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Original Article

Association between Perception Constructs and Attitude towards Adoption of Artificial Intelligence as a Teaching Tool among Medical Students

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ABSTRACT

Objective: To determine the association between key perception constructs measured using the technology acceptance model (TAM) questionnaire and attitude towards adoption of artificial intelligence (AI) as a teaching tool among medical students in Pakistan.

Methodology: This cross-sectional analytical study was conducted at Allama Iqbal Medical College, Lahore, from September 2025 to February 2026 after ethical approval. Two hundred and eighty five MBBS students aged ≥18 years of any gender were included using a non-probability convenience sampling technique after obtaining informed written consent. Students with prior AI experience or enrollment in AI programs were excluded. A predesigned TAM questionnaire was used to collect data. The data was entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 21. The key perception constructs, perceived usefulness (PU) and perceived ease of use (PEU), were compared with the main dependent outcome, i.e., attitude towards AI use.

Results: The mean age of the participants was 21.5±1.5 years. Most students were females [156(54.7%)] and majority of the students belong to 4th year MBBS [105(36.8%)]. Multivariable regression showed that perceived usefulness had a significantly positive association with attitude towards AI adoption (p-value=0.001) whereas perceived ease of use demonstrated a weak but significant negative association with attitude (p=0.005).

Conclusion: Perceived usefulness is found to be a primary driver of AI adoption among medical students. However, perceived ease of use demonstrated a small but significant negative association with attitude, suggesting that its role may be secondary when usefulness is accounted for in the model.

Keywords: *Artificial intelligence. Machine learning. Adoption. Chatbots. ChatGPT.*

INTRODUCTION

The advent of emerging technologies has significantly rephrased educational paradigms across the globe. In the digital world, students' expectations for learning tools are evolving, and today's era demands the development of personalized, systematic, and innovative tools. However, over the past two decades, the incorporation of artificial intelligence (AI) into medical education has remained limited. This limited use highlights the need to reevaluate teaching methodologies and consider emerging approaches.[1] Artificial intelligence refers to systems and processes that can adapt to the latest information, support decision making, and solve problems.[2] In medical education, AI guides to improve future healthcare professionals' training, enabling them to utilize flexible teaching methods and innovative learning practices.[3]

A study conducted in Kuwait reported on the awareness of AI principles and familiarity with basic terms used in AI among 352 university students. The findings showed moderate awareness (50%) of basic principles, and 60% of respondents had a good understanding of AI concepts. A large majority (93.4%) were comfortable with AI vocabulary. Most students (83.5%) believed that using AI would enhance their efficiency and productivity, but many also reported a need for training on the appropriate use of AI.[4]

To address the challenges of AI adoption in medical education, the widely used technology acceptance model (TAM) offers a theoretical framework for understanding how students accept and use AI tools. This model is based on the theory of reasoned action and emphasizes key cognitive constructs such as perceived usefulness (PU) and perceived ease of use (PEU) in determining students' attitudes toward adopting technology.[5]

As healthcare undergoes rapid digital transformation and AI is becoming increasingly integrated into daily life and clinical practice, the willingness of future physicians to adopt these technologies is a key determinant of their successful implementation. However, evidence regarding medical students' perceptions and acceptance of AI remains limited in Pakistan. Evaluating these perceptions can help shape resource allocation, curricular planning, and capacity building initiatives within medical education. Such evidence can also serve as a needs assessment for the integration of AI into medical

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curricula. Therefore, this study was designed to assess medical students' attitudes towards AI adoption and determine their association with the key TAM constructs, perceived usefulness and perceived ease of use.

METHODOLOGY

This cross-sectional analytical study was conducted at Allama Iqbal Medical College, Lahore, from September 2025 to February 2026 after ethical approval from the institutional review board (Letter No. ERB/192/5/07-08-2025/AIMC/JHL, 07-08-2025). A sample size of 212 was calculated at a 95% confidence level, 5% margin of error, and an anticipated prevalence of perceived usefulness at 83.5% among students.[4] However, 285 MBBS students were enrolled using a non-probability convenience sampling technique from a total population of 1,750 medical students. Participants aged ≥18 years of either gender who provided informed written consent were included, while those with prior formal training in artificial intelligence were excluded. Data was collected through Google Forms using a predesigned TAM questionnaire comprising five domains: perceived usefulness, perceived ease of use, attitude towards use, behavioral intention, and actual usage.[5] Responses were measured on a five point Likert scale comprising strongly agree, agree, neutral, disagree, and strongly disagree. Exploratory factor analysis (EFA) was performed to determine the underlying factor structure of the perception items. Sampling adequacy and factorability were confirmed using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. Principal component analysis with Varimax rotation was applied, and factors were retained based on Eigenvalues >1, scree plot analysis, and factor loadings ≥0.40. Internal consistency of the identified constructs was assessed using Cronbach's alpha, which demonstrated good reliability for perceived usefulness (α=0.864) and perceived ease of use (α=0.815).

