

Undergraduate Medical Students' Views on the Role of Artificial Intelligence in Medical Education: A Cross-Sectional Study

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ABSTRACT

Background: Artificial intelligence (AI) is increasingly being used in medical education, offering opportunities for personalized learning, rapid access to information, and support for academic activities. However, concerns regarding accuracy, overdependence, and reduced critical thinking remain.

Objectives: To assess the perceptions, attitudes, perceived benefits and concerns regarding the use of AI tools among undergraduate medical students.

Methods: A cross-sectional study was conducted among 767 undergraduate medical students at a tertiary care teaching institution in Bharuch, Gujarat, India, from January to March 2026. Students from all MBBS years who provided informed consent were included. Data were collected using a pre-tested, semi-structured questionnaire administered through Google Forms. Descriptive statistics were used to summarize the findings as frequencies and percentages.

Results: Among 767 participants, AI use was reported daily by 207 (27.0%) students, on a few days per week by 282 (36.8%), and occasionally or rarely by 278 (36.2%). ChatGPT was the most commonly used AI tool reported by 698 (91.0%) students, followed by Google Gemini 398 (51.9%). The most common academic purpose of AI use was clarifying difficult concepts, reported by 561 (73.1%) students, followed by obtaining quick summaries or notes 460 (60.0%). AI was considered very helpful for understanding concepts by 445 (58.0%) students, while 515 (67.1%) reported faster learning. Nearly half 367 (47.8%) supported integrating AI into medical teaching. However, inaccurate information 334 (43.4%), reduced critical thinking 327 (42.6%), and overdependence 252 (32.8%) were major concerns.

Conclusions: AI tools are widely used and positively perceived by medical students. Structured and responsible integration of AI into medical education may maximize its benefits while minimizing potential risks.

Keywords: Artificial Intelligence, ChatGPT, Medical Education, Medical Students

INTRODUCTION

Artificial intelligence (AI) refers to computational technologies capable of performing tasks that are traditionally associated with human intelligence, including learning, reasoning, language processing, pattern recognition, and decision-making. The application of AI in healthcare has expanded considerably, and medical education is increasingly being influenced by these developments. AI-based educational applications have the potential to support teaching, assessment, simulation, personalized learning, and clinical reasoning. [1,2]

The emergence of generative AI and large language models has further expanded the educational applications of AI. Tools such as ChatGPT and other conversational AI platforms can generate explanations, summarize information, answer questions, assist with problem-solving, and provide interactive learning support. Such technologies may be particularly useful for medical students who need to process large volumes of theoretical and clinical information. [3,4] Research evaluating ChatGPT has demonstrated its ability to perform well on some medical examination-style questions, although its performance does not eliminate the need for human supervision and verification. [5]

AI may provide several advantages in medical education, including personalized learning, rapid feedback, access to educational resources and support for self-directed study. However, its use also introduces challenges. AI-generated responses may contain inaccurate or fabricated information, and students may have difficulty recognizing such errors. Concerns have also been raised regarding privacy, academic integrity, ethical use, bias, and excessive dependence on AI-generated information. [3,6]

The increasing use of AI in healthcare also means that future physicians will need an understanding of AI technologies and their limitations. AI literacy should extend beyond the ability to use digital tools and

include critical appraisal, verification of information, understanding of ethical implications, and awareness of appropriate clinical applications. Several authors have therefore advocated the incorporation of AI-related competencies into medical education. [7,8]

Previous studies conducted among medical students have reported increasing awareness and use of ChatGPT and other AI technologies, together with generally favorable attitudes toward their educational applications. [9,10] However, concerns related to accuracy, privacy, critical thinking, and dependence remain important. The available evidence also indicates that medical schools are still developing appropriate approaches for integrating AI into undergraduate curricula. [8,11]

In India, evidence describing how undergraduate medical students use AI tools, the purposes for which they use them, their perceptions of educational benefits, and their concerns remains relatively limited. Understanding these factors may assist medical institutions in developing appropriate guidance and AI-literacy initiatives.

Therefore, the present study was undertaken to assess the perceptions, attitudes, perceived benefits and concerns regarding the use of artificial intelligence tools among undergraduate medical students.

MATERIALS & METHODS

Study Design and Setting

A cross-sectional study was conducted among undergraduate medical students at a tertiary care teaching institution in Bharuch, Gujarat, India, from January to March 2026. The study aimed to assess the perceptions, attitudes, and concerns regarding the use of AI tools among undergraduate medical students.

