ORIGINAL ARTICLE https://doi.org/10.52206/jsmc.2025.15.2.997 OPEN ACCESS

Effect of ChatGPTon Various Aspects of Undergraduate Medical Education

Khurram Naushad,[1] Afreenish Malik,[2] Maidha Jadoon,[3] Dure Saman,[3] Raima Bilal,[3] Roohullah[4]

1. Khyber Girls Medical College, Peshawar, Pakistan
2. IHPER, Khyber Medical University, Peshawar, Pakistan
3. DMER, Women Medical & Dental College, Abbottabad, Pakistan
4. Pak International Medical College, Peshawar, Pakistan

ABSTRACT

Background: Artificial intelligence (AI) has emerged as a transformative tool across various domains, including medical education. AI applications, such as ChatGPT, present new opportunities for enhancing student learning, instructional strategies, clinical scenario simulations, and collaborative learning.
Objective: This study examines the impact of Artificial Intelligence on various aspects of undergraduate medical education.
Materials and Methods: This study employed a quantitative cross-sectional design to assess the impact of AI in medical education. A total of 300 participants, including medical students, educators, and healthcare professionals, were surveyed. The study was conducted over six months (June to December 2023) across multiple medical institutions. Scenario modeling was used to simulate clinical cases, where participants engaged in AI-assisted diagnostic decision-making and learning activities in a controlled academic setting. Ethical approval was obtained from the Institutional Review Board (IRB) of Women Medical & Dental College Abbottabad. Data were collected using a structured questionnaire, which evaluated AI's role in student learning, collaborative education, and instructional methods. Factor analysis and Cronbach's alpha were used to validate the questionnaire's reliability and construct validity.
Results: It revealed significant positive impacts, with 80% showed improved learning experiences and 85% acknowledging the benefits of simulated clinical scenarios. Collaborative learning effectiveness was recognized by 70%, mainly among educators who noted adaptability. Reliability measures showed strong internal consistency (Cronbach's alpha values), and factor analysis highlighted key dimensions such as Personalized Learning.
Conclusion: This research provides empirical evidence in support of using AI in medical education. The results indicate that AI applications can improve student learning outcomes, enhance teaching, and even assist in the simulation of clinical scenarios. These finding further indicate research directed towards optimising advanced technology in medical education.
Keywords: Artificial intelligence (AI), AI in healthcare, Clinical simulations, Collaborative learning, Medical education, Student learning.

This article may be cited as: Naushad K, Malik A, Jadoon M, Saman D, Bilal R, Roohullah. Effect of ChatGPTon Various Aspects of Undergraduate Medical Education. *J Saidu Med Coll.* 2025;15(2):261-267. https://doi.org/10.52206/jsmc.2025.15.2.997

INTRODUCTION

Over the past few years, the field of medical education has been disrupted by powerful advances in artificial intelligence (AI).[1] It refers to a computer system's ability to perform functions that would normally be carried out by a human, including problem-solving and decision-making and understanding languages.[2] In modern educational technologies, ChatGPT, IBM Watson, and Bard AI, are being increasingly integrated into education to enhance learning efficiency, provide real-time feedback, and improve student engagement.[3]

AI had significant role in healthcare as well as medical education through aiding diagnosis, treatment planning, medical research, and training.[4] In the context of medical education, AI-based tools help learners understand complicated fundamentals, self-study, and role-play clinical scenarios. ChatGPT is an advanced AI language model that facilitates active learning, case-based discussions, and personalised study assistance making it a valuable tool for both students and educators.[5]

Correspondence: Dr. Khurram Naushad
Khyber Girls Medical College, Peshawar, Pakistan
Email: khurram.naushad@yahoo.com

Received: June 12th, 2024 - 1st Revision: August 06th 2024
2nd Revision: March 03rd 2025 - 3rd Revision: March 18th 2025
Accepted: March 22th, 2025

Multiple studies show that ChatGPT can be beneficial in medical education, especially in areas like simulated clinical training, problem-solving, and knowledge retention.[6] Studies show that ChatGPT competes at the level of third-year medical students during the United States Medical Licensing Examination (USMLE) standardised exams making medical education more accessible and efficient.[7] Despite these benefits, the risks and challenges the integration of AI into education raise many other concerns, data accuracy, ethics, and over-reliance on AI-generated content, require further exploration.

