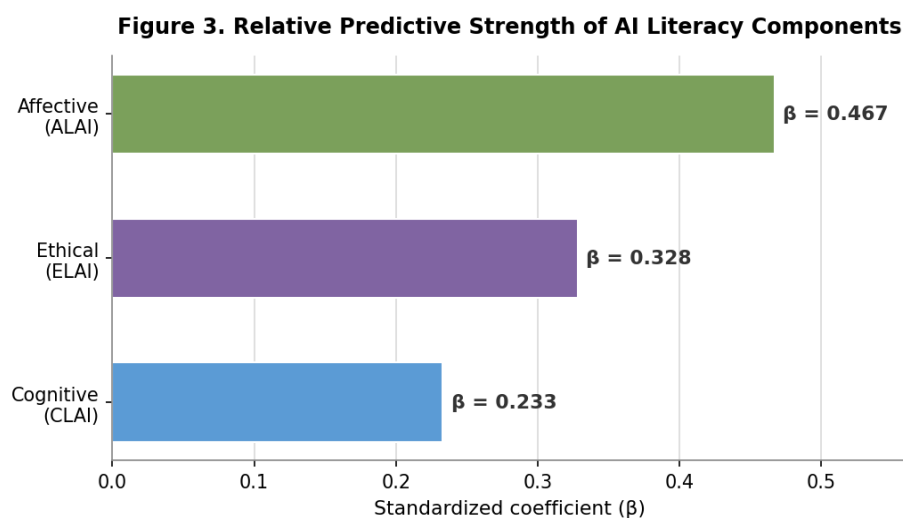
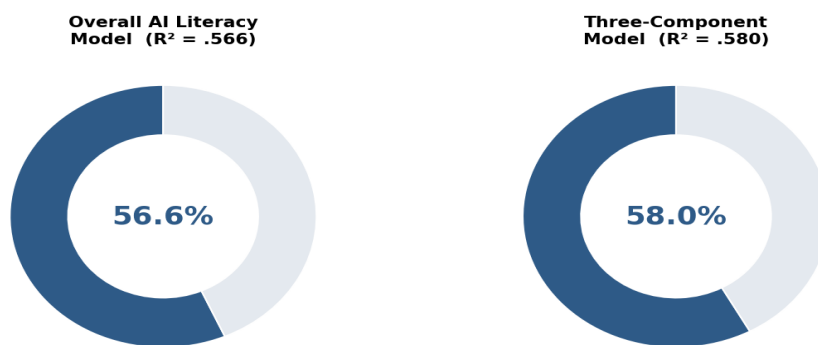


Figure 3. Relative predictive strength (β) of AI literacy components on the learning process.

Figure 4. Proportion of Variance in Learning Process Explained**Figure 4. Variance in the learning process explained by the two regression models.**

5. Findings

The overall findings of the study showed that there exist a strong, statistically significant positive relationship between AI literacy and the learning process ($r = .752$, $p < .01$). All three components of AI literacy affective, cognitive, and ethical correlate significantly and positively with the learning process, with affective learning showing the strongest correlation ($r = .623$). Among learning-process dimensions, motivational interaction and learning support are more strongly associated with AI literacy than learning readiness. AI literacy is a strong predictor of the learning process, explaining 56.6% of its variance ($r^2 = .566$). At the component level, affective learning is the strongest predictor ($\beta = .467$), followed by ethical ($\beta = .328$) and cognitive ($\beta = .233$) learning; together they explain 58.0% of the variance. Although a strong predictor, the ethical dimension recorded the lowest mean among AI literacy components, revealing a gap between students' AI use and their ethical awareness.

6. Discussion

The results of this research are consistent with and are building on the international research literature on AI literacy in higher education. The positive correlation between AI literacy and the learning process favours Activity Theory framing used here: the learning activity system as a whole is more effective when the mediating artifact AI is skilfully understood and used. It aligns with the systems perspective of Nikou (2024) on AI-mediated learning, and the empirical consensus that learning benefits are due to proficiency in the AI tools themselves, not exposure to them.

