

IMPACT OF THE USE OF AI-BASED TOOLS ON UNIVERSITY STUDENTS IN PUNJAB, PAKISTAN

Amina Shahzadi^{*1}, Ahmad Saleem², Komal Hameed³, Ahmad Atiq ul Rehman⁴

^{*1,2,3,4}Government College University (GCU), Lahore, New Campus, KSK

^{*1}aminashahzadi@gcu.edu.com

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Corresponding Author: *

Amina Shahzadi

Abstract

This study has a scope on Artificial Intelligence and its effect on university students in Punjab, Pakistan. The second involves studying the ways in which students' academic performance and learning behaviour change as a result of AI tools, including intelligent tutoring systems and plagiarism detectors, in higher education. So, while students in urban areas are able to utilize tools like Grammarly, ChatGPT and other more than AI tools to help them with their writing and research skills, students in rural areas have barriers such as no internet access making these barriers worse and further increasing the inequality in education. To address ethical as well as academic dishonesty and data privacy concerns, the study also discusses to the extent to which factors, like perceived usefulness and ease of use, affect the adoption of AI tools using the Technology Acceptance Model (TAM). This finding stresses upon the imperative of policy interventions to bridge the digital divide and to make AI tools available to all students in Pakistan's higher education system to enable all the students to benefit from these AI tools in Pakistan's higher education system.

Novel factors contained in this study include the impact of Artificial Intelligence (AI) on university students' academic performance, motivation, skill development, and learning behavior which were investigated through chi square analysis and factor analysis. Results of the chi square tests show statistical existence of associations for different academic and technical variables showing that AI is of a great impact in helping to understand complex concepts, assignment completion and motivation for the study. Additionally, the factor analysis of the data sorted the data into meaningful themes related to academic performance, technological adaptation, independent learning, research skills, and negative aspects such as dependency and the removal of human connection. Although, AI has made positive contributions in providing support for learning processes, the findings also show a shift towards AI tools in assignments and, in some circumstances, this may impede students' ability to self-write and develop critical thinking. It is worrying for students to use AI to complete tasks instead of relying on their own thought process which could be a result in rising rates of creativity decline and cheating. The study ends with recommendations to educators regarding how balanced AI use can be promoted, the independent learning encouraged, as well as the strategies that will ensure student engagement with core educational values.

INTRODUCTION

Over the past few years, AI based tools have made their way globally, and the integration of AI based tools in education has seen a hike in their adoption to significantly enhance the learning experience as well as enhance the academic outcomes. Students across the world are increasingly using these tools such as personalized learning platforms and automated assessments. University students have begun to adopt AI tools in Pakistan and particularly, in Punjab. AI is taken up by the students of Punjab across educational sectors such as problem solving, data analysis, exam preparation, and research, with personalized learning as well as immediate point of reference to information. Punjab, Pakistan, is no exception where AI is transforming the landscape of higher education across the world as mentioned in Simionescu et al., (2023). AI based tools are being used by university students for academic writing, academic research, data analysis, even academic exam preparation. Hence, of all the AI tools, ChatGPT, DeepSeek, Quillbot, and AI-driven tutoring platforms have taken education to a completely different level, providing the students access to more information at a much easier level of understanding and making academic tasks less complicated. AI enables students to generate ideas, refine writing, or automate monotonous tasks of how they study, all of which increase efficiency and productivity. Indeed, with the lack of an ethical check on an AI's actions, there is a risk of plagiarism, as said by Aydin et al., (2025). In addition, it may result in misplacing the importance of students' reasoning abilities in problem-solving and thinking critically in classes. Additionally, the access to these AI tools can further widen the social inequality among students. With the rise of AI as an integral part of academia, universities in Punjab are left to tame the fine line between using the perks affiliated with AI and combating its vulnerabilities so as to help students utilize AI responsibly and maximally for educational growth. Grammarly and Turnitin give you tools to improve your writing skills to make your writing better but by using the real time grammar and checking of plagiarism, thus promoting better academic integrity and professionalism. The AI driven tutoring platforms are also helping students learning complex concepts in subjects like

mathematics and science at their appropriate pace as Wulandari et al., (2024).