STATISTICAL ANALYSIS

The data was entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 21. Quantitative variables were presented as mean±standard deviation (SD), while qualitative variables were presented as frequencies & percentages. Multivariable linear regression analysis was performed to determine the association of TAM constructs (perceived usefulness and perceived ease of use) with attitude toward AI use. Both unstandardized coefficients (B), representing absolute effect size, and standardized coefficients (β), allowing comparison of relative predictor strength, were reported along with p-values and confidence intervals. Model fit was assessed using the coefficient of determination (R^2) and overall model significance. A p-value <0.05 was considered statistically significant.

RESULTS

This study of 285 medical students reveals a slight female majority (54.7%) and a high proportion of hostel residents (65.6%). The mean age of the participants was 21.5±1.5 years. Participants were enrolled across all years of the MBBS program, with 4th year students constituting the largest cohort (36.8%). Table 1 presents the detailed descriptive analysis of the participants and their responses to the TAM questionnaire.

The mean score of attitudes toward AI adoption was 4.00±0.719. The mean scores for the two key TAM perception constructs, perceived usefulness and perceived ease of use, were 3.96 ± 0.658 and 3.95 ± 0.618, respectively.

Multiple linear regression analysis showed that perceived usefulness and perceived ease of use were significant predictors of attitude toward AI adoption among medical students. The regression model was statistically significant ($p < 0.001$) and explained 78.6% of the variance in attitude toward AI adoption, as accounted for by PU and PEU ($R^2 = 0.786$). Perceived usefulness was a strong positive predictor of attitude toward AI adoption ($B = 1.021$, $\beta = 0.934$, $p = 0.001$), indicating that higher perceived usefulness was associated with a more favorable attitude. Perceived ease of use was a small but statistically significant negative predictor ($B = -0.108$, $\beta = -0.093$, $p = 0.005$). Overall, perceived usefulness emerged as the dominant determinant of attitude toward AI adoption in the model (Table 2).

DISCUSSION

The present study demonstrates a high level of adoption of AI tools among medical students, with frequent usage and predominantly positive attitudes. Our participants had a mean age of 21.5±1.5 years with slight female predominance (54.7%). About 67% of participants had been using AI tools for medical studies daily. The mean scores for the key TAM constructs, perceived usefulness and perceived ease of use, were 3.96±0.658 and 3.95±0.618, respectively. The regression model yielded an R^2 value of 0.786, indicating that both factors explained 78.6% of the variance in students' attitudes toward AI adoption. A study conducted in India predicted

the adoption of artificial intelligence in higher education. They reported that most participants were male (54.1%) and aged between 21 and 23 years. A total of 176(43.9%) participants reported using AI in their daily routine. The mean PU and PEU scores were 3.68±0.76 and 3.30±0.87, respectively, and were significantly associated with AI adoption (p <0.01). Further analysis showed that PU and PEU explained 55.8% of the variance in AI adoption among students.[6]

Multivariable linear regression in this study showed that perceived usefulness had a significantly positive association with attitudes toward AI adoption (p=0.001), whereas perceived ease of use demonstrated a small but statistically significant negative association with attitudes (p=0.005). Another study reported the influence of PU and PEU on users' attitudes toward AI chatbot usage. Consistent with our findings, perceived usefulness had a significant positive effect on attitudes (β=0.63, p <0.01). However, in contrast to our results, that study reported a weak but positive and significant association between perceived ease of use and attitudes (β=0.29, p <0.01).[7] Alyoussef et al. examined the factors influencing AI adoption in higher education and reported that a majority of participants were aged between 23 and 26 years, with a slight female predominance (54%). Perceived usefulness (β=0.51, p <0.001) and PEU (β=0.43, p <0.001) were significant predictors of AI adoption, indicating that both utility and usability play important roles in shaping users' attitudes and behavioral intentions toward AI based tools.[8]

Table 1: Distribution of Responses to the TAM Questionnaire among Medical Students

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Using AI chatbots would improve my performance in studies	78(27.4%)	157(55.1%)	32(11.2%)	9(3.2%)	9(3.2%)
Using AI chatbots during work would improve my productivity	95(33.3%)	126(44.2%)	32(11.2%)	25(8.7%)	7(2.4%)
Using AI chatbots would enhance my effectiveness in studies	71(25%)	171(60%)	22(7.7%)	12(4.2%)	9(3.15%)
Learning to operate the AI chatbots would be easy for me	75(26.3%)	160(56.1%)	37(13%)	8(2.8%)	3(1%)
I would find it easy to get AI chatbots to do what I want them to do	70(24.5%)	153(53.7%)	48(16.8%)	9(3.15%)	5(1.7%)
I would find the AI easy to use	74(26%)	162(56.8%)	37(13%)	8(2.8%)	4(1.4%)
I am confident in using AI within my learning process.	72(25.2%)	133(53.6%)	49(17.2%)	10(3.5%)	1(0.3%)
I have the knowledge and expertise to use AI chatbots for my learning.	48(16.8%)	132(46.3%)	78(27.3%)	26(9.1%)	1(0.3%)
I intend to use AI chatbots for medical education to enhance my learning outcome	74(26%)	151(53%)	45(15.8%)	10(3.5%)	5(1.7%)
I utilize AI within my medical studies daily	62(21.7%)	129(45.2%)	52(18.2%)	26(9.1%)	16(5.6%)
I utilize AI within my medical studies every week	75(26.3%)	162(56.8%)	27(9.4%)	13(4.5%)	8(2.8%)
Using AI for learning processes is a wise idea	74(26%)	155(54.3%)	43(15.1%)	4(1.4%)	9(3.15%)
AI chatbots are a positive tool for learning processes in medical education	75(26.3%)	163(57.2%)	39(13.6%)	6(2.1%)	3(1%)
I plan on using AI for learning purposes regularly in the future.	81(28.4%)	139(48.8%)	43(15.1%)	17(6%)	5(1.7%)