This study seeks to answer the question: how effective is AI, particularly ChatGPT, in enhancing student learning, supporting collaborative education, and improving clinical scenario training in medical education?

The implementation of AI in medical education has the potential to innovate modernize learning approaches, provide tailored study plans, and improve clinical training. However, further study is required for the accuracy, ethical, and dependency issues AI could create. This research aims to analyze the role of AI in medical education, assess its benefits and risks, and explore how it can be optimized to support students and educators.

MATERIALS AND METHOD

This study followed a quantitative cross-sectional design to evaluate the effectiveness of ChatGPT in medical education. Ethical approval was obtained from the Institutional Review Board (IRB) of Women Medical & Dental College Abbottabad, dated 20/06/2023. The study adhered to ethical standards, ensuring participant privacy, informed consent, and proper data handling. The study was conducted across multiple medical institutions between June and December 2023.

A total of 300 participants were included in the study. Stratified random sampling was used to ensure representation across different medical education institutions. The participants consisted of: Medical students (various years of study). Educators (lecturers, professors, instructional designers) and Healthcare professionals (physicians, nurses, surgeons, specialists). The following students/faculty members were included in the study;

- Medical students enrolled in recognized institutions.
- Educators and healthcare professionals actively involved in teaching or training.

The following sample population were excluded;

- Individuals not involved in medical education.
- Those who declined to participate or provided incomplete responses.

Operational Definitions

Key study parameters included:

- Student Learning: Improvement in understanding, engagement, and retention of medical knowledge.
- Teaching Methodologies: Perceived changes in teaching approaches with AI integration.
- Collaborative Learning: AI's impact on peer-to-peer learning and teamwork.
- Clinical Scenario Simulations: AI's effectiveness in replicating real-life medical scenarios.

Data Sources and Measurements

A structured questionnaire was used to collect data on the effectiveness of ChatGPT in medical education. The questionnaire included Likert-scale questions assessing:

- Engagement and learning experience
- Teaching methodology improvements
- Effectiveness in clinical scenario training
- Impact on collaborative learning

The Likert scale (1-5) was used to evaluate all questionnaire responses, measuring engagement, learning experiences, teaching methodology effectiveness, and perceptions of ChatGPT's role in medical education. Each response was assigned a numerical value from 1 to 5, where:

- 1 = Strongly Disagree
- 2 = Disagree
- 3 = Neutral
- 4 = Agree
- 5 = Strongly Agree

The questionnaire was developed and validated by expert educators and AI specialists to ensure reliability. Factor analysis and Cronbach's alpha were used to assess its construct validity and internal consistency.

Bias Control

To minimize bias:

- Random sampling was used for participant selection.
- The questionnaire was pre-tested to ensure clarity.
- Responses were anonymized to avoid influence or pressure.

Statistical Analysis

Quantitative data analysis was performed using SPSS version 25. The following statistical tests were applied: Descriptive statistics (mean, median, standard deviation) to summarize data. Factor analysis to validate questionnaire structure. Cronbach's alpha to test internal reliability. Chi-square test for categorical data comparisons. A p-value of <0.05 was considered statistically significant.

RESULTS

The study's participants represented a diverse cross-section of the medical education community, including 180 medical students, 60 educators, 25 healthcare professionals, and 35 clinical instructors, totalling 300 individuals. The gender distribution was relatively balanced, with 160 male and 140 female participants. The majority of participants were between 18 and 25 years old (195), while 105 fell within the 26-35 age range. Medical students, comprising the largest group, were primarily younger (150 in the 18-25 age group), while educators and healthcare professionals were more evenly split between the two age groups (Table 01).