AI tools are not distributed equally in Punjab; urban students of better established universities in Pakistan also avail a bigger chunk of the AI resources whereas rural students in local universities have not been much exposed to AI at all and find it difficult to access reliable internet connectivity for their classes. The fact that there is this disparity points to the digital divide in educational opportunities. Rapidly, artificial intelligence (AI) is changing the education system and the opportunities and challenges imposed on the university students. AI based tools have all turned into an indispensable aspect of students' academic journey in Punjab, Pakistan; they help them in research, learning, and managing time. The use of these tools makes the students improve their academic performance, understand complex concepts as well as stay engaged in their studies. Personalized learning experiences are supported by AI for students with learning disabilities. At the same time, although AI has many benefits to offer, there have been some concerns over its too extensive use, among them, a drop in critical thinking, creativity, and independent problem solving. Growth of ethical issues like plagiarism and academic dishonesty is also growing. Moreover, although not all learners have equal access to AI tools, an AI digital divide develops between privileged and underprivileged learners. Another question is that they raise over the potential for AI to replace traditional teaching methods, and to alleviate the exercise of human interaction in education. By evaluating the impacts, addressing the shortcomings and their responsible use in Jumriah et al.,(2024), AI is likely one of the tools that should be always present in Schools to enhance learning.

The first problem at hand is that AI could ruin the ability to think and solve problems, because students could get too dependent on it to come up with the ideas, complete the tasks, and answer deeply complex questions. Overreliance on this type of thinking may make it difficult for them to come up with an original argument and set themselves apart. Meanwhile, AI tools also put forward ethical grey areas in academic integrity, such as the use of the tools to churn out plagiarized and AI generated contents without much effort, which may affect

academic integrity in education. A downside is that the accessibility gap is another disadvantage because not every student has the same opportunity to use advanced AI tools (because of financial issues or lack of digital literacy), making the gap between the haves and the have notes widened. Also, AI generated responses are not always accurate or in context, and students will be misled if they rely on the information as provided. Balanced usage of AI tools is crucial as they can be used if and only if it is not done irresponsibly, when they can easily weaken common learning processes and therefore also affect the sake of education. It is shown that the general reliability of expert judgment in AI timeline prediction is poor, congruent with previous studies on the general competence of experts in the context of Armstrong et al., (2014).

By integrating learning AI, is education becomes more personalized, engaging, intelligent tutoring and automated grading better outcomes and lessens administrative tasks. These technologies are well integrated in developed countries and help to streamline education and ease educators' workload Luckin & Holmes, (2016) and Hwang et al., (2020). There is much literature on the use of AI to improve performance on education. Personalized learning platforms and research assistants improve students' learning and research skills by providing tailored support, clarifying complex concepts Woolf, (2010). According to Li & Jan, (2023), the role of AI in raising student productivity and alleviating stress through the means of intelligent tutoring, automated feedback, and time management tools. However, of course, while there is more efficiency here in learning, there are some challenges: how dependent you become on the AI, privacy, and having less interaction with a human being. Traditional teaching may be replaced by AI, and so the student teacher connection might be lost Selwyn, (2019). Such AI tools allow students to be more autonomous about their learning and learn at a pace they set. Platforms like Khan Academy foster independent learning habits. AI tools also make students in Punjab more confident and more able to cope with time, although excessive use of AI can be used to undermine critical thinking Shoukat, (2024).

Moreover, AI is also thought to contribute to technologically savvy students, extremely important

for their future jobs Luckin & Holmes, (2016). Akavova et al., (2023) discuss AI driven adaptive learning in education and its value in personalizing instruction and improving engagement. They talk about what they, such as intelligent tutoring, data driven decision making, and automated assessment and they talk about ethics and data privacy and the digital divide. AI's possible future and the importance of taking a responsible approach to it are highlighted by the review. AI's use in education is just emerging in Pakistan. It is the usage of AI in higher education mostly concentrated to the urban areas with good digital infrastructure. However, grammar checking as well as plagiarism detection tools such as Grammarly or Turnitin are supplementary rather than part of central classroom curriculum Raheem et al., (2023). There are issues of underfunded institutions, lack of digital resources, as well as technical expertise regarding the broader adoption of AI. Real time feedback and personal learning improves the academic performance in developing countries through the use of AI tools.

Data privacy and has been explored as a challenge by Holmes & Porayska-Pomsta, (2023) as has bias and transparency. Risks of inequality, reduction of human oversight are highlighted and they call for ethical frameworks that guarantee fairness and accountability. However, the review defends responsible AI implementation to protect its 'students' rights and well-being'. There are challenges of digital divide, cost of AI tools, lack of awareness and training. In addition, high subscription costs as well as limited internet access in rural areas also exacerbate educational inequalities. According to the Technology Acceptance Model (TAM), perceived usefulness and ease of use affect to adopt technology. Thus, the acceptance of AI tools in Pakistani universities depends on what they understand to be their effectiveness in raising academic performance and in usability when practical resources Rizvi & Ali, (2024).