Table 2: Multivariable Linear Regression Analysis showing the Association of Perceived Usefulness and Perceived Ease of Use with Attitude towards AI Adoption

Perception Constructs	Unstandardized coefficient (B)	Standard error	Standardized coefficient (β)	p-value	95% Confidence Interval	
					Lower limit	Upper limit
Perceived Usefulness (PU)	1.021	0.036	0.934	0.001	0.951	1.092
Perceived Ease of Use (PEU)	-0.108	0.038	-0.093	0.005	-0.183	-0.033

A study among business students reported that 16% of participants used AI tools daily, indicating comparatively lower frequency of use than that observed in the present study. The mean PU (4.03±0.72) and PEU (4.04±0.74) scores were slightly higher than those reported in the present study. Perceived usefulness was found to be significantly associated with intention to use AI (β=0.567; p-value=0.000). However, contrary to our results, PEU was not found to be associated with intention to use.[9] Sallam et al. conducted a validation study on medical students, where a TAM based framework was specifically used for one AI chatbot, ChatGPT. They reported high mean scores for PU and PEU, which significantly determine users' attitude towards AI adoption and usage.[10] Similar findings are also reported by a multinational study where ChatGPT usage was found to be directly associated with higher GPA scores.[11] Students who perceived AI as beneficial for improving academic performance showed higher adoption and positive attitudes, reinforcing that perceived usefulness is the primary driver of adoption.[12]

In the present study, most participants demonstrated a positive intention toward adopting AI in medical education. Nearly four fifths of the respondents (78.9%) agreed that they intended to use AI chatbots to enhance their learning outcomes, while 77.2% reported plans to use AI regularly in the future. Furthermore, 80.3% considered the use of AI in learning to be a wise idea, and 83.5% viewed AI chatbots as a positive tool for medical education. These findings are consistent with those of Ibrahim et al., who reported that more than 90% of participants intended to use chatbots in the near future.[13] A study conducted in Abbottabad, Pakistan, among medical and dental students reported the use of various AI tools in academic activities. The most frequently used AI tool among students was ChatGPT, particularly for advanced medical studies and research purposes.[14] Another study was conducted in Pakistan at Jinnah Medical College, Peshawar, and showed that 71% of medical students perceived AI as a potential tool for both undergraduate and postgraduate medical education.[15] The favorable perception of AI observed in our study is further supported by qualitative evidence showing that ChatGPT provides immediate responses to students' queries, timely feedback, and continuous learning support outside the classroom.[16] The proactive behavior of medical students as well as physicians, the perceived usefulness of AI tools, and rapidly evolving medical education demand the adoption of advanced digital technologies to prepare and fully equip our future generation.[17]

CONCLUSION

Medical students perceive artificial intelligence as highly useful, resulting in a positive attitude toward the adoption of AI in their education. Perceived usefulness emerged as the primary driver of AI adoption among medical students. Perceived ease of use demonstrated a small but statistically significant negative association with attitude, suggesting that its role may be secondary when usefulness is accounted for in the model. A majority of respondents reported integrating AI tools into their daily or weekly academic routines, reflecting strong acceptance and perceived enhancement of academic performance. Overall, the findings suggest that AI chatbots are becoming an important component of medical education and are likely to remain integrated into students' future academic practice.

LIMITATIONS & RECOMMENDATIONS

The cross-sectional study design and convenience sampling technique are among the few limitations in this study. Since the study was conducted at a single center with a relatively small sample size, the findings may not be representative of all medical students. Multi-centered study designs with large sample sizes from both public and private medical colleges are recommended. Additionally, the students should be sensitized and trained in AI during medical undergraduate programs to foster a holistic learning environment and develop clinical skills, making a difference in patients' lives.

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Authors' Contributions:
A.A: Conceived and designed the study, interpreted data, and critically revised the manuscript.
S.S: Analyzed data, interpreted results, and drafted the manuscript.
A.R: Conducted literature review, assisted in data collection, and reviewed the manuscript.

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