Table 01. Participant Demographics and Role Details

Profession	Participants (n)	Male (n)	Female (n)	Age 18-25 (n)	Age 26-35 (n)
Medical Students	180	110	70	150	50
Educators	60	20	40	20	25
Healthcare Professionals	25	15	10	15	10
Clinical Instructors	35	15	20	10	20
Total	300	160	140	195	105

The impact of ChatGPT on learning experiences showed that 80% (240 participants) reported improved learning, while 10% (30) saw no change, 5% (15) experienced decreased engagement, 3% (9) were unsure, and 2% (6) preferred not to say. The results were statistically significant (chi-square test, p = 0.001), with a mean score of 4.3 and a median of 4 on a 1-5 scale (Table 2). Male participants reported an 80% improvement, while 73% of female participants noted the same. Younger participants aged 18-25 reported the highest improvement at 84%, compared to 72% for those aged 26-35 (Table 02).

Table 02. Improvement in Learning Experiences (Impact of ChatGPT)

Category	Improved Learning (n)%	No Change (n)%	Decreased Engagement (n)%	Not Sure (n)%	Prefer Not to Say (n)%	p-value	Mean (Scale 1-5)	Median (Scale 1-5)
Percentage of Participants	(240) 80	(30) 10	(15) 5	(9) 3	(6) 2	0.001	4.3	4
Male Participants	(160) 80	15	8	5	4	-	-	-
Female Participants	(140) 73	14	7	4	2	-	-	-
Age Group 18-25	(195) 84	22	10	5	3	-	-	-
Age Group 26-35	(105) 72	7	4	3	1	-	-	-

The perception of ChatGPT's impact on teaching methods was positive for 75% (225 participants), with medical students showing the highest positive response at 80% (150 participants). Educators and healthcare professionals also had favourable views, with 70% (25 participants) and 75% (50 participants), respectively. A small percentage of participants, 15% (45), were neutral, while 5% (15) reported no impact. Negative perceptions were minimal, with only 3% (9) reporting a negative impact and 2% (6) preferring not to respond. The chi-square test revealed a significant correlation (p-value = 0.002) between perceptions of impact and participant roles, with a mean score of 4.2 and a median of 4 on a 5-point scale, indicating a positive sentiment towards ChatGPT's contribution to teaching methods (Table 03).

Table 03. Participants' Perceptions of ChatGPT's Impact on Teaching Methods

Variables	Medical Students (n=180)	Educators (n=60)	Healthcare Professionals (n=25)	Clinical Instructors (n=35)	Total Participants (n=300)
Positive Impact (%)	(150) 80	(25) 70	(50) 75	(50) 75	(225) 75
Neutral (%)	(30) 16	(10) 17	(5) 20	(5) 15	(45) 15
No Impact (%)	(10) 5	(3) 5	(2) 5	(2) 5	(15) 5
Negative Impact (%)	(5) 3	(2) 3	(2) 3	(2) 3	(9) 3
Prefer Not to Say (%)	(5) 2	(1) 1	(0) 0	(2) 2	(6) 2
p-value	0.002				
Mean (Scale 1-5)	4.2				
Median (Scale 1-5)	4				

The effectiveness of ChatGPT in simulated clinical scenarios and collaborative learning was also analyzed. For simulated scenarios, 85% (255 participants) found ChatGPT valuable, with a mean score of 4.4 on a 5-point scale (median = 4), while only 8% were neutral, 5% considered it not valuable, and 2% preferred not to respond. The p-value of 0.001 suggests a statistically significant result. In collaborative learning, 70% (210 participants) found ChatGPT effective, with a mean score of 4.1 (median = 4), though a higher proportion expressed neutrality (18%), and 10% found it ineffective. This result was also statistically significant, with a p-value of 0.003 (Table 04).