In their study, Rasheed et al., (2025) explore how personalized learning using the AI and how it can bring in equal access to education. Additionally, they bring attention to AI initiated tools that may adapt to an individual's needs, support various learners, and help out disadvantaged learners. Advantages that AI brings are that it helps in increasing the level of

engagement and inclusivity but the downside part is there are challenges like much digital infrastructure and ethical concerns. It provides an overview on AI's equal potential for education, with responsible implementation. As Pedro et al., (2019) have explored AI contribution into education and sustainable development, the benefits that AI can provide include personalized learning, automated assessment, and data based decisions. In addition, they discuss digital inequality, ethical risk and policies to ensure fair integration of AI. The study reasserts how completely AI is changing our world.

Both of these issues pertain to ethical issues. Some AI tools may be used to circumvent plagiarism checks or to automate assignments, thereby leaving student work suspect. Another concern is the lack of data privacy, especially, when thoughts from students in Pakistan are being processed by international AI tools for use in Pakistani classrooms Chinta et al., (2024). In Rane, (2024) paper, he talks about AI generative and its positive impact in education, which includes its ability to automate tasks, personalize learning, providing instant feedback. Additionally, he explores issues related to academic dishonesty, dependence on AI, and maintaining critical thinking. It discusses ethical issues of the data privacy and biases with ethical issues pertaining to responsible AI integration in education.

Ju, (2023) in this study, we examine the effect of generative AI on academic reading material learning efficacy. This implies that reliance on AI for writing tasks resulted in excessive reduction of comprehension accuracy, so we cannot blindly rely on AI tools. In AI dialogue systems, rely too much on, Zhai et al., (2024), examine how it reduces students' critical thinking, decision making, and analytical abilities. A preference for AI Hallucinations and AI shortcuts adds to their recurrent assault on independent analysis and threatens academic integrity. The study draws attention to the importance of fostering critical engagement with AI to provide children with cognitive development and integrity.

Education holds a lot of potential for AI, and it presents a personalized learning and better performance. Nevertheless, in Pakistan adoption of AI tools is still hindered by complication of digital inequality and ethical problems. Thus there is a need

to develop effective integration strategies and regulatory framework for the maximization of the benefits of AI while addressing the above issues accurately. Finally, I argue that while there is a promise of transformation of the educational environment for the university students of Pakistan by AI, the implementation is nonetheless a product of the developmental challenges confronting the country. Second, this research concentrates on the opportunities and challenges faced with the AI adoption in Punjab's higher education system.

Based on the analysis of all collected data, the next phase of our study will focus on interpreting the findings in the context of existing educational frameworks and digital learning environments. We will explore how the integration of AI tools impacts students' academic motivation, self-learning habits, and overall engagement with educational content, particularly in relation to writing and reading skills. Additionally, we will examine the role of learner support systems and institutional strategies in balancing technological assistance with the development of independent learning competencies. This will help us formulate practical recommendations for educators and institutions to enhance student learning outcomes while addressing the potential drawbacks of excessive reliance on AI-based tools.

Methodology:

A quantitative approach has been employed in this research to measure the effect of AI based tools on university student in Punjab, Pakistan. Data were gathered from the final year students of GC University, Lahore through a structured survey. The survey was focused on the usage patterns, usage perceptions and challenges of AI tools by the students from different departments to find out the commonalities and the differences. Sample of this study was 214 final year students of GC University, Lahore covering all the departments of various degrees. Participants were selected in such a way so as to represent the various geographic and academic disciplines from Punjab, Pakistan.

A self-administered questionnaire was used to collect data including: Demographic questions provided information on participant's age, gender, areas of residence, family income and such other relevant

background details. Usage and impact questions focused on Usage of AI Tools frequency of use, and integration into academic routines, Perceived Benefits of Student perceptions of how AI tools enhance learning experiences, improve academic performance, and facilitate problem-solving, and Challenges Faced Issues encountered by students, including access limitations, technical difficulties, and any perceived drawbacks of AI tool usage etc. Data analysis was conducted using SPSS Statistical Package for the Social Sciences (Corp., 2020) and involved the steps like, descriptive analysis were computed to summarize demographic characteristics of participants, as well as their responses regarding AI tool usage, benefits, and challenges, Chi-Square Test (Field, 2018) is used to examine the relationships and dependencies between categorical variables. To resolve if there are significant implications on AI tool usage pattern by different groups according to the demographic characteristic e.g. system administrator, information systems analyst, information systems designer, etc., this test was used to determine; factor analysis (Hair, 2019) to find underlying factors or dimensions within the AI tool usage data. This technique will give us a clearer picture of main constructs surrounding perceived benefits as well as challenges of AI tools.