Study Participants and Sample Size

The study population comprised undergraduate MBBS students from all academic years. A universal sampling approach was adopted, wherein all students

present during the study period were invited to participate. Students who provided informed consent were included in the study, whereas those who were unwilling to participate were excluded. A total of 767 undergraduate medical students were enrolled in the study.

Study Tool and Data Collection

Data were collected using a pre-tested, semi-structured questionnaire administered through Google Forms. The questionnaire link was disseminated through Gmail and WhatsApp, and participants could also access it using a Quick Response (QR) code. The objectives and purpose of the study were explained to all participants before data collection.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee of Dr. Kiran C. Patel Medical College and Research Institute, Bharuch, Gujarat, (Approval No. IEC/2026/11). Electronic informed consent was obtained from all participants before enrollment. Participation was voluntary, and confidentiality and anonymity of the

participants were maintained throughout the study.

Statistical Analysis

The data were entered and analyzed in Microsoft Excel 2016. Descriptive statistics were used to summarize the data and were expressed as frequencies and percentages.

RESULT

Socio-demographic Characteristics

A total of 767 undergraduate medical students participated in the study. The mean age of the participants was 20.6 ± 1.66 years. Males constituted a slightly higher proportion of the study population, accounting for 390 (50.8%) participants, followed by females with 374 (48.8%) participants, while 3 (0.4%) participants preferred not to disclose their gender. The highest proportion of participants belonged to the third MBBS Part-II 286 (37.3%), followed by third MBBS Part-I 189 (24.6%), first MBBS 147 (19.2%), and second MBBS 145 (18.9%). Among the 767 participants, 282 (36.8%) respondents used AI tools on a few days per week followed by occasional or rare use, 278 (36.2%) and daily use 207 (27.0%).

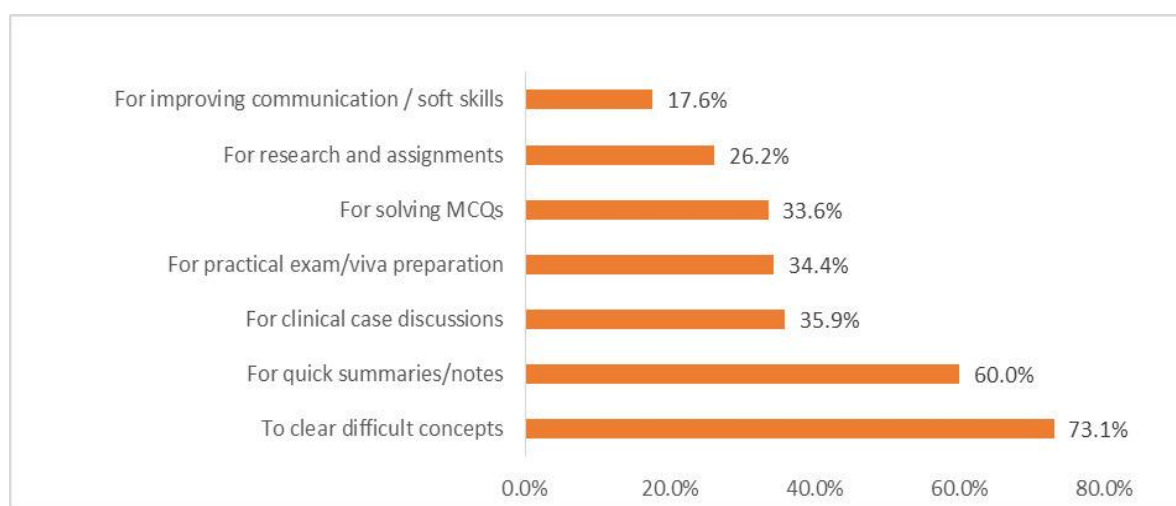


Figure 1. Academic Purposes of AI Use among Undergraduate Medical Students
Note: Multiple responses were permitted; therefore, percentages do not total 100%.

The most frequently reported academic purpose of AI use was clarification of difficult concepts 561 (73.1%), followed by obtaining quick summaries/notes by 460

(60.0%). AI was also used for clinical case discussions by 275 (35.9%), practical examination/viva preparation by 264 (34.4%), and solving MCQs by 258

(33.6%). A total of 201 (26.2%) students used AI for research and assignments, while 135 (17.6%) used it for improving communication/soft skills (figure 1).

