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Digital Intelligence and Human Well-Being: Investigating the Influence of Artificial Intelligence on Student Learning and Psychological Well-Being

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ABSTRACT

Artificial intelligence (AI) is rapidly transforming higher education by reshaping how students access information, engage with academic content, and manage learning activities, while its broader implications for students' psychological well-being remain an important area of inquiry. This study examined the influence of artificial intelligence on student learning and psychological well-being, with particular emphasis on understanding the educational and human dimensions of AI-supported learning. A quantitative, cross-sectional study was carried out with a sample comprised of 423 students from higher education institutions in Punjab and Sindh. Data on the study variables were collected using a structured research instrument, designed on the basis of the study's objectives and adopted from the literature, and distributed via Google Forms. The completed research instruments were downloaded to Microsoft Excel, and the data were analyzed using IBM SPSS Statistics. To study the differences between the groups and the study variables, the following statistical methods were applied: descriptive statistics, the independent-samples t-test, analysis of variance (ANOVA) and Tukey HSD post-hoc tests, multiple linear regression, and Cronbach's alpha and Pearson correlation. The study findings indicated that artificial intelligence (AI) positively and significantly correlated with student learning and psychological well-being. Regression analysis indicated that AI positively and significantly predicted both student learning and psychological well-being. The study also revealed that the higher the reported level of AI use, the better students' learning and psychological well-being. Moreover, significant differences were also found among the low-, moderate-, and high-AI use groups. The study is a pioneer in addressing the possible positive impacts of ethical AI on learning, well-being, and responsible digital practices, providing a foundation for human-centered AI in higher education.

Introduction

AI is no longer a computing tool reserved for specialists. It is coming to be an important part of most aspects of contemporary society. Educational technology is no exception. Generative AI, intelligent tutoring systems, educational chatbots, automated feedback, and AI learning analytics are changing the way learners access, interact with and engage with learning tasks and

educational content, and receive feedback. In the context of higher education, AI is seen more holistically, as a more fundamental part of the learning environment, that can foster personalized learning, self-regulation, engagement, and on-demand learning. As stated in Wang et al. (2024), the applications of AI in education have broadened in a more comprehensive manner across teaching, learning, assessment, learning support, and educational administration, whereas Almasri (2024) advanced that AI holds a great promise for personalizing learning and enriching the educational experience of learners. The impact of these changes can be most significantly felt by learners in a university setting, as learning continues to be conducted in more and more digitally mediated spaces, where learners can get explanations, facilitate ideas, structure information, and receive personalized support with the help of AI tools.

AI also signifies a shift in the understanding of how students learn more generally. Traditionally, classrooms focus on more or less fixed teaching resources and relatively inflexible teacher-student interactions. Places where learning is supported by the use of AI can offer adaptable help that responds to the needs of students in real time. Students can use AI to explain tough concepts, provide different explanations, create practice problems, give useful feedback, and help students take control of their learning. Some studies have shown that the use of AI in pedagogical practice may help students have a greater sense of engagement, motivation, self-efficacy, and learning outcomes when AI and similar technologies are used properly in teaching practice (Badger et al., 2025; Long et al., 2026). However, the transformation creates a paradox in that more convenience may lead to diminished critical thinking, or cognitive engagement. Is the cost of convenience worth the the cognitive engagement lost? The educational worth of AI is really dependent on the critical, ethical, and responsible use of the technology when AI is readily available.

Here, digital intelligence matures in importance as genuine AI-supported learning surpasses even the most developed levels of basic tech literacy. Students should be equipped to analyze AI outputs, understand their shortcomings, uphold academic honesty, use their own judgment, and treat AI as an additional learning resource rather than an alternative to their learning efforts. The new body of literature supports human-centered approaches with embedded AI, critical thinking, self-regulated learning, and responsible digital practices (Bond et al., 2024; Mustafa et al., 2024). Grasping the nature of the AI integration is essential; the impact AI has on how students learn is part of the psychological and human aspects of education. Thus, to analyze how digital intelligence mediates the integration of AI within learning frameworks you have to understand how the digital age will allow students to learn in new, innovative ways while still preserving their autonomy, cognitive engagement, and overall well-being.

Artificial Intelligence and Student Learning

The impact of AI on learning is extensive, and cannot be evaluated in terms of learning outcomes alone. Learning systems supported by AI can provide, for example, a tailored explanation, learning interventions that adapt to the learner's needs, instant feedback, and interactive learning support. Learning chatbots, as described by Guan et al. (2025), can foster self-regulated learning by helping learners to plan, control, and evaluate their learning. This is also seen in the works of Albadarin et al. (2024) and Mohebi (2024), who observed that the use of tools like ChatGPT is on the rise for academic assistance, information gathering, writing, and problem-solving.

Interactivity and accessibility are both ways Artificial Intelligence can bolster engagement with academic materials. Students can utilize AI to simplify a concept, provide examples, suggest revisions, create a summary, and form multiple viewpoints on a given topic. These new resources may inspire students to take charge of their individual learning and initiate independent study. The impact of AI on education is determined by the integration of technology into the study process. AI, when used as a reflection and exploration tool, is a valuable educational resource. When the technology is used to fill in the gaps of a student's intellectual work, the resource's learning potential is reached.

The main focus of the research is the over-reliance on AI dialogue systems, which Zhai et al. (2023) express concern over. Acceptance of AI-generated responses, without the use of personal judgment, can lead to a lack of cognitive engagement and inhibit critical thinking. AI should not be perceived as a fail-safe way to facilitate learning, as its value relies on its use in combination with appropriate academic guidance. AI, when integrated with critical thinking, independent study, and a personal touch, holds the potential to be a valuable educational resource. This integrated approach also mitigates the cognitive and academic consequences associated with over-reliance on technology.