DISCUSSION

The comprehensive study explored ChatGPT's impact on various aspects of medical education, including student learning, collaborative learning, teaching methodologies, and clinical scenario simulation. Findings revealed that 80% of participants experienced improved learning, particularly noting heightened engagement and a personalized approach. Notably, gender and age variations were evident, with male participants and those aged 18-25 reporting a stronger positive impact. These observations align with other studies, such as those by Alkhaaldi et al., and sami et al which affirm the platform's benefits in enhancing medical education.[8,9]

General remarks and recommendations:

Appendix: Questionnaire for Evaluating the Effectiveness of ChatGPT in Medical Education

Section	Subcategory	Question	Response Options
Participant Demographics	Role	What is your role?	Medical Student
			Educator (Professor, Lecturer, Instructional Designer
			Healthcare Professional (Doctor, Nurse, Surgeon, Specialist)
	Gender	What is your gender?	Male
			Female
	Age Group	What is your age group?	18-25
			26-35
			36-45
			46+
	Experience	How many years of experience do you have in your field?	0-5 Years
			6-10 Years
			11-15 Years
			16+ Years
	Expertise	What is your primary area of expertise?	
Impact on Learning	Learning Experience	How has ChatGPT affected your learning experience?	Improved
			No Change
			Decreased
			Not Sure
			Prefer Not to Say
	Learning Enhancement	Please rate the extent to which ChatGPT has enhanced your learning. 1 (Not at all) to 5 (Significantly)	
	Engagement	How has ChatGPT influenced your engagement with the material? 1 (Not at all) to 5 (Significantly)	
Teaching Methods	Impact on Teaching	How has ChatGPT impacted your teaching methods?	Positive Impact
			Neutral
			No Impact
			Negative Impact
			Prefer Not to Say
	Usefulness	Please rate the usefulness of ChatGPT in providing	
		additional explanations and resources. 1 (Not at all) to 5 (Extremely Useful)	

	Frequency of Use	How often do you use ChatGPT in your teaching?	Daily
			Weekly
			Monthly
			Rarely
			Never
Simulated Clinical Scenarios	Value	How valuable do you find ChatGPT for simulating clinical scenarios?	Valuable
			Neutral
			Not Valuable
			Prefer Not to Say
	Effectiveness	Please rate the effectiveness of ChatGPT in providing realistic clinical scenario simulations. 1 (Not at all) to 5 (Extremely Effective)	
	Frequency	How frequently do you use ChatGPT for clinical scenario simulations?	Daily
			Weekly
			Monthly
			Rarely
			Never
Collaborative Learning	Effectiveness	How effective is ChatGPT in fostering collaborative learning?	Effective
			Neutral
			Ineffective
			Prefer Not to Say
	Facilitaion	Please rate the extent to which ChatGPT has facilitated peer-to-peer interactions. 1 (Not at all) to 5 (Significantly)	
	Frequency of Use	How often do you use ChatGPT in collaborative learning environments?	Daily
			Weekly
			Monthly
			Rarely
			Never
General Feedback	Concerns	What concerns, if any, do you have about the integration of ChatGPT in medical education?	
	Satisfaction	Please rate your overall satisfaction with ChatGPT in medical education. 1 (Not satisfied) to 5 (Extremely satisfied)	
	Recommendation	Would you recommend the use of ChatGPT to others in your field?	Yes
			No
			Not Sure

Studies also demonstrated that AI-driven tutoring systems, including ChatGPT, significantly improve student knowledge retention and adaptability in medical education.[10-12] Similarly, Studies reported that AI-based interactive tools foster deeper comprehension in complex medical subjects,[13,14] further supporting our findings that ChatGPT enhances engagement. Furthermore, a previous studies highlighted that AI-assisted education tools improve students' performance in standardized medical exams, reinforcing the potential of ChatGPT in structured learning.[15-17]

The study also highlighted ChatGPT's significant potential in teaching, with medical students showing a greater appreciation for its adaptability compared to educators and healthcare professionals. This supports findings from "ChatGPT: The Most Intelligent Student in the Class"[18,19] and comparative analyses in medical education, emphasizing the tool's capacity to revolutionize traditional teaching methods.[20,21] The results underscore ChatGPT's valuable role in improving student learning and teaching effectiveness, though they also indicate a need for further exploration of demographic-specific impacts.