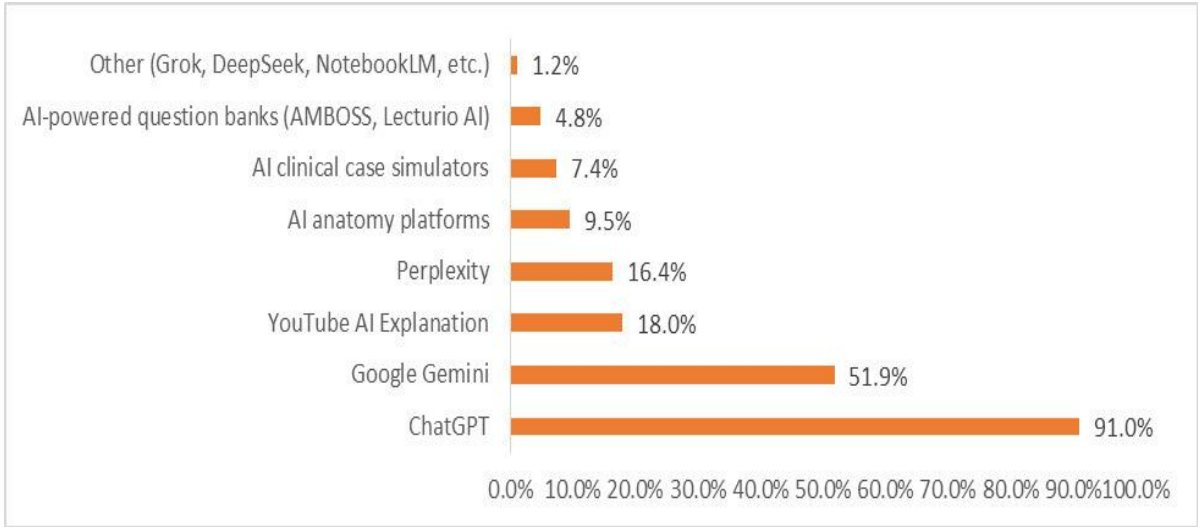


Figure 2. AI Tools Used by Undergraduate Medical Students
Note: Multiple responses were permitted; therefore, percentages do not total 100%.

ChatGPT was the most commonly used AI tool, reported by 698 (91.0%) respondents, followed by Google Gemini by 398 (51.9%). YouTube AI explanations were used by 138 (18.0%), while 126 (16.4%) students reported using Perplexity. AI anatomy platforms were used by 73 (9.5%) respondents and AI clinical case simulators by 57 (7.4%). AI-powered question banks such as AMBOSS and Lecturio AI were used by 37 (4.8%) students, whereas 9 (1.2%) reported using other AI tools (Grok, DeepSeek, NotebookLM, Marrow, and similar platforms) as depicted in figure 2.

Table 1. Perception of AI-assisted learning among undergraduate medical students (N = 767)

Variable	Response	Frequency (n)	Percentage (%)
Helpfulness in understanding concepts	Very helpful	445	58.0
	Somewhat helpful	311	40.5
	Not helpful	11	1.4
Academic performance improvement	Significant	249	32.5
	Moderate	330	43.0
	Slight improvement	149	19.4
	It makes study slower	3	0.4
	No change	36	4.7
Dependence on AI tools	Yes	246	32.1
	No	290	37.8
	Sometimes	231	30.1
Improved confidence in viva/practical examinations	Yes	370	48.2
	No	138	18.0
	May be	259	33.8
Faster learning	Yes	515	67.1
	No	50	6.5
	May be	202	26.3

More than half of the participants 445 (58.0%) considered AI tools to be very helpful in understanding difficult concepts, while 311 (40.5%) regarded them as somewhat helpful (table 1). Only 11 (1.4%) of respondents perceived AI tools as not helpful. 330 (43.0%) of students reported a moderate improvement in their academic performance, whereas 246 (32.5%) experienced a significant improvement

following the use of AI-based tools. A further 149 (19.4%) reported slight improvement, while only 36 (4.7%) observed no change in their academic performance. Very few participants 3 (0.4%) felt that AI tool use made studying slower.