Artificial Intelligence and Psychological Well-Being

Artificial intelligence (AI) use in higher education has extended beyond understanding the implications of AI in the classroom and teaching and learning, to considering the psychological experiences and well-being of students. University students contend with a myriad of psychological pressures due to the competitive and uncertain nature of university education. These could include splitting,

focus, performance, and deadline pressures. AI has the potential to alleviate some of these pressures by providing explanatory support, instructional support, and feedback in real time. Abbas et al. (2024) explained that university students experience many generative AI educational advantages, such as support to complete academic tasks, easily accessible educational support, and information. These advantages to academic tasks could create a positive psychological experience for students and a sense of control and support in the educational process.

Unfortunately, negative psychological experiences may emerge as a result of the use of AI. These could include effects on psychological well-being due to automated support being a substitute for personal effort, trust in the automation, and loss of personal control. Support, in this case, may negatively affect the student's confidence in developing independent problem-solving and critical thinking skills. Shahzad, M et al. (2024) argued that using AI could support students educationally, but it could also adversely affect students psychologically in many different ways.

Hence, a balanced, human-centered analysis is needed to understand the relationship between psychological well-being and Artificial Intelligence. AI can potentially improve students' well-being and lessen some academic struggles, better provide learning support, and promote self-directed learning, granted that AI is used purposefully and responsibly. Likewise, teaching and learning support, as well as the kind of academic challenges students face and the level of control students have, influence the kind of interactions students have with AI. It is thus important to look at psychological well-being with the use of AI in Learning to understand the type of interactions technology creates within the learning environment of university students that is more supportive and less stressful.

Research Objectives

- To examine the influence of artificial intelligence on student learning.
- To determine the relationship between artificial intelligence use and students' psychological well-being.
- To assess the overall role of digital intelligence in promoting student learning and psychological well-being.

Research Questions

- What is the influence of artificial intelligence on student learning?
- What is the relationship between artificial intelligence use and students' psychological well-being?
- What is the overall role of digital intelligence in student learning and psychological well-being?

Problem Statement

Artificial intelligence (AI) use in higher education has advanced how students interact with learning, how students complete tasks, how students receive feedback and how students gain access to learning information. The increased use of AI presents a significant problem of study regarding its potential impacts on students' learning and psychological health. Most studies of AI focus on technology acceptance, academic performance, learning efficiency, and narrow educational contexts. There is little evidence of the impact of AI learning solutions on students' psychological health (Bond et al., 2024; Wang et al., 2024). AI learning solutions provide the ability to learn at one's own pace, receive feedback in real-time and to control the learning process. However, concerns about overdependence, a lack of cognitive engagement, anxiety and the erosion of academic integrity and AI learning solutions, suggest that the solutions of learning technology may not have a positive impact on learning (Zhai et al., 2024; Abbas et al., 2024). AI solutions for learning have also been criticized for a lack theoretical focus and the need for more comprehensive, holistic, and human-centric studies to understand the impact of AI on learning and psychological health (Bond et al., 2024; Mustafa et al., 2024). Thus, understanding how the use of AI learning technology impacts students' psychological health is an important area to address. Bridging this gap is important because learning efficiency alone is an inadequate measure of success in education if the resulting integration technology comes with damaging psychological outcomes. This study seeks to understand the effects of artificial intelligence on student learning and psychological health. It presents a holistic view of the educational and psychological aspects of digital intelligence.

Significance of the Study

This study is significant because it integrates both student learning and psychological health and concerns in light of the use of artificial intelligence in modern educational systems. Important to the study is the contribution to the emerging field of artificial

intelligence and education, specifically in filling the research gap in psychological and psychological and learning-related outcomes of artificial intelligence (Bond et al, 2024; Wang et al, 2024). This research may assist teachers in the application of artificial intelligence in teaching and learning, allowing students to remain mentally active and independent. This may help university leaders and policy and framework developers to create responsible artificial intelligence, digital literacy, and student support policies and frameworks, emphasizing the positive use of artificial intelligence and not its misuse. It is hoped that this study may assist students in gaining understanding of the psychological impacts of artificial intelligence, thus creating a gap of psychological and educational impacts via artificial intelligence, allowing students to create a more balanced approach in the use of artificial intelligence. This research may also help future scholars and researchers in digital intelligence, artificial intelligence, student learning, and the intersection of human well-being in various educational systems and cultural contexts.

Literature Review

AI technologies have rapidly transformed the higher education landscape. AI helps students in all dimensions of learning, including information retrieval, academic processing, task completion, and feedback acquisition. AI technologies include adaptive and predictive learning systems and generative AI. The power of these technologies is the individualized, specification-based learning they support. Klimova, B et al. (2025) say the inclusion of ChatGPT in higher education is supported by the increasing empirical research on ChatGPT. Velastegui, D et al. (2023) agree that AI, in addition to traditional forms of automation, supports the personalized structuring of learning. AI is not a ubiquitous learning support tool. Still, it offers a strong assistance learning role necessary to help the higher education student who interacts with numerous large and complex information resources. The role AI plays in higher education is that of a learning facilitator and not a tool.

Personalization, accessibility, and prompt learning assistance are paramount in the AI learning support role. Systems based on AI can offer learning support in the form of feedback and examples that learning interested individuals can use at their own pace. According to Prinsloo, P et al. (2024), the empirical evidence on generative AI chatbots suggests that generative AI chatbots enhance learning through participation, engagement, and self-efficacy, as well as the capacity for critical and creative learning. Likewise, An et al. (2026), in a systematic analysis of 39 empirical studies, revealed that the use of generative AI by students to complete learning tasks was associated with predominantly positive learning outcomes, despite students' perceptions regarding learning outcomes being mixed. With this in mind, if students supplement their use of AI to answer learning tasks with other resources to aid explanation, reflection, and feedback, and to support students' learning, AI is likely to have a positive impact on learning.

Despite the above positive findings, the relationship between AI and student learning is not positive and the body of literature is increasingly focused on the importance of the manner in which AI is incorporated into the learning process. The overreliance of students on generative AI may result in learning to be disengaged and more likely to be superficial, if students accept AI-generated responses without questioning the validity and rationale of the responses. Dai, Y et al. (2020) highlighted that the educational impact of ChatGPT is supported by a lack of consensus in empirical studies, as the outcome is highly dependent on the educational context and the student's engagement with the technology. AI-augmented learning does have a diminishing utility as the convenience of technology displaces the cognitive effort students have to contribute. Shin, Y. (2025) conducted a systematic review of 73 studies, and demonstrated that AI tools enhance learning outcomes and student engagement when used in conjunction with effective pedagogical practices, such as provision of scaffolding and interactive learning. AI should not be treated as an alternate cause of the learning outcome; its impact on learning seems to rely on learning design, student agency, and the human–AI interaction context.