Results and Discussion:

With this, the research procedure started with the construction of a thorough questionnaire which sought information about AI tool usage among university students. There were 6 demographic questions included in the questionnaire, and 35 others that dealt with the types of tools used, their frequency of use, what benefits it was perceived they provide, the challenges encountered with the use of these tools, etc. The questionnaire underwent a process of review and validation by a panel of the experts in educational technologies to ensure validity and reliability of the questions. After the development of the questionnaire, purposive sampling method was used to choose 214 students at the final year from various departments at GC University Lahore. Participation in AI tool features will be encouraged to include people who had probably exposed to AI toolers deeply. After the data collection period, the responses were checked to ensure completion and consistency. In order to maintain quality of the data, all incomplete or erroneous responses were excluded. This was also used to summarize the demographic information and patterns of AI tool usage. Categorical variables such as demographic characteristics and use of AI tool were explored through chi value tests. In addition, exploratory factor analysis was carried out to determine the underlying factors associated with the use of perceived benefits and challenges of using AI tools.

Table 1: Looking after Rotated Components Matrix for Factor Analysis:

Factors	Groups	Factor Label
F1	X ₇ = improvement of academic performance X ₈ = Understanding complex concepts X ₁₈ = Completion of assignments X ₁₉ = Motivation for studies	Academic Performance and Motivation
F2	X ₁₆ = Technologically savvy X ₃₀ = AI-based algorithms X ₂₉ = Scheduling & Organizing X ₂₈ = User-friendly	Technological Adaptation and Tools
F3	X ₃₀ = AI-based algorithms X ₂₃ = Encouragement of students to use AI for learning X ₂₄ = Integration of AI into teaching methods	AI in Education
F4	X ₂₇ = Role in shaping the future X ₂₁ = Critical thinking and problem-solving skills X ₂₅ = Effect on educational process	Critical Thinking and Future-Oriented Skills

F5	X ₃₂ = Negative impact in students X ₃₆ = Excessive dependence X ₂₆ = Loss of human connection between students and teachers	Negative Impact and Dependence on Technology
F6	X ₁₇ = Development of own opinions and ideas X ₃₇ = Independent learners X ₃₈ = Adaptable to change	Independent and Adaptable Learning
F7	X ₂₀ = Competitiveness in the job market X ₄₀ = Information about industry trends X ₄₁ = Effective problem-solvers	Career Preparedness and Industry Awareness
F8	X ₁₂ = Research skills X ₃₄ = Guidance on research methodologies	Research Skills and Methodologies
F9	X ₃₀ = AI-based algorithms X ₂₈ = User-friendly	Usability and Technological Integration
F10	X ₁₃ = Learning gap for students X ₁₀ = Diverse needs of students with learning disabilities	Educational Inclusivity and Accessibility
F11	X ₃₁ = Prevention of unintentional plagiarism X ₃₃ = Saving of students' time and effort	Academic Integrity and Efficiency
F12	X ₂₆ = Lose of human connection between students and teachers X ₃₉ = Lack of appreciation	Challenges in Teacher-Student Relationships
F13	X ₁₀ = Diverse needs of students with learning disabilities X ₁₁ = Replacement of traditional support systems	Student Support Systems
F14	X ₁₅ = Lack of understanding of the human experience X ₃₉ = Lack of appreciation	Humanistic Aspects in Education

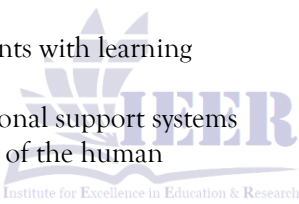


Table 2: Table of Hypothesis between variables:

Sr. no	Hypothesis	Pearson Chi-Square (df)	Likelihood Ratio (df)	Linear-by-Linear Association (df)	p-value
1	H ₀ = There is no association between X ₇ and X ₈ . H ₁ = There is association between X ₇ and X ₈ .	118.408 (16)	100.746 (16)	53.477 (1)	.000
2	H ₀ = There is no association between X ₉ and X ₁₀ . H ₁ = There is association between X ₉ and X ₁₀ .	43.699 (16)	43.200 (16)	7.050 (1)	.000
3	H ₀ = There is no association between X ₁₁ and X ₁₂ . H ₁ = There is association between X ₁₁ and X ₁₂ .	21.063 (16)	24.870 (16)	2.227 (1)	.176
4	H ₀ = There is no association between X ₁₃ and X ₁₄ . H ₁ = There is association between X ₁₃ and X ₁₄ .	16.656 (16)	16.841 (16)	2.772 (1)	.408
5	H ₀ = There is no association between X ₁₅ and X ₁₆ . H ₁ = There is association between X ₁₅ and X ₁₆ .	40.524 (16)	43.410 (16)	.212 (1)	.001
6	H ₀ = There is no association between X ₁₇ and X ₁₈ . H ₁ = There is association between X ₁₇ and X ₁₈ .	41.899 (16)	43.458 (16)	2.787 (1)	.000
7	H ₀ = There is no association between X ₁₉ and X ₂₀ . H ₁ = There is association between X ₁₉ and X ₂₀ .	61.401 (16)	54.145 (16)	20.669 (1)	.000
8	H ₀ = There is no association between X ₂₁ and X ₂₂ . H ₁ = There is association between X ₂₁ and X ₂₂ .	9.447 (16)	9.933 (16)	.000 (1)	.306
9	H ₀ = There is no association between X ₂₃ and X ₂₄ . H ₁ = There is association between X ₂₃ and X ₂₄ .	69.648 (16)	65.243 (16)	26.467 (1)	.000
10	H ₀ = There is no association between X ₂₅ and X ₂₆ .	22.406 (16)	17.019 (16)	.575 (1)	.033

11	\mathcal{H}_1 = There is association between X_{25} and X_{26} . \mathcal{H}_0 = There is no association between X_{27} and X_{28} .	88.167 (16)	73.592 (16)	40.314 (1)	.000
12	\mathcal{H}_1 = There is association between X_{27} and X_{28} . \mathcal{H}_0 = There is no association between X_{29} and X_{30} .	54.717 (16)	57.878 (16)	25.216 (1)	.000
13	\mathcal{H}_1 = There is association between X_{29} and X_{30} . \mathcal{H}_0 = There is no association between X_{31} and X_{32} .	48.581 (16)	52.155 (16)	10.068 (1)	.000
14	\mathcal{H}_1 = There is association between X_{31} and X_{32} . \mathcal{H}_0 = There is no association between X_{33} and X_{34} .	58.842 (16)	47.731 (16)	8.062 (1)	.000
15	\mathcal{H}_1 = There is association between X_{33} and X_{34} . \mathcal{H}_0 = There is no association between X_{35} and X_{36} .	23.119 (16)	10.741 (16)	2.765 (1)	.003
16	\mathcal{H}_1 = There is association between X_{35} and X_{36} . \mathcal{H}_0 = There is no association between X_{37} and X_{38} .	116.528 (16)	73.357 (16)	25.286 (1)	.000
17	\mathcal{H}_1 = There is association between X_{37} and X_{38} . \mathcal{H}_0 = There is no association between X_{39} and X_{40} .	41.508 (16)	44.743 (16)	8.830 (1)	.000
18	\mathcal{H}_1 = There is association between X_{39} and X_{40} . \mathcal{H}_0 = There is no association between X_1 and X_7 .	7.058 (4)	7.142 (4)	2.627 (1)	.133
19	\mathcal{H}_1 = There is association between X_1 and X_7 . \mathcal{H}_0 = There is no association between X_{27} and X_{36} .	76.239 (8)	15.054 (8)	.116 (1)	.000
20	\mathcal{H}_1 = There is association between X_{27} and X_{36} . \mathcal{H}_0 = There is no association between X_1 and X_{16} .	3.420 (4)	3.281(4)	1.446 (1)	.490
21	\mathcal{H}_1 = There is association between X_1 and X_{16} . \mathcal{H}_0 = There is no association between X_1 and X_{19} .	11.264 (4)	12.301(4)	8.188 (4)	.024
22	\mathcal{H}_1 = There is association between X_1 and X_{19} . \mathcal{H}_0 = There is no association between X_{30} and X_{34} .	28.648 (16)	32.703 (16)	1.125 (1)	.026
23	\mathcal{H}_1 = There is association between X_{30} and X_{34} . \mathcal{H}_0 = There is no association between X_{30} and X_{39} .	38.216 (16)	34.656 (16)	11.258 (1)	.001
24	\mathcal{H}_1 = There is association between X_{30} and X_{39} . \mathcal{H}_0 = There is no association between X_{25} and X_{27} .	81.052 (16)	77.028 (16)	34.966 (1)	.000
25	\mathcal{H}_1 = There is association between X_{25} and X_{27} . \mathcal{H}_0 = There is no association between X_6 and X_{19} .	25.481 (16)	20.340 (16)	5.365 (1)	.080
	\mathcal{H}_1 = There is association between X_6 and X_{19} .				