Concerning dependence on AI, 246 (32.1%) of respondents acknowledged becoming dependent on these tools, and 231(30.1%) indicated that they sometimes felt dependent, whereas 290 (37.8%) did not perceive any dependence. Nearly half of the participants- 370 (48.2%) reported increased confidence in viva and practical examinations after using AI tools, while 259 (33.8%) were uncertain about this benefit

and 138 (18.0%) did not perceive any improvement in confidence. The majority of students 515 (67.1%) believed that AI tools facilitated faster learning. In contrast, 50 (6.5%) disagreed, whereas 202 (26.3%) were unsure about their effect on learning speed.

Overall, the findings suggest that AI-based tools were perceived positively by medical students, particularly with respect to conceptual understanding, learning efficiency, academic performance, and confidence during practical and viva examinations. However, concerns about dependence on these technologies were also evident among a considerable proportion of respondents.

Table 2. Attitudes toward the Integration and Future Role of AI in Medical Education (N = 767)

Variable	Response	Frequency (n)	Percentage (%)
AI should be integrated into teaching	Yes	367	47.8
	No	139	18.1
	Maybe	261	34.0
AI essential for future doctors	Yes	369	48.1
	No	139	18.1
	Maybe	259	33.8
Would recommend AI tools to others	Yes, Definitely	245	31.9
	Yes, With caution	355	46.3
	Maybe	130	16.9
	No	37	4.8
AI reduce self-study from textbooks	Yes	277	36.1
	No	130	16.1
	Maybe	360	46.9

Nearly half of the respondents 367 (47.8%) believed that artificial intelligence (AI) should be incorporated into medical teaching, whereas 261 (34.0%) were uncertain and 139 (18.1%) opposed its integration (table 2). Similarly, 369 (48.1%) considered AI essential for future doctors, while 139 (18.1%) did not and 259 (33.8%) were uncertain.

Regarding recommendations to peers, the majority of students were willing to recommend the use of AI tools to their peers. Specifically, 355 (46.3%) stated that they would recommend these technologies with caution, and 245 (31.9%) indicated that they would definitely recommend them. In contrast, 130 (16.9%) were undecided and only 37 (4.8%) would not recommend AI tools to others. When asked about the

impact of AI on traditional learning methods, 277 (36.1%) of respondents believed that AI reduced self-study from textbooks, whereas 130 (16.9%) disagreed. However, the largest proportion 360 (46.9%) remained uncertain about the influence of AI on textbook-based learning. Overall, the findings indicate a generally favorable attitude toward the incorporation of AI into medical education and its future role in clinical practice. Although most participants supported the use of AI tools and were willing to recommend them, many expressed reservations and preferred a cautious approach. Furthermore, uncertainty persisted regarding the extent to which AI might replace conventional self-directed learning from textbooks.

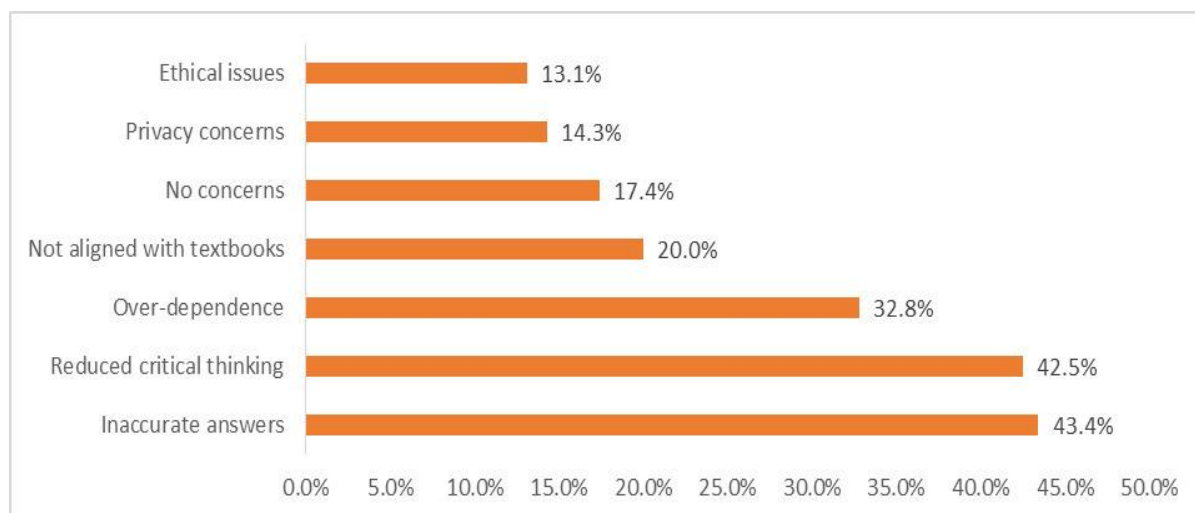


Figure 3. Concerns Regarding the Use of AI Tools among Medical Students
Note: Multiple responses were permitted; therefore, percentages do not total 100%.