AI-Supported Learning and Academic Engagement

The role of AI-enhanced learning is becoming much more prominent in the ways university students engage in academic activities, how they process learning materials, and manage their learning. Academic engagement generally refers to the behavioral, cognitive, and emotional aspects that students demonstrate when they are involved in learning activities. It includes their involvement in academic activities, attention span, the effort they exert, and their interaction with learning aids. AI has the potential to positively influence all these aspects by providing instant feedback, customized messages, and flexible learning aids and resources. Alruwaili, N et al. (2025) contend that AI-facilitated learning environments bolster personalized learning pathways and the responsive engagement of learners in a more interactive context. In the same vein, Li, H et al. (2025) noted that the growing body of works that assess the impact of generative AI, document its role in the support of learning, the search for information, the writing process, the solving of learning-related tasks and academic engagement. The above outcomes support the belief that the evolving role of AI creates varied learning contexts and engagement, allowing learners to interact with learning materials that are not constrained by the traditional learning of the classroom.

The self-regulated and interactive components of learning are where AI's real promise for bolstering academic engagement can be observed. There are many ways for students to interact with AI to answer questions, generate practice questions, receive feedback, organize ideas, and suggest alternate ways to look at things. These all provide additional means for students to actively engage with their learning. Benelli, F et al. (2025) suggest that educational chatbots can address many aspects of self-regulated learning, such as helping students plan, track, and control their learning activities. Self-regulation is important because it affects how much a student engages with learning and how much they are willing to take ownership of their learning. Also, Yang, J et al. (2025) state that when appropriately integrated into educational practice, generative AI chatbots may positively impact motivation, engagement, self-efficacy, self-regulation, and learning performance. Thus, AI-based learning may enhance academic engagement not merely by assisting students in completing tasks, but by providing multiple ways for students to engage with learning, practice, get feedback, and identify learning gaps in order to continue learning on their own.

The connection between AI use and academic engagement remains mixed. Considerable tech interaction does not equal substantive intellectual engagement. For instance, if students use AI to produce finished homework, solve problems, or even to do their thinking for them, the convenience that tech offers AI can diminish the student's cognitive involvement. For example, Aydın, B et al. (2026) expressed the danger of students relying on AI more and continuously thinking less, as they will come to accept the information provided without critically evaluating or reasoning. Additionally, Syahrin, M et al. (2024) noted that the effect of generative AI on education is different based on the context of its use, and the application of AI on its own should not be considered a way of enhancing learning. Engagement also relies on the quality of interactions. AI-promoted learning is more engagement positive when the learning activity is dynamic and the students are kept in the loop rather than the AI-generated information.

Artificial Intelligence and Students' Psychological Well-Being

The role that Artificial Intelligence plays in higher education does not only concern what students learn in the classroom. AI will, and does, have an impact on students' experiences and the way they feel during and after learning. University students use AI in many ways, including, but not limited to, seeking help with writing, seeking help with problems, seeking help with decisions, and seeking help with information. AI, therefore, has the potential to impact the majority of students' daily learning. With regards to students' emotional and mental well-being, AI systems have the potential to have a positive impact on students' emotional and mental stability and stress levels. AI systems can also help to improve students' confidence and sense of autonomy. According to Karayer, M. (2024), the support and convenience offered by generative AI help to relieve the support and convenience barriers of highly time and energy demanding academic tasks. Similarly, Alhwaiti, M. (2023) claim that AI in education can help to provide a high level and fast support of learning, which positively impacts students' learning and education. With regard to the above information, it can be assumed that in the education of students, AI can help improve students' mental and emotional well-being if it is used in the classroom in a supportive manner and not in a way to replace people.

One way AI could affect the psychology of students is by easing the burden they feel about schoolwork. Students struggle with many things: deadlines, difficult schoolwork, tests, and the time it takes a teacher to respond to them. Having AI systems at their fingertips could help students tackle a lot of difficult tasks by answering questions, helping organize, and creating study materials, all while providing continuous help. Tjano (2025) believes that educational chatbots aid in self-regulated learning by helping students plan, monitor, and control their schoolwork. This may lead to students feeling as though they are more in control and more capable, both of which are healthy for psychological wellbeing. That being said, the psychological effects of AI will mainly depend on how the individual uses it. If students see AI in a positive light as a tool to learn and work independently, it will positively affect self-confidence and self-control. If students avoid working and become overly reliant on AI, it could negatively affect self-confidence and the students' belief they have the ability to work with less help and support.

There may be psychological issues for students associated with an increased reliance on AI, despite the associated advantages. The rapid expansion of generative AI has raised concerns about the authenticity of the academic experience, the future of work, personal capability, and the worth of skills. Abbas et al. (2024) noted how even with the many advantages of generative AI, students are concerned about academic integrity and dependency. Zhai et al. (2024) expressed that a dependency on AI systems may result a students losing the ability and/or motivation to think on their own, as well as a growing dependency on systems for thinking. The reliance on AI may ultimately impact a student's autonomy and self-efficacy, due to the loss of opportunities to think on one's own and experience the outcome of that effort. The increased reliance on AI may negatively impact the student experience even more than the technology offers an easy way to complete academic tasks. The nature of the tasks completed on AI to support academic learning, even more than the fact that tasks are completed, is more likely to impact a student's overall well-being.

