

acquaintance to Artificial Intelligence in Medical Education: A Rich or Challenging Opportunity in Students' Learning?

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Published: 25 December 2025

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Dear Editor

The rapid advancements in artificial intelligence (AI) in recent years have transformed the boundaries of knowledge and practice in medical sciences. From deep learning-based diagnostic systems to virtual clinical assistants, this technology promises a profound revolution in the delivery of healthcare. However, the medical education system, which is responsible for training the next generation of physicians, is still at an early stage of familiarization with the requirements of educating students in the age of AI. The strategic question is whether merely exposing students to AI tools prepares them to intelligently face clinical challenges, or whether such exposure without a fundamental redesign of curricula may lead to pitfalls such as the weakening of independent reasoning and the decline of essential skills. This letter, drawing on the most recent scientific evidence, analyzes the opportunities and threats posed by integrating AI into medical education and offers practical solutions for educational policymakers.

The fundamental question regarding the use of AI in medical education is whether familiarity with AI inherently improves learning or, depending on the manner of integration, can also have detrimental consequences. In medical education, critical thinking, problem-solving, and clinical reasoning must remain the cornerstones of health sciences education. In an era where AI automates many knowledge-based tasks, education must move toward cultivating higher-order skills such as metacognition, creativity, and ethical reasoning. By automating low-level cognitive tasks, AI can act as an “invisible teaching assistant” and free up time for deeper learning.

The first and most important opportunity for educating health professions students using AI is interactive learning through dynamic simulations. Studies have shown that ChatGPT-generated virtual patients are comparable in educational quality and medical accuracy to human-generated virtual patients and can serve as effective tools for teaching clinical reasoning to students.^[1] The second opportunity is personalized learning and reduction of cognitive load. Research has demonstrated that AI-driven personalized learning platforms, through dynamic adaptation of resources, affective computing, and behavioral data analysis, significantly improve learning outcomes, classroom engagement, and self-directed learning abilities of medical students.^[2] The third opportunity is enhancing data literacy and critical thinking. Study results indicate that critical thinking, problem-solving, and clinical reasoning must remain the foundation of health sciences education; the goal is not merely to arrive at the correct answer, but to cultivate an understanding of why it is correct and how to act in situations of error. In an era where AI can automate many knowledge-based tasks, health education must shift toward fostering higher-order thinking skills such as metacognition,

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creativity, contextual thinking, and ethical reasoning. The fourth opportunity is saving cognitive time for deeper learning. Automating low-level cognitive tasks through AI can serve as an “invisible teaching assistant” that does not replace thinking but rather prepares the ground for higher-level thinking. Evidence shows that purposeful integration of AI can enhance learning quality. Furthermore, AI-based personalized learning platforms, through dynamic adaptation of resources, increase medical students’ learning outcomes and engagement. Large language models can improve history-taking and physical examination skills by providing personalized insights.^[1,3]

On the other hand, there are significant challenges. The first and most dangerous consequence is over-reliance, or automation bias. Excessive reliance on generative AI undermines students’ critical thinking skills and exacerbates existing biases in data. Automation bias occurs when trainees uncritically accept incorrect recommendations from AI systems. AI can reduce diagnostic sensitivity among expert readers and, through automation bias, promote uncritical acceptance of outputs. The second challenge is the digital divide and educational inequity. Recent systematic reviews have identified seven key ethical dimensions including privacy, algorithmic bias, accountability, justice, and technological reliability; neglecting these can exacerbate existing inequities. The third challenge is the widespread lack of preparedness among faculty members, and the fourth challenge is the weakening of basic diagnostic skills and clinical reasoning.^[4]

Beyond cognitive and educational challenges, ethical and psycho-educational considerations must also be deeply addressed. The ethical dimensions of integrating AI and large language models into medical education include data privacy and security, algorithmic bias, accountability, ensuring justice, technological reliability, dependence on application, and patient autonomy. Neglecting these ethical dimensions can have irreversible consequences for students’ trust and professional identity.

In summary, familiarizing students with AI is neither inherently good nor inherently bad; rather, the manner, timing, and framework of its integration determine the learning outcomes. Therefore, the following recommendations are offered: designing a mandatory course on “Fundamentals of AI in Medicine” comprising at least 20 hours of theoretical and practical instruction in the basic sciences phase and a 10-hour refresher during clinical clerkships, emphasizing both the strengths and limitations of algorithms; using a “human-in-the-loop” model in practical assignments whereby students are required to first record their own diagnosis, then view the AI output, and in case of any discrepancy, provide

a written scientific justification – this method preserves independent judgment and strengthens critical thinking;^[5] mandatory faculty development through in-service workshops covering “basic machine learning concepts,” “assessing the risk of bias in algorithms,” and “designing integrated assignments”; developing an ethical guide for the use of AI in teaching and assessment by national medical education committees; and finally, conducting national longitudinal studies to measure the real impact of these interventions on students’ clinical competencies, not just short-term test scores.

In conclusion, the medical education community is invited to embrace this historic opportunity with a balanced, evidence-based perspective. The future of medical education lies not in choosing between human or machine, but in designing intelligent interaction between the two.

Keywords Artificial Intelligence, Medical Education, Students’ Learning, Clinical reasoning

Declarations

Acknowledgments

The author would like to thank the Vice Chancellor of Education of Neyshabur University of Medical Sciences for providing the researcher with the opportunity to conduct this study.

Artificial Intelligence Disclosure

The authors confirm that no artificial intelligence (AI) tools were used in the preparation of this manuscript.

Authors’ Contributions

H.M carried out all stages of editing this article.

Availability of Data and Materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of Interest

The author declares no conflicts of interest.

Consent for Publication

Not applicable.

Ethical Considerations

Not applicable.

Funding

This research received no specific grant from any funding agency

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