Regarding simulated clinical scenarios, 85% of participants found ChatGPT beneficial, particularly for medical students, aligning with research such as "Impact of the Implementation of ChatGPT in Education". Despite this, challenges in handling complex medical situations were noted. This suggests that while ChatGPT enhances simulation, there are areas needing improvement. The results from Khan et al. presented a wide demographic, with 80% of participants reporting improved learning experiences using ChatGPT, particularly in simulated clinical scenarios (85% found it valuable). [22,23] The current study, however, revealed that 49.5% of international medical graduates preparing for the United States Medical Licensing Examination found ChatGPT beneficial for study-related activities like concept clarification, with moderate satisfaction (3.7/5), but concerns about accuracy and plagiarism were highlighted, leading to mixed results on its effectiveness.

The study's findings also corroborate previous research on ChatGPT's role in collaborative learning, with 70% of participants noting its effectiveness. However, some technical difficulties and interaction restrictions were reported, consistent with issues highlighted in "ChatGPT in Education: Methods, Potentials, and Limitations". The study's insights into role-specific concerns, such as potential biases and ethical issues, resonate with literature on artificial intelligence in education. These results underscore the importance of addressing these concerns to optimize ChatGPT's integration into medical education.

CONCLUSION

The study provides valuable insights into the impact of ChatGPT in medical education, particularly in student learning, collaborative learning, teaching methodologies, and simulated clinical scenarios. The positive feedback from participants highlights its potential to enhance engagement, personalize learning experiences, and support clinical training.

However, certain challenges remain, including accuracy concerns, potential biases, and the need for more structured integration into medical curricula. Based on these findings, our study recommend further research to evaluate long-term outcomes, improve AI-driven educational models, and develop guidelines for responsible implementation in medical training. Additionally, future studies should explore ChatGPT's effectiveness across different medical disciplines and levels of training to optimize its integration into diverse educational settings.

Ethical Consideration

This study was approved by Institutional Review Board of Women Medical & Dental College, Abbottabad, Pakistan.

Funding

There is no role of any funding agency in this study.

Conflict of Interest

Authors declared no conflict of interest.

REFERENCES

1. Preiksaitis C, Rose C. Opportunities, challenges, and future directions of generative artificial intelligence in medical education: scoping review. *JMIR medical education*. 2023:9;e48785. https://doi.org/10.2196/48785
2. Grunhut J, Marques O, Wyatt AT. Needs, challenges, and applications of artificial intelligence in medical education curriculum. *JMIR medical education*. 2022:8(2); e35587. https://doi.org/10.2196/35587
3. Charow R. Artificial intelligence education programs for health care professionals: scoping review. *JMIR Medical Education*. 2021:7(4); e31043. https://doi.org/10.2196/31043
4. Mir MM. Application of artificial intelligence in medical education: current scenario and future perspectives. *Journal of advances in medical education & professionalism*. 2023:11(3); 133. PMC10352669
5. Oyeniyi J, Oluwaseyi P. Emerging trends in AI-powered medical imaging: enhancing diagnostic accuracy and treatment decisions. *International Journal of Enhanced Research In Science Technology & Engineering*. 2024:13; 2319-7463. ISSN: 2319-7463
6. Lee H. The rise of ChatGPT: Exploring its potential in medical education. Anatomical sciences education. 2024:17(5);926-31. https://doi.org/10.1002/ase.2270