Research Gap

There is a significant empirical gap regarding the interconnectedness of artificial intelligence (AI), learning, and the psychological well-being of learners, despite the rapid expansion of the literature on the role of AI within the higher education sector. Most studies incorporate elements of AI and learning and study the interaction of AI with academic performance, acceptance of technology, learning efficiency, self-regulated learning, and learning engagement. However, many studies have examined the educational and psychological ramifications of AI within the same scope (Albadarin et al., 2024; Wang et al., 2024). Recent literature has pointed out the difficulty of establishing any meaningful conclusions about the impact of AI on students, because of the considerable diversity of research contexts and approaches, and the considerable variety of outcome measures (Bond et al., 2024; Mustafa et al., 2024). While there is evidence that AI has the capacity to facilitate personalized learning, feedback, and support, many of the psychological issues related to the overreliance of students on AI tools, self-cognitive engagement, and the overall autonomy of students remain largely unexplored (Zhai et al., 2024; Abbas et al., 2024). There is limited empirical research on the psychological and educational ramifications of AI from an integrated student experience perspective. Thus, an integrated, empirical approach is required to understand the relationship learning AI in contemporary higher education and the psychological well-being of students. This approach can offer new insights on the rapidly integrating AI in learning from a more holistic, integrated, and human-centric approach to education.

Research Hypotheses

H1: There is a significant positive relationship between artificial intelligence use, student learning, and students' psychological well-being.

H2: Artificial intelligence use significantly predicts student learning and students' psychological well-being.

H3: There is a significant difference in student learning and psychological well-being between students with lower and higher levels of artificial intelligence use.

H4: There is a significant difference in student learning and psychological well-being across different levels of artificial intelligence use.

Conceptual Framework

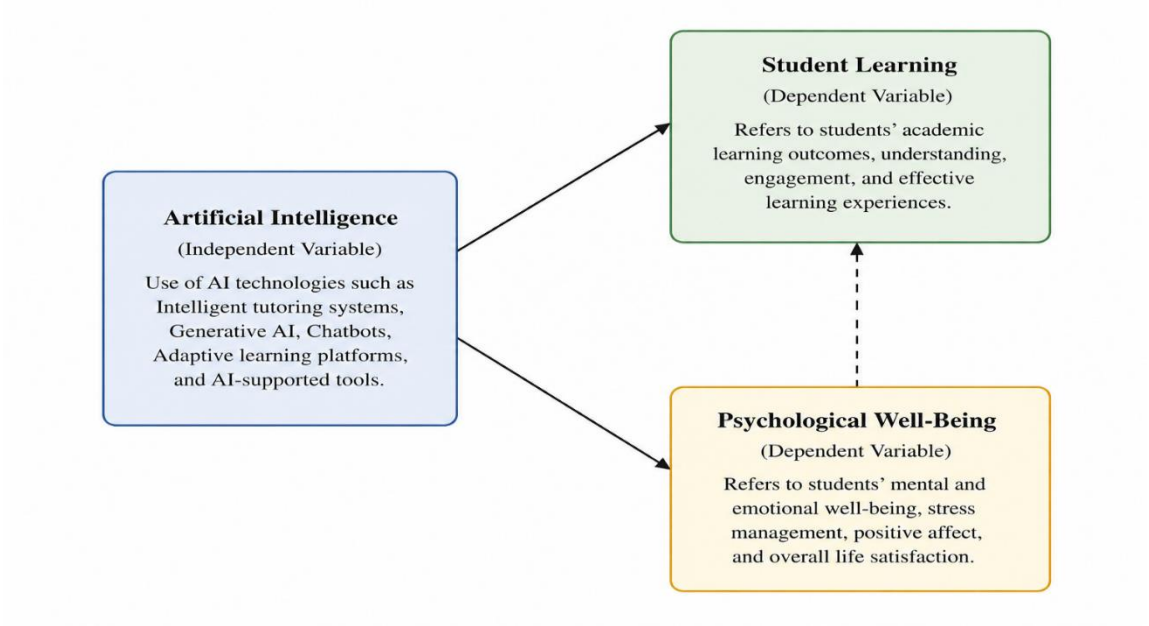

Fig.1 Conceptual Framework

The proposed relationship between Artificial Intelligence (AI), Student Learning, and Psychological Well-Being is illustrated in the conceptual framework. Student learning and psychological well-being are portrayed as dependent variables in this research. AI is considered independent in this context. The effect of AI on both variables is represented by the arrows in this framework.

Methodology

Research Design

The research design of the study was based on quantitative, cross-sectional research design. The main research instrument for this study was a structured questionnaire, the aim of which was to gather data of a numerical value regarding the presence of artificial intelligence, student learning and psychological well-being. The quantitative research paradigm was suitable and used in this case as the study was interested in definable and quantifiable relationships and predictive dimensions of the variables. Data of the study was collected from students at one time, providing a great opportunity to address the relationships among artificial intelligence, student learning and psychological well-being.

Population

The population for this study was university students in higher education institutions in Punjab and Sindh in Pakistan. The students of the Punjab province comprised students of Bahauddin Zakariya University and The Islamia University of Bahawalpur. In addition, students of universities from Sindh province included the University of Sindh and University of Karachi. Through the inclusion of students from both provinces, the study aimed to collect responses from students in varied geographic and institutional areas within Pakistan. The population for this research was pertinent as university students are a group where a large number of students come into contact with new AI learning technologies and the use of digital learning in educational contexts.

Target Audience

The target audience included university students involved with higher education and with the availability of digital and AI-enhanced educational resources. To include a range of students' experiences with AI-enhanced educational resources, students from all higher education levels and all academic programs were included. It was anticipated that the respondents would have the required experience with digital educational resources to enable them to respond to questions about the role of AI in education and their views on the subject

Sampling Technique and Sample Size

Since the questionnaire was made available online and participating students were responding of their own accord, a non-probability sampling technique was used. This type of sampling allowed us to reach the desired participants in the targeted locations and helped the researchers to receive responses in an online survey. The study sample consisted of 423 participants. After the data collection process, the 423 respondents' records were organized and prepared for analysis, and this was the dataset that was used for the statistical analysis of the study

Data Collection Procedure

Adopted and modified structured questionnaires were the main data collection tools. These were administered in an online survey using the Google Forms application. The digitally distributed questionnaires were shared with university students by posting them on the most appropriate student communication channels and by sharing the survey link directly. Study participants were provided with a brief description of the study, including the information that their participation would be of their own accord. Google Forms provided an automated capture of the participants' responses and these were exported for data preparation and analysis.