The most important results from the study were the high positive correlation between the learning process and the level of AI literacy. The high correlation suggests that students who are AI literate will likely have positive learning experiences through a learning environment supported by AI. This finding aligns with the notion that AI Literacy is not only a characteristic but is a critical component to a student's ability to use AI tools for learning. Moreover, the research done by Singh et al. (2025), Soni (2024) and Shi et al. (2025) have also revealed that there is a positive correlation between AI literacy and academic engagement, performance and wellbeing. Hence, the present study adds insights to the study of AI literacy in the Pakistan HE context where empirical research about AI literacy is still very in its infancy.

AI literacy's predictive effect on the learning process further emphasizes the significant role of AI literacy as a basic educational ability. The results revealed a significant regression coefficient for AI literacy, indicating that there is quite a bit of variance to be explained by an increase in students' AI literacy, suggesting that enhancing students' AI literacy will positively affect their learning experiences. This is a huge issue for higher education policy and practice. The institutions that offer AI literacy curriculum, development, faculty training and student assistance might be able to cater to enhancing the learning experiences of students. This research has demonstrated that the competency level of AI literacy is significant for prediction purposes, and this is a factor that needs to be taken into account by every institution, as it is not simply a technological competency, but also a strategic competency.

The analysis was carried out on the relative contribution of the dimension of AI literacy which revealed that affective learning has the highest contribution, followed by ethical learning and cognitive learning. The centrality of emotional engagement in students' experience of AI supported learning is a key discovery here. The students' curiosity, interest, and emotional involvement with the technologies of AI seem to create increased engagement and learning outcomes in the AI-enhanced learning environment. Similarly, Liang and Reiss (2025) have emphasized that positive emotions play an essential role in the engagement and enjoyment of learning with AI. Moreover, this phenomenon is also observed by Singh et al. (2025) who noted that the correlation between AI literacy and academic outcomes is positive for undergraduate students, and by Shi et al. (2025) who found positive relationships between AI literacy and students' performance and psychological health in generative AI-

supported learning. These studies collectively support the current result that the affective aspect of AI literacy is the most powerful factor to improve the learning process.

7. Conclusion

This study the study found that there was a strong and significant correlation between the literate use of AI and the learning process. AI literacy was also revealed to be a significant predictor of learning outcomes with large variance explained. The results of this study would validate that by improving AI literacy in students, students can also prove to be more ready to learn, supported and engaged in academic settings. The evidence is clear and consistent. AI literacy is strongly and positively related to the learning process, and it is a robust predictor, explaining well over half of the variance in students' learning outcomes. Disaggregating AI literacy into its constituent dimensions reveals that affective engagement is the most powerful driver, followed by ethical awareness and then cognitive understanding. At the same time, the ethical dimension though influential remains the least developed among students, exposing a critical gap between the speed of AI adoption and the maturity of students' ethical reasoning.

8. Recommendations

Based on the findings and conclusions of the study, several recommendations were proposed:

1. Universities should formally integrate AI literacy into curricula across all disciplines, given that AI literacy significantly predicts students' learning outcomes.
2. Educators should emphasize affective engagement strategies such as curiosity-driven tasks and interactive AI-based activities because affective learning emerged as the strongest predictor of the learning process, surpassing both cognitive and ethical dimensions.
3. Higher education institutions should incorporate dedicated modules on AI ethics, responsibility, and societal impact, as the ethical dimension recorded the lowest mean score among AI literacy components despite being a strong predictor.
4. AI literacy interventions should target the active phases of learning motivation and support where AI literacy exerts its strongest influence, while additional strategies address the weaker link with learning readiness.
5. Faculty development programs should equip instructors to model responsible, confident, and critically informed AI use, so that literacy is cultivated through practice rather than left to unguided student experimentation.

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