The most frequently reported concern was the possibility of inaccurate AI-generated answers, reported by 334 (43.4%) participants (figure 3). This was followed by concern regarding reduced critical thinking, reported by 327 (42.6%). Overdependence on AI was identified by 252 (32.8%) participants. Other concerns included AI-generated responses not being aligned with textbooks 154 (20.0%), privacy concerns 110 (14.3%), and ethical issues 101 (13.1%).

Overall, although medical students generally use AI-tools for medical education, many recognized the importance of verifying AI outputs with traditional sources. Concerns regarding accuracy, potential impairment of critical thinking, and excessive dependence on AI emerged as the major challenges associated with the use of these technologies in medical education.

DISCUSSION

The present study provides an overview of how undergraduate medical students are using AI tools and how they perceive their role in medical education. Among 767 students, AI use was common, with more than one-fourth reporting daily use and more than one-third using AI several days per week. The findings indicate that students have incorporated AI primarily as a supplementary learning resource rather than

as a replacement for conventional medical education.

Pattern and academic purpose of AI use

In the present study, the most common reason for using AI was to clarify difficult concepts, reported by 73.1% of students, followed by obtaining summaries or notes (60.0%). Clinical case discussions, viva/practical preparation, and MCQ solving were also frequently reported.

This pattern suggests that students particularly value AI for immediate explanations and rapid processing of educational information. Similar applications have been reported in previous research examining medical students' experiences with generative AI. Ganjavi et al. reported that medical students used ChatGPT for explaining medical concepts and supporting clinical and academic activities.^[9] Alkhaaldi et al. similarly found that medical students viewed ChatGPT as a potentially useful educational resource.^[10]

The ability of generative AI systems to provide interactive responses may make them attractive for self-directed learning. However, such use should be complemented by established educational resources and faculty guidance, especially when students are dealing with clinically important information.

AI tools used by medical students

ChatGPT was the most commonly reported platform in the present study, used by 91.0% of participants, followed by Google Gemini at 51.9%. This substantial preference for ChatGPT is consistent with its first-mover advantage & its widespread adoption since the emergence of publicly accessible generative AI tools. The high use of ChatGPT may partly reflect its conversational interface and ability to generate explanations, summaries, questions, and educational content. Previous studies have also demonstrated considerable awareness and use of ChatGPT among medical students. [9,10]

The relatively lower use of specialized AI tools, including anatomy platforms, clinical simulators, and AI-enabled question banks, suggests that students may currently prefer general-purpose conversational systems over specialized educational applications or that they simply lack awareness of them.

Perceived usefulness and impact on learning

The findings indicate a favorable perception of AI-assisted learning. Nearly all participants considered AI at least somewhat helpful for understanding concepts, with 58.0% describing it as very helpful. Furthermore, 67.1% believed that AI enabled faster learning. These findings are consistent with the potential educational benefits identified in previous literature. AI applications may provide personalized explanations and facilitate access to educational information, thereby supporting self-directed learning. [1-2,8]

Approximately three-fourths of participants reported either moderate or significant improvement in academic performance. However, these findings represent students' perceptions rather than objectively measured academic outcomes. Therefore, they should not be interpreted as evidence that AI directly improves examination performance. Future studies should compare objective academic outcomes among students using structured AI-supported

learning with those using conventional learning methods.

Almost half of the students reported improved confidence in viva and practical examinations. AI may support preparation through repeated questioning, case-based discussions, and explanation of concepts. Nevertheless, AI-based learning cannot replace practical exposure, bedside teaching, patient interaction, clinical supervision, or direct feedback from experienced educators.

AI dependence and critical thinking

An important concern identified in this study was dependence on AI. Approximately one-third of participants reported definite dependence, while another 30.1% reported occasional dependence. Thus, more than half of the participants experienced at least some degree of perceived dependence.

This finding is important because excessive reliance on AI-generated responses may reduce students' motivation to independently search for information, formulate explanations, or critically evaluate alternative answers. The concern is particularly relevant in medicine, where clinical reasoning requires the ability to assess evidence, recognize uncertainty, and make decisions based on multiple sources of information.