The survey contained segments measuring artificial intelligence, student learning, psychological well-being, and the demographics of the respondents. For the main attitude measures, a 5-point Likert-type response format was used, with 1 = strongly disagree and 5 = strongly agree. For the AI-related section, measures were taken from the early works on the measurement of AI literacy. In particular, Ng et al. (2024) worked on the development and validation of the Artificial Intelligence Literacy Questionnaire (AILQ) and included the affective, behavioral, cognitive, and ethical components of AI literacy. Development of the AILQ was done through the construction of items through the literature and the validation of the items by experts, with the use of a 5-point agreement scale. In the present study, to place contextual focus of the AI items, the survey did not use the AILQ as is. Rather, the survey used items to focus on the interactions and the use of AI by the students in the educational setting.

The student learning and engagement section used existing measures of engagement in the higher education sector as a reference. Maroco et al. (2016) developed the University Student Engagement Inventory (USEI), which includes cognitive, behavioral, and emotional engagement. The development and validation of the measure was specifically for university students, and as a result, was considered appropriate for measuring students' engagement with academic learning in this study. There was also evidence on the reliability and validity of the USEI from cross-cultural studies involving university students from different countries (Assunção et al., 2020).

Psychological wellbeing was measured using items from the WHO-5 Well-Being Index, which is a brief measure of subjective psychological wellbeing. The context of the World Health Organization partially shaped the WHO-5, but it has been studied in various communities and countries since. Evidence from modern studies shows that the WHO-5 is a valid and reliable measure for assessing subjective well-being, and it has been extensively used in many countries for cross-cultural studies (Topp et al., 2015). Recent studies that focus on the validation of assessments further endorse the use of the WHO-5 in different populations and studies.

To ensure that the instruments used in the study were easily understandable and relevant to the university context of Pakistan, some of the items were modified. During the modification, the appropriate meaning of the items was kept. The instruments were also used to measure students' experiences of AI-Enhanced Education, their engagement in studies, and their psychological well-being.

Ethical Considerations

During the entire process of data collection, ethics were taken into consideration. The participants were fully informed of the purpose of the study, and their participation was voluntary. The participants of the study did not have to provide any unnecessary personal information. The researcher kept their responses confidential and did not use them for any purpose other than for this study. The participants were informed that they had the right to withdraw their participation from the study at any time, and there was no consequence for doing this. The researcher obtained informed consent from the participants prior to their participation.

Data Analysis

The collected responses were downloaded from Google Forms and organized in Microsoft Excel. The dataset was reviewed for completeness, consistency, accurate coding, and readiness for statistical procedures. After the preliminary data screening, the finalized dataset was transferred to IBM SPSS Statistics. Appropriate variable codes were developed, and the questionnaire items were placed in the expected order for inferential statistical analyses.

Descriptive statistics were used to summarize the demographic characteristics of the respondents and the primary study variables. For categorical demographic variables, frequencies and percentages were reported, while means and standard deviations were reported for continuous or scale-level study variables. The assessment of internal consistency for the adopted scales was conducted using Cronbach's alpha, permitting the evaluation of the reliability of the measures for AI, student learning, and psychological well-being for the present study.

The relationship between artificial intelligence, student learning, and psychological well-being was evaluated using correlation analysis. The correlation analysis evaluated the direction and strength of the linear relationships among the primary study variables. The multiple linear regression analysis was used to evaluate the relationships between the AI-related variables, student learning, and psychological well-being. The regression coefficients, along with the criteria for model adequacy, were evaluated to appraise the impact of the related variables on the outcome variables of the study.

An independent-samples t-test was used to compare two groups of students based on the characteristics of their AI-use. Specifically, it was used to identify whether there were significant differences in student learning and psychological well-being of the two groups. For AI-use categories that were comprised of more than two groups, one-way ANOVA was conducted to determine differences in the mean scores of student learning and psychological well-being across the categories. When ANOVA was statistically significant, Tukey's HSD post-hoc test was used to identify the specific groups that were statistically significant. Each of the statistical tests was performed using the SPSS, and statistical significance was tested at the traditional level of $\alpha = 0.05$.

Table 1: Demographic Characteristics of the Respondents (N = 423)

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	211	49.9
	Female	212	50.1
	Total	423	100.0
Age	18–21 years	154	36.4
	22–25 years	181	42.8
	26–30 years	62	14.7
	Above 30 years	26	6.1
	Total	423	100.0
Academic Level	Undergraduate	258	61.0
	Master's	119	28.1
	MPhil/MS	34	8.0
	PhD	12	2.8
	Total	423	100.0
Province	Punjab	259	61.2
	Sindh	164	38.8
	Total	423	100.0
Academic Discipline	Social Sciences	96	22.7
	Natural Sciences	73	17.3
	Computer/IT	81	19.1
	Business/Management	68	16.1
	Health Sciences	61	14.4
	Engineering	44	10.4
	Total	423	100.0
Frequency of AI Use	Rarely	48	11.3
	Occasionally	92	21.7
	Sometimes	133	31.4

Demographic Variable	Category	Frequency (n)	Percentage (%)
	Frequently	101	23.9
	Very frequently	49	11.6
	Total	423	100.0

Demographics of the 423 participants showed 211 male and 212 female participants, showing an even gender split. While the most common age group was 22–25 (42.8%), the second most common was 18–21 (36.4%), with even fewer aged 26–30 (14.7%) and over 30 (6.1%). Looking at their education, most were at the undergraduate level (61.0), most of the remainder were Master's students (28.1%), and the last few groups were MPhil/MS students (8.0%) and PhD students (2.8%). 61.2% of the sample lived in Punjab and 38.8% lived in Sindh. The most common field (22.7%) was the Social Sciences, with the other most common groups including Computer/IT (19.1%), Natural Sciences (17.3%), Business/Management (16.1%), Health Sciences (14.4%), and Engineering (10.4%). Participants most commonly said that they used AI sometimes (31.4%), with less saying that they used AI frequently (23.9%), occasionally (21.7%), very frequently (11.6%), and rarely (11.3%). This shows that the students in the sample used AI to different extents, and so different relationships could be formed between the use of AI and the students learning and psychological well-being.