7. Magalhães SA, Cruz-Correia R. Incorporating ChatGPT in medical informatics education: mixed methods study on student perceptions and experiential integration proposals. *JMIR medical education*. 2024:10; e51151. https://doi.org/10.2196/51151
8. Alkhaaldi SM. Medical student experiences and perceptions of ChatGPT and artificial intelligence: cross-sectional study. *JMIR Medical Education*. 2023:9(1); e51302. https://doi.org/10.2196/51302
9. Sami A. Medical students' attitudes toward AI in education: perception, effectiveness, and its credibility. *BMC Medical Education*. 2025:25(1);82. https://doi.org/10.1186/s12909-025-06704-y
10. Salloum A, Alfaisal R, Salloum SA. Revolutionizing medical education: empowering learning with ChatGPT, in Artificial Intelligence in Education: The Power and Dangers of ChatGPT in the Classroom. 2024:Springer;79-90. https://doi.org/10.1007/978-3-031-52280-2_6
11. Wu Y. Embracing ChatGPT for medical education: exploring its impact on doctors and medical students. *JMIR Medical Education*. 2024:10; e52483. https://doi.org/10.2196/52483
12. Chun J. A Comparative Analysis of On-Device AI-Driven, Self-Regulated Learning and Traditional Pedagogy in University Health Sciences Education. *Applied Sciences*. 2025:15(4);1815. https://doi.org/10.3390/app15041815
13. Galdames IS. From Anatomy to Algorithm: Scope of AI-Assisted Diagnostic Competencies in Health Sciences Education. *International Journal of Medical and Surgical Sciences,(IJMSS)*. 2024: 11(3);1-24. ISSN 0719-3904
14. Weidener L, Fischer M. Proposing a principle-based approach for teaching AI ethics in medical education. *JMIR Medical Education*. 2024:10(1); e55368. https://doi.org/10.2196/55368
15. Sabri H. Performance of three artificial intelligence (AI)-based large language models in standardized testing; implications for AI-assisted dental education. *Journal of periodontal research*. 2024. https://doi.org/10.1111/jre.13323
16. Kung TH. Performance of ChatGPT on USMLE: potential for AI-assisted medical education using large language models. *PLoS digital health*. 2023:2(2);e0000198. https://doi.org/10.1371/journal.pdig.0000198
17. Sharma P. Performance of ChatGPT on USMLE: Unlocking the potential of large language models for AI-assisted medical education. arXiv preprint arXiv:2307.00112, 2023. https://doi.org/10.48550/arXiv.2307.00112
18. Tangadulrat P, Sono S, Tangtrakulwanich B. Using ChatGPT for clinical practice and medical education: cross-sectional survey of medical students' and physicians' perceptions. *JMIR Medical Education*. 2023:9(1);e50658. https://doi.org/10.2196/50658
19. Chaiban T. The intent of ChatGPT usage and its robustness in medical proficiency exams: a systematic review. *Discover Education*. 2024:3(1);232. https://doi.org/10.1007/s44217-024-00332-2
20. Menon D, Shilpa K. "Chatting with ChatGPT": Analyzing the factors influencing users' intention to Use the Open AI's ChatGPT using the UTAUT model. *Heliyon*. 2023:9(11). https://doi.org/10.1016/j.heliyon.2023.e20962
21. Wongras P, Tanantong T. An extended UTAUT model for analyzing users' Acceptance factors for artificial Intelligence adoption in human resource recruitment: A case study of Thailand. *Education and Information Technologies*. 2023:3(7);13-27.
22. Khan M. Integration of ChatGPT in IMG Study Strategies: An Exploratory Study of User Experiences and Perceptions. *Innovative Research in Applied, Biological and Chemical Sciences*. 2024:2(1):47-54. https://doi.org/10.62497/IRABCS.2024.29
23. Firat M. What ChatGPT means for universities: Perceptions of scholars and students. *Journal of Applied Learning and Teaching*. 2023:6(1);57-63. https://doi.org/10.37074/jalt.2023.6.1.22

DATA SHARING STATEMENT: The data that support the findings of this study are available on request from the corresponding author. The data is not publicly available due to privacy or ethical restrictions.

AUTHORS' CONTRIBUTION

The following authors fulfill authorship criteria as per ICMJE guidelines;

Naushad K, Malik A: Substantial contribution to conception and design, drafting the manuscript, final approval, agreed to be accountable for all the work.

Jadoon M, Saman D: Substantial contribution to conception and design, data acquisition, drafting the manuscript, final approval, agreed to be accountable for all the work.

Bilal R: Analysis and interpretation of data, drafting the manuscript, final approval, agreed to be accountable for all the work.

Roohullah: Analysis and interpretation of data, critical revision, final approval, agreed to be accountable for all the work.

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License, which permits unrestricted use, distribution & reproduction in any medium provided that original work is cited properly.