They were then interpreted to learn something about student AI tool use, the upsides and pitfalls of using AI tools. The research team or academic advisor was reviewed with a detailed report that provided statistical summaries and key insights and was validated with the research team. During the study, ethical issues were considered at all times, meaning that informed consent of participants, confidentiality, and anonymity of their responses were all met. Feedback was also used to refine the final report and to cope with any problems it was found in the reviewing process. The analysis of data on how AI is seen by the respondents provides us key insights about respondent's perceptions on AI in education. The participants, who were assessed to be urban residents, day scholars at Punjab living in 18-25 yrs age group and with varying family incomes, were evenly split between males and females, out of which 214 took part. Different from this, a majority agreed with a positive stance on AI's influence, as it aids in better academic performance, provides better means to understand complex concepts and fills gaps

in one's learning. Respondents also remarked on how easy to use the AI tools were, and how they could order tasks and automate the research process. Additionally, using the Chi-square analysis, numerous variables showed statistically significant association between the key variables implying strong relationships between students' demographic characteristics, academic behavior, and perceptions of usage of the AI tool. This was also confirmed for instance in the cases where associations between variables like X7 (improvement in academic performance) and X8 (understanding the complex concepts) resulted to highly significant value ($p = .000$) where those who find the AI tools to do so in terms of improving in academic performance also find the specialist tools to do the same in terms of understanding complex academic materials. Also, X19 (motivation in studying) showed strong relations with X20, X29 (scheduling, arranging), and X30 (AI algorithms), as well as X25 (impact on educational process) and X27 (contribution to shaping the future), where the p-values were highly significant, as

it suggested that use of AI is positively associated to motivation, organizational habits, on the path of the future. However, there were some relationships that were not significant such as between X13 and X14, or between X1 (demographic variable) and multiple AI usage variables – indicating that some factors within the data do not indicate the large increase in the way in which students rely on AI tools in completing their university assignments which is a valid and pertinent point regarding the decrease of critical thinking skills and the development of self-writing ones. The Negative Impact and Dependence on Technology factor is derived from four variables; 'excessive dependence', 'negative impact on students', and 'loss of human connection between students and teachers'. This reinforces observations about students relying on AI to a high degree more as a shortcut for academics work than it is utilized as learning aid. Moreover, these chi square results support that these variables are associated significantly with some of the other variables related to academic performance and also to the usability of AI (X7, X8, X18, and X19), showing that AI might facilitate academic efficiency but it also implies that students' ability to think independently and express themselves are decreased. Additionally, another factor, Academic Integrity and Efficiency (X31 and X33), notes that while AI can avert plagiarism and take the time out of your students' hands, this may actually result in students' incentive to sidestep the crucial process of web-building knowledge. However, the lack of significant associations in some instances, such as for variables pertaining to human experience and appreciation (X15 and X39) further indicates that students may be underestimating the importance of personal participation in the learning tasks. Overall, the AI data suggests that while being convenient and boost academic output, students are increasingly relying on AI to write assignments, which is eroding their self-writing skills, critical thinking, and creativity and so on. Therefore, educational institutions should adopt balanced strategies by encouraging the use of AI in educational institutions before going through the use of it, while simultaneously developing student's analytical writing skills to achieve sustainable learning outcomes. However, ground may not directly affect AI tool effectiveness.

However, some pairs of variables did not show statistically significant association as the p-values were more than 0.05. The pairs of them are: X11 (replaced for conventional support systems); X12 (research skills); X13 (learning gap for student); X14 (replaced for human teacher or teacher); and X21 (critical thinking and problem solving skills), X22 (the most effective teaching strategies). Since these pairs of variables lack statistical importance, this implies that they are not strongly associated in the given data set. It sheds light on the key variable relationship and how this can assist decision making and further research.

To add further depth, the variables were further factored and binned into coherent, thematic constructs. Among the fourteen distinct factors extracted, each factored is representative of one of the key domain in students' experiences with AI in education. The first factor, Academic Performance and Motivation, grouped together variables related to students improvement of academic performance, understanding complex concepts, completing assignments and motivation to studies wherein that is a close relationship between use of AI and its relationship to the students' engagement with learning. For the second factor, Technological Adaptation and Tools, there were variables concerned with being technologically savvy, as well as the usage of AI algorithms in managing academic tasks, reflecting how students are changing to and making use of digital tools. An additional close by related factor, that of AI in Education, alluded to the prevalent incorporation and establishment of AI in study hall conditions. In addition, Critical Thinking and Future Oriented Skills factor was noted separately, that students perceive AI as a tool to facilitate current tasks but also to develop critical thinking in future.