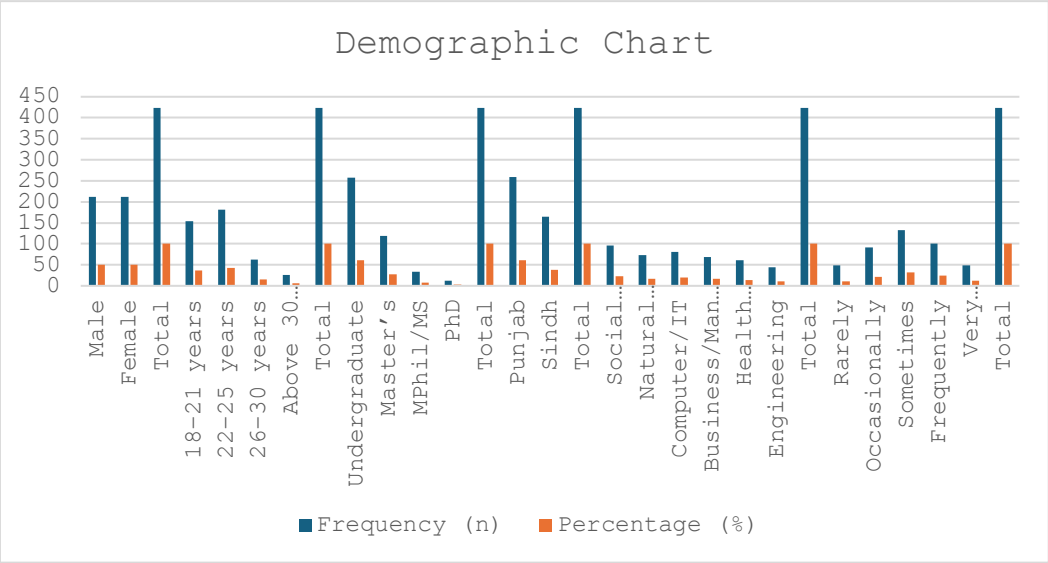

Fig. 2 Demographic Characteristics of the Respondents (N = 423)

Table 2: Pearson Correlation Analysis Among Artificial Intelligence, Student Learning, and Psychological Well-Being (N = 423)

Variables	Artificial Intelligence	Student Learning	Psychological Well-Being
Artificial Intelligence	1	.642**	.518**
Student Learning	.642**	1	.574**
Psychological Well-Being	.518**	.574**	1
N	423	423	423
Sig. (2-tailed)	—	< .001	< .001

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

Pearson correlation analysis indicated positive connections among the 3 variables being studied. Artificial intelligence positively correlated with student learning at the strongest instance (AI and student learning, $r = .642$, $p < .001$). This means the greater the use of AI, the greater learning by the students. AI correlated moderately with psychological well-being (AI and psychological well-being, $r = .518$, $p < .001$) meaning the more learning with AI support, the more the students' psychological well-being improved. Student learning positively correlated with psychological well-being (student learning and psychological well-being, $r = .574$, $p < .001$), meaning the students with improved learning also had improved psychological well-being. It can also be said there is a positive correlation among artificial intelligence, student learning, and psychological well-being.

Table 3: Multiple Linear Regression Predicting Student Learning (N = 423)

Predictor	**B**	**SE**	**β**	**t**	**p**
Constant	1.214	.168	—	7.226	< .001
Artificial Intelligence	.684	.041	.642	16.683	< .001

Model Statistics	**Value**
R	.642
R^2	.412
Adjusted R^2	.410
F	278.33
p	< .001

Table 4: Multiple Linear Regression Predicting Psychological Well-Being (N = 423)

Predictor	**B**	**SE**	**β**	**t**	**p**
Constant	1.736	.183	—	9.486	< .001
Artificial Intelligence	.557	.050	.518	11.140	< .001

Model Statistics	**Value**
R	.518
R^2	.268
Adjusted R^2	.266
F	124.10
p	< .001

The regression analysis indicated the use of artificial intelligence positively influences learning and psychological well-being. AI substantially improves learning ($\beta = .642$, $p < .001$), and the regression analysis ($R^2 = .412$) indicates that AI accounts for 41.2% of the variance in learning. The regression analysis is statistically significant ($F = 278.33$, $p < .001$). AI accounts for 26.8% of the variance in psychological well-being ($R^2 = .268$), and the regression is statistically significant ($F = 124.10$, $p < .001$). AI has a substantial influence on psychological well-being, ($\beta = .518$, $p < .001$). The results indicate that learning and psychological well-being increase when the use of AI increases, and therefore, AI has significant predictive influence on learning and psychological well-being.

Table 5: Independent-Samples t-Test Comparing Student Learning and Psychological Well-Being by Level of AI Use (N = 423)

Dependent Variable	AI Use Group	n	Mean	SD	t	df	p
Student Learning	Low AI Use	191	3.31	0.61	-8.72	421	< .001
	High AI Use	232	3.83	0.57			
Psychological Well-Being	Low AI Use	191	3.38	0.64	-6.21	421	< .001
	High AI Use	232	3.76	0.57			

There are significant differences shown in student learning and psychological well-being between students based on their artificial intelligence usage, as demonstrated by the independent-samples t-test. Students using AI more reported higher levels of student learning ($M = 3.83$, $SD = 0.57$) compared to students using AI less ($M = 3.31$, $SD = 0.61$), $t(421) = -8.72$, $p < .001$. Also, students using AI more had higher levels of psychological well-being ($M = 3.76$, $SD = 0.57$) compared to students using AI less ($M = 3.38$, $SD = 0.64$), $t(421) = -6.21$, $p < .001$. There is a clear difference between the two AI use groups in student learning and psychological well-being. The group of students using AI more reported higher levels of both.

