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Letter to editor

Reflection on the Applications and Obstacles of Artificial Intelligence in Medical Education

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Dear Editor,

Artificial intelligence (AI), defined as machines exhibiting intelligent behavior such as observation, reasoning, learning, and communication, is a rapidly evolving field reshaping science and society. First coined by John McCarthy et al. in 1955 (1), AI has the potential to transform medical education by introducing personalized learning experiences, enhancing skill development through realistic simulations, and optimizing educational resources. This shift could make training more adaptive, efficient, and aligned with individual student needs, ultimately producing better-prepared medical professionals (2-4).

One example of generative artificial intelligence (AI) is Chat GPT, which relies on large language models (LLMs)—advanced algorithms trained on massive datasets to generate human-like text. This technology enables ChatGPT to assist in clinical teaching and classroom settings by responding to queries and providing tailored content (5). However, its use comes with limitations, such as the risk of generating inaccurate information and ethical concerns, including potential over-reliance by students and privacy issues tied to processing personal data (2, 3, 5).

Applications of AI in Medical Education Include, for Instance:

Simulation: AI produces vivid simulations of medical scenarios, enabling students to sharpen their skills in a safe, controlled setting. For example, medical trainees can work with virtual patients—designed by AI to show realistic symptoms like those of a heart attack or adjust to treatments in real-time—improving their ability to diagnose and treat without endangering real patients (2, 3). This practical training links classroom learning to clinical practice, building confidence and expertise.

Adaptive learning (Personalization): AI adjusts the curriculum to fit each student's learning pace, strengths, and gaps, delivering a tailored educational journey. By reviewing data like test scores or study duration, AI might focus on tricky areas—such as pharmacology—while moving swiftly through mastered topics like anatomy, helping students learn faster and retain more effectively (2, 3).

Assessment: AI tools offer immediate, detailed feedback on performance, going beyond basic scoring. For instance, AI might assess a student's technique after a simulated procedure, note errors like incorrect suture placement, and recommend ways to improve. This real-time advice allows learners to progressively spot weaknesses and enhance their skills (2, 3).

Virtual assistants: AI-powered assistants provide constant academic support, answering questions, explaining tough concepts, and suggesting relevant resources. A student puzzled by biochemistry could get a clear explanation of enzyme functions, a link to a

helpful video, or custom practice questions, boosting independent study outside regular hours (2, 3).

Resource optimization: AI streamlines resource use by directing students to key materials—like case studies or articles—based on their needs while pinpointing topics like rare conditions that need more attention. For instructors, it highlights curriculum weaknesses, ensuring resources are used where they matter most (2). AI can assist in raising the standard of medical education by utilizing these skills to make it more effective, efficient, and interesting for students.

These applications promise to elevate the quality of medical education by making it more effective and student-centered, equipping future practitioners with robust, practical skills. Although AI offers great promise, its integration into medical education encounters substantial obstacles:

Educator Preparation and Skills: Many instructors lack the necessary knowledge to use AI effectively, requiring thorough training initiatives to bridge this gap (6).

Financial and Access Barriers: The development and deployment of AI systems demand significant investment, restricting their use in institutions with limited resources (2, 3).

Privacy Risks and Algorithmic Bias: AI depends on large volumes of student data, sparking confidentiality concerns, while flawed training datasets can result in biased and inequitable evaluations (2, 3).

AI in medical education cannot be successfully implemented unless these issues are resolved.

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