Insights from factors linked with concerns and challenges are also equally important. Secondly, the fifth factor, Negative Impact and Dependence on Technology, is when students were worried about over dependence on AI, loss of human race, and other possible negative impacts including on student teacher relationship. Another factor, Challenges in Teacher-Student Relationships added to this concern because it highlighted the emotional and interpersonal gap perceived to come about due to

increased use of AI. An opposing result was obtained with the Independent and Adaptable Learning factor, as students said they were learning to be more self-directed and adaptable, at least partly because of AI. Furthermore, the Career Preparedness and Industry Awareness were also positively recognized by students as AI can use in making their job competitive in the market and it can update themselves with the industry trends.

The analysis also highlighted the importance of AI in research skills, usability and technological integration, as well as AI's use in offering diversified learning requirements, and which are mainly focused on the development of learning skills, user friendly design of AI tools and dimensionality of AI tools in delivering diverse learning needs, particularly for students with disabilities. Additionally, Academic Integrity and Efficiency assessed the practical benefits of AI in such academic tasks through components such as prevention of unintentional plagiarism and time saving. The humanistic concerns were, finally, bunched together into one factor called Humanistic Aspects in Education that pointed to the student fears of AI's inability to replace the 'nude, emotional' elements of learning.

In factor labeling procedure, key dimensions of the educational data are organized into different factors which represent a certain aspect of the learning experience uniquely. From technological adaptation, AI integration, critical thinking, to the importance of academic performance and career preparedness, factors are the spectrum of themes. Additionally, it encourages minds to contemplate technology's bad affects, the requirement regarding independent learning, and the necessity that people will be inclusive and informed themselves on matters of academic integrity. However, overall the procedure offers a well-structured view from what different aspects of modern education as to what has been happening in the education world, showing both the opportunities and the challenges.

Improvement and Suggestions Report Based on Factor Analysis Results:

Academic Performance and Motivation:

AI tools are proving effective in enhancing students' academic performance, helping them grasp complex concepts, and increasing motivation. However,

improvements can be made by integrating Assignments should blend AI assistance with personal interpretation to ensure balanced development of analytical skills.

Technological Adaptation and Tools:

While students are adapting well to technological tools, continued digital literacy education is essential. Institutions should provide workshops on AI functionality, critical evaluation of AI outputs, and ethical usage. Curricula should include AI fluency components that go beyond usage—encouraging students to understand AI mechanisms, limitations, and applications.

AI in Education:

The integration of AI in classrooms requires strategic implementation. Rather than replacing teachers, AI should serve as a pedagogical aid. Educators should be trained to use AI as a facilitative tool and adopt blended teaching models that combine human instruction with AI support. Clear policies must be established to guide responsible and effective AI integration.

Critical Thinking and Future-Oriented Skills:

AI's ease of use can suppress critical thinking if overused. To address this, instructors should incorporate assignments that require evaluation and comparison of AI-generated and self-generated work.

Negative Impact and Dependence on Technology

Students' dependence on AI risks undermining their self-reliance and academic integrity. Institutions should monitor and limit excessive AI reliance by setting rules for AI use in assessments and promoting academic honesty.

Independent and Adaptable Learning:

AI promotes self-directed learning, and this should be cultivated through personalized AI-powered learning dashboards, goal tracking tools, and flexible learning paths. Educators must monitor student autonomy to ensure they stay on a constructive track. Human guidance should complement adaptive learning technologies for optimal results.

Career Preparedness and Industry Awareness:

Students acknowledge AI's role in preparing them for competitive job markets. Institutions should respond by integrating industry-grade AI tools into courses, offering virtual internships, and hosting seminars with industry professionals. Students should be trained to assess AI trends and align academic learning with market needs.

Research Skills and Technological Integration:

Training sessions on AI-assisted literature reviews, citation tools, and data analysis are necessary. Students should be taught to cross-verify AI-generated information with authentic sources and document their research processes transparently.

Diversified Learning Needs and Accessibility:

To maximize AI's potential in meeting diverse learning needs, platforms must be inclusive—supporting multiple languages, visual aids, and accessibility features. Institutions should audit AI tools for equity and ensure students with disabilities or from underserved backgrounds receive appropriate support and training.