Table 6: One-Way ANOVA Comparing Student Learning and Psychological Well-Being Across AI-Use Groups (N = 423)

Dependent Variable	AI-Use Group	n	Mean	SD
Student Learning	Low AI Use	98	3.28	0.58
	Moderate AI Use	169	3.61	0.55
	High AI Use	156	3.89	0.51
Psychological Well-Being	Low AI Use	98	3.35	0.61
	Moderate AI Use	169	3.59	0.57
	High AI Use	156	3.82	0.54

ANOVA Summary

Dependent Variable	Source	SS	df	MS	F	p
Student Learning	Between Groups	29.684	2	14.842	48.76	< .001
	Within Groups	127.910	420	0.305		
	Total	157.594	422			

Dependent Variable	Source	SS	df	MS	F	p
Psychological Well-Being	Between Groups	15.927	2	7.964	23.14	< .001
	Within Groups	144.511	420	0.344		
	Total	160.438	422			

Tukey HSD Post-Hoc Comparisons

Dependent Variable	Group Comparison	Mean Difference	p
Student Learning	Low vs. Moderate	-0.33	< .001
	Low vs. High	-0.61	< .001
	Moderate vs. High	-0.28	< .001
Psychological Well-Being	Low vs. Moderate	-0.24	.006
	Low vs. High	-0.47	< .001
	Moderate vs. High	-0.23	.011

The results of the one-way ANOVA indicated that there were statistically significant differences in student learning and psychological well-being among the three levels of artificial intelligence use. There was a significant difference in student learning of low-, moderate-, and high-AI-use groups, $F(2, 420) = 48.76$, $p < .001$. The means scores of the low-AI-use group was $M = 3.28$, the moderate-AI-use group $M = 3.61$, and the high-AI-use group $M = 3.89$. There was a significant difference of psychological well-being in the three groups, $F(2, 420) = 23.14$, $p < .001$, the means scores of low-AI users $M = 3.35$, moderate-AI users $M = 3.59$, and $M = 3.82$ for high-AI users. The Tukey HSD post-hoc comparisons showed statistical significance in all pairwise group differences for both outcomes. These results indicated that students reporting higher AI use reported higher levels of student learning and psychological well-being.

Discussion

This study investigated how artificial intelligence impacts student learning and well-being from a psychological standpoint for university students. By and large, the results illustrated a harmonious optimistic trend for the correlation, regression, independent-samples t-test, and one-way ANOVA analyses. AI was seen to have a positive impact on student learning and psychological well-being. Regression results suggested that AI contributed significantly in predicting both variables. Moreover, students who reported that they used AI to a larger extent, demonstrated a higher level of favorable learning and psychological well-being than students who used AI to a lesser extent. It was also shown in ANOVA that there was a positive progression in learning and psychological well-being in groups of students who used AI to a lower, moderate, and higher extent, respectively. To summarize, the results presented in this study show that AI is not used as just a technological tool or for students' learning and teaching convenience, but most probably, AI is becoming an important part of students' evolving learning systems.

The beneficial connection that artificial intelligence has with students is apparent across literature that has been published regarding AI's ability to adapt to interactive and dynamic forms of learning. The correlation analysis that was performed revealed a strong positive connection between AI and student learning ($r = .642$, $p < .001$). The regression analysis performed predicted student learning with AI ($\beta = .642$, $p < .001$) and accounted for nearly 41.2% of the variance. This is consistent with the findings of Wang et al. (2024). Their systematic literature review identified the educational applications of AI to intelligent tutoring, personalization, adaptive learning, and automated feedback. Recent literature continues to strengthen this view. Long et al. (2026) assessed 73 peer-reviewed studies and documented that AI technologies, when seamlessly integrated with an interactive teaching style that employed project-based learning, the flipped learning paradigms, and scaffolded feedback, have the ability to greatly

improve the level of student engagement. In the same vein, a systematic review and meta-analysis that was conducted in 2025 concluded that the use of generative AI within a particular learning framework and style positively influenced the motivation and engagement of university students, though the size of the effects was not consistent.

The level of collaboration observed between AI and student learning is most likely due to the fact that students are able to receive individualized responses to their academic queries when using an AI system. Unlike traditional tools and resources used in the learning process, generative AI relies on an interactive process that enables a student to receive multiple responses to questions, receive assistive explanations, and work through examples and even facilitate the process of revision. This has the ability to foster a culture of active learning and engagement, and can even help to manage the challenges of limited learning opportunities and the delays that are often caused by feedback and support from the instructor. The findings here support the notion that AI acts as a learning support system, provided students use AI as an assistance tool rather than a substitution tool, and use it in conjunction with their own efforts. It also aligns with Long et al. (2026) who noted the contribution of AI in education is dependent on the teaching context in which the tool is located. Therefore, the association the current study uncovered, should be interpreted as evidence of an educational connection. It should not be interpreted as evidence that AI brings about a learning improvement without constraints.

Further, the study findings on student engagement strengthen this interpretation. Even though the current study was primarily focused on student learning, the study outcomes appear to align with the findings that AI encourages cognitive engagement, as well as behavioral and emotional engagement. Long et al (2023) also mentions a systematic review and meta-analysis that found in a given context, generative AI produced large improvements in learner motivation and engagement: cognitive, as well as emotional engagement. It is critical to understand this, because it is unlikely that learning improvements would happen if students simply had access to AI. It is likely that learning improvements would happen if AI encouraged students to meaningfully engage with academic materials, seek feedback, and correct misconceptions. Thus, AI learning accessibility and engagement might deepen learning.

The second significant discovery focused on the associations between artificial intelligence and psychological well-being. AI was found to have a moderate positive association with psychological well-being ($r = .518$, $p < .001$). Regression analysis revealed that AI was a positive predictor of psychological well-being ($\beta = .518$, $p < .001$), explaining about 26.8% of the variance. It was reported that the more students used AI, the better their psychological well-being was. This result aligns with the available literature that suggests the use of AI in education might help decrease some academic challenges by offering available resources and through the provision of tailored guidance and assistance in self-paced learning. A systematic review based on 38 studies published between 2018 and 2024 reported that the use of AI in education enhances tailoring, comprehension, engagement, and academic success while potentially alleviating some levels of stress and anxiety in students. The review noted the danger of increased reliance on technology, and social isolation, thus it is important to note that the relationship between AI and well-being cannot be deemed as purely positive.