Generative AI should therefore be positioned as a supplementary learning aid rather than a substitute for independent reasoning. Students should be encouraged to question AI-generated outputs and verify important information using standard textbooks, peer-reviewed literature, clinical guidelines, and faculty expertise. [6,8]

Attitudes toward integration of AI into medical education

The study demonstrated a generally positive but cautious attitude toward incorporating AI into medical education. Nearly half of the students supported integration of AI into teaching, and a similar proportion considered AI essential for future doctors. More than one-third of participants believed

that AI reduced their self-study from textbooks, while almost half were uncertain. This finding raises an important educational concern.

These findings support the growing recognition that future physicians will require competencies related to AI and digital health. Paranjape et al. have argued that medical education needs to adapt to the increasing role of AI in healthcare and should provide appropriate training for future professionals.^[7] Similarly, systematic evidence suggests that undergraduate medical curricula should incorporate AI-related competencies, including basic concepts, applications, ethical issues, and critical appraisal.^[8] AI-generated summaries can be useful for rapid revision and initial conceptual understanding, but they may omit important details or contain inaccurate information. Generative AI systems may also present information confidently even when the content is incorrect. Therefore, medical students should not treat AI-generated responses as equivalent to authoritative medical references.

The fact that approximately one-third of students selected “maybe” regarding AI integration suggests that students may prefer a structured and cautious approach rather than unrestricted incorporation. This uncertainty may reflect concerns about accuracy, academic integrity, dependence, and the possibility of replacing conventional learning. The use of AI should complement rather than replace textbooks, peer-reviewed literature, clinical guidelines, classroom teaching, and supervised clinical learning. The ability to cross-check AI-generated information should be considered an important component of AI literacy.^[6,8]

Concerns regarding AI use

The most important concerns reported by students were inaccurate answers (43.4%) and reduced critical thinking (42.6%), followed by over-dependence on AI (32.8%). These concerns are particularly important in medical education because inaccurate information can influence

students' understanding of diseases, diagnosis, treatment, and clinical decision-making.

Previous studies have also identified accuracy and reliability as important concerns regarding generative AI in medical education.^[3,6] Ganjavi et al. reported concerns related to inaccurate responses, privacy, and other limitations of ChatGPT among medical students.^[9] Similarly, studies assessing medical students' perceptions have emphasized the importance of verifying AI-generated information before relying upon it.^[2]

The concern regarding reduced critical thinking is particularly relevant. If students routinely accept AI-generated answers without questioning or verification, they may have fewer opportunities to independently analyze problems. Therefore, AI literacy should include not only the ability to operate AI tools but also the ability to question, verify, compare, and critically appraise AI-generated information.^[8]

Privacy concerns were reported by 14.3% of participants, while 13.1% reported ethical concerns. Although these proportions were lower than those reporting concerns regarding accuracy and critical thinking, they remain important in medical education. Students should be instructed not to enter identifiable patient information into publicly accessible AI platforms. Ethical use, confidentiality, academic integrity, and responsible use of AI should therefore be included in AI-related training.^[6,8]

Limitations

The study had several limitations. As the data is self-reported, and may be influenced by subjective perceptions and biases. The study was conducted at a single institution, which may limit the generalizability of the findings to medical students from other institutions or regions. And finally, AI technology is rapidly evolving; therefore, students' usage patterns, preferred platforms, and perceptions may change as newer AI systems become available.

CONCLUSION

The present study demonstrates widespread utilization of AI tools among undergraduate medical students, with ChatGPT being the most commonly used platform. Students primarily used AI to clarify difficult concepts, obtain summaries, discuss clinical cases, prepare for practical and viva examinations, and solve MCQs. Overall, students perceived AI positively, particularly regarding conceptual understanding and learning efficiency.

At the same time, concerns regarding inaccurate information, reduced critical thinking, and dependence were substantial. These findings indicate that the educational value of AI should be balanced against its potential risks. Medical institutions should therefore promote responsible and guided AI use, emphasizing verification of information, critical appraisal, data privacy, ethical practice, and independent reasoning. AI should complement rather than replace textbooks, faculty teaching, clinical exposure, and professional judgment. Further multicentric and longitudinal studies are needed to determine the effect of structured AI-assisted learning on objective academic performance, clinical reasoning, and professional competencies.

Declaration by Authors

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