Academic Integrity and Efficiency:

AI helps prevent unintentional plagiarism and saves time, but risks replacing meaningful engagement. To

address this, universities should revise honor codes to include AI guidelines, and educators should require students to submit reflective reports or usage logs explaining how AI tools were used.

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Humanistic Aspects in Education:

Students fear losing the emotional dimension of learning. This concern should be addressed by preserving the humanities in education and incorporating courses on empathy, ethics, and communication. AI should be a tool that supports, not replaces, the emotional and interpersonal dimensions of learning.

Factor Labeling and Thematic Constructs:

The organization of educational data into thematic constructs highlights key trends in student experiences. Future research should continue refining these themes through regular evaluation and stakeholder feedback.

Table 3: Summary Table of Factors, Insights and Recommendations

Factor	Key Insight	Improvement Suggestion
Academic Performance and Motivation	AI boosts performance and motivation	Combine AI with reflective, analytical tasks
Technological Adaptation and Tools	Students adapt well to tools	Offer AI literacy and evaluation training
AI in Education	AI is prevalent in classrooms	Develop blended human-AI pedagogy and policies
Critical Thinking and Future Skills	Risk of critical thinking decline	Assign evaluation and independent thinking tasks
Negative Impact and Dependence	High reliance on AI for tasks	Limit overuse, promote academic independence
Independent and Adaptable Learning	Encourages autonomy	Use AI dashboards with human oversight
Career Preparedness and Industry Awareness	AI supports market readiness	Include real-world tools and industry training
Research Skills and Tech Integration	Facilitates research	Train ethical and accurate AI research methods

Diversified Needs and Accessibility	AI supports varied learners	Ensure inclusive, accessible AI platforms
Academic Integrity and Efficiency	Reduces plagiarism, saves time	Require usage logs and reflective components
Humanistic Aspects in Education	Fear of losing emotional learning	Keep humanities and ethics in curriculum
Factor Labeling and Constructs	Shows learning spectrum	Continue thematic refinement with feedback

Research skills as well as academic integrity must be given more priority, especially through the use of AI. AI tools that aid in detecting plagiarism, free time, and provide guidance on the right research method should be used and encouraged by institutions. Teachers should also go to the awareness session to inform the students on how to use AI in an ethical manner and promote critical thinking and responsible use of technology.

Finally, although the data lends credence to the conclusion that the use of AI in education is effective in the absence of strategic planning for implementation, policy and for continuous evaluation. We need an approach that combines technological advancement with the human values of equity, accessibility and makes sure the AI becomes a useful force for educational change and not a disruptive one.

Conclusion:

The AI based tools offer great benefits to Punjab university students in Pakistan on academic performance and academic efficiency. However, there are several issues to face with regard to ethical issues, over reliance, and unequal access to AI technologies. Finally, the conclusion reports on the fraction of students that use AI tools and how these tools contribute to students’ study as well as the connotations between various factors. This is an index of the agreement and disagreement in the use of AI tools between participants. AI tools and their effects are used equally by urban and rural students. Also, students from STEM (Science, Technology, Engineering and Mathematics) and non-STEM fields alike demonstrate same adoption and proficiency of these tools.

The overall conclusion is based on the information from the complete data set (chi square tests, factor analysis, and descriptive insights) and it is concluded that the AI based tools significantly and have a dual

effect on the university students in Punjab, Pakistan. As the statistical results indicate, there are strong associations between numbers of AI usage and numerous academic and psychological outcomes. For this reason, AI makes the students to perform academically superb, comprehend advanced topics, and solve assignments and motivate students. Furthermore, AI enables adaptation of technological, independent learning, and career readiness by exposing the students to the current trends in the industry and enhancing the critical thinking and problem solving skills.

However, there are serious concerns as expressed in the data. However, the huge number of students resort to AI to do homework with the intent to get everything done to study, and they tend to inefficient overuse of technology, which results in obvious deterioration in self-filling potential of the person, and in their excessive reliance on technology.

Additionally, the findings identified the loss of meaningful student teacher interaction, the risk for academic dishonesty, loss of human connection, and a weakened sense of human connection. Analysis of factor emphasized on negative impacts on cognitive growth as well as challenges in educational inclusivity and the erosion of traditional support systems because of dependency on AI.

While AI tools have a lot to offer for education, they also have several risks, which could compromise the core educational values. The conclusion urges for an integrated AI into education using a balanced and directed approach, encouraging its fair use, fostering the digital literacy, creating an opportunity for original thought, ethical learning and thriving student-teacher relationships to nurture holistic development of the students.

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