The positive relationship between AI and psychological well-being can be explained by the perception of students feeling a greater sense of control over academic tasks when learning support provided by AI becomes instant. Students have the ability to use AI to gain clarification of complex ideas, structure information, generate practice questions, and receive practice question feedback without the need to wait for support during teaching. This helps to lessen doubt and helps students gain confidence to better manage academic challenges. This view aligns with studies about AI-assisted self-regulated learning. More advanced intelligent educational systems have been researched for their ability to help learners at the planning, monitoring, and self-regulation stages of learning systems. Even so, the current research should not be interpreted to mean that AI systems have a direct effect on the improvement of psychological well-being. The cross-sectional nature of this study means that the association may be that learners with greater psychological well-being are more self-assured and willing to engage with AI systems. Therefore, influence should be assessed through longitudinal and experimental studies.

Findings from the independent-samples t-test also supported the proposed association. Notably, students who reported greater AI use also reported greater student learning, and the same was true for psychological well-being. Student learning for the greater AI-use group was 3.83, and for the lesser-use group it was 3.31. Likewise, psychological well-being was 3.76 for the greater AI-use group and 3.38 for the lesser AI-use group. Given the statistically significant differences, the use of AI systems was related to meaningful differences in the educational and psychological experiences of students. Despite this, the group comparison should be viewed with caution as simplifying a continuous pattern of AI use to two groups may mask the quality of the relationship. Thus, the most appropriate interpretation of the findings is that students with different levels of AI engagement have different average results. This does not mean that differences were caused by increased use of AI systems.

One-way ANOVA results also revealed additional layers of complexity as low, moderate, and high AI use groups were compared. ANOVA results indicated significant overall differences in student learning across the three groups, $F(2, 420) = 48.76$, $p < .001$, where a higher mean value was observed in the high AI use group ($M = 3.89$) compared to the moderate ($M = 3.61$) and low AI use group ($M = 3.28$). Similarly, psychological well-being also observed higher mean values the higher the level of AI use, where the low, moderate, and high AI use groups observed mean values of 3.35, 3.59, and 3.82 respectively, $F(2, 420) = 23.14$, $p < .001$. Tukey HSD results indicated significant differences across all three groups. The most interesting aspect of this finding was that the relationship was not limited to users/non-users of AI. The current study found that higher amounts of AI use, was related to higher amounts of learning and psychological well-being in the current sample. This finding is in line with the emerging literature that the effect of generative AI has on motivation and engagement is contextual based and/or dependent on the level of use.

Conclusion

The present study found that the use of artificial intelligence, by university students, had a strong positive association with student learning and an even stronger positive association with psychological well-being. The results of the current study showed a strong positive relationship between the use of AI and enhanced student learning and a moderate positive relationship between the use of AI and enhanced psychological well-being. The results of the current study also showed that the use of AI had a high level of prediction of both enhanced student learning and psychological well-being based on the results of the independent samples t-test and one-way ANOVA. Further, the results of the independent samples t-test and one-way ANOVA indicated that students that used AI to a higher extent, reported more positive learning and well-being outcomes. This research implies that AI-based learning technologies can give students personalized academic aid, really fine-tuned to their needs and including instant feedback and greater flexibility; all of this might facilitate learning and improve students' mental well-being, and functioning.

Essentially, the AI learning systems being studied have an enormous potential to assist students beyond academic learning, and the systems have potential to support student psychological well-being and functioning. The study doesn't say that more AI systems are better for students or that all of the systems being studied promote positive learning and psychological well-being, especially because of the study's cross-sectional nature. The proper use of AI demands responsibility, digital literacy, active critical assessment, and right pedagogy. AI literacy should be paired with teaching students not to shy away from their original thinking and interpersonal connections. AI, therefore, can help learning at all levels, everywhere, not at the expense of students' emotional or cognitive needs.

Recommendations

1. Integrate AI into teaching: Universities should incorporate AI-supported tools into teaching and learning activities to enhance personalized and flexible learning.
2. Develop AI literacy: Students should receive training in responsible, ethical, and effective use of artificial intelligence for academic purposes.
3. Promote critical thinking: AI use should be combined with activities that strengthen students' independent reasoning, evaluation, and problem-solving skills.
4. Monitor psychological well-being: Educational institutions should regularly assess students' psychological well-being as AI technologies become increasingly integrated into academic environments.
5. Establish responsible AI policies: Universities should develop clear guidelines addressing appropriate AI use, academic integrity, privacy, and responsible technology adoption.
6. Strengthen teacher guidance: Faculty members should guide students in using AI as a learning-support resource rather than relying on it as a replacement for independent academic work.
7. Conduct longitudinal research: Future studies should use larger and more diverse samples and longitudinal or experimental designs to examine the long-term effects of AI on student learning and psychological well-being.

Future Implications

This study predicts disruptive changes for the field of AI-enhanced higher education. As AI technology becomes even more sophisticated, it is likely that universities will use more and more advanced intelligent tutoring systems, generative AI applications,

and more adaptive and personalized learning technologies. Because of these changes in the technology that will be used, educational practices will have to go beyond the integration or application of the technology in the traditional sense and design AI systems that combine the psychological well-being of students with their critical thinking, independent learning, digital literacy, and emotional intelligence. Increasingly, organizations will have to implement structured AI literacy programs, responsible AI use policies, and supportive systems for students that will allow them to use AI in ways that are beneficial and less psychologically and emotionally disruptive and less dependent and less misinformative. The relationships established in this study also need to be examined in the context of other academic disciplines, institutions, and cultures to determine the stability of the positive results over time. The focus of these types of innovations should be on developing a learning environment in higher education that integrates sustain support technologies with Artificial Intelligence in learning.

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