

Artificial Intelligence and the Hidden Curriculum in Medical Education: Balancing Technological Innovation with Humanistic Values

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ABSTRACT

Artificial Intelligence (AI) is increasingly integrated into medical education, transforming teaching, learning, and assessment. While its benefits, such as personalized learning, simulation-based learning, and data-driven feedback, are well established, its effects on the hidden curriculum are less explored. The hidden curriculum encompasses implicit values, norms, and behaviors transmitted through learning environments. The hidden curriculum is defined as the implicit values, norms, and behaviors that are transmitted through learning environments. In this article, the intersection of AI and the hidden curriculum in medical education is critically examined, with associated risks analyzed and strategies for human-centered integration proposed. Drawing on existing literature and conceptual analysis, risks such as dehumanization, reinforcement of bias, and erosion of soft skills are examined, alongside the potential for enhanced learning. Strategies for human-centered AI integration are recommended, and critical AI literacy, empathy-based education, and interprofessional collaboration are advocated to preserve the humanistic nature of medical education.

Keywords: Artificial Intelligence; Education; Medical; Hidden Curriculum; Empathy; Ethics

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Introduction

The hidden curriculum of medical education is a process of informal transmission of norms, values, and habits that happens outside the formal syllabus through institutional culture, role modeling, and interpersonal relationships. According to Hafferty and Franks (1994), it has a powerful role in developing ethical thinking, empathy, and professional identity (1). The hidden aspect cultivates empathy, ethical reasoning, and interpersonal skills essential for patient-centered care (2). The integration of Artificial Intelligence (AI) into medical education through adaptive learning

platforms, virtual patient simulations, and automated feedback systems introduces new educational dynamics that may modify these underlying influences (3).

AI improves efficiency and scalability in education by delivering personalized learning experiences and data-informed feedback (4). Despite these advantages, AI may unintentionally prioritize values such as speed and accuracy at the expense of humanistic aspects of care, potentially diminishing the emotional quality of patient interactions (5). For instance, students who rely extensively on AI-based simulations

may have fewer opportunities to engage in authentic doctor–patient encounters, which can limit their ability to navigate complex clinical situations effectively (6).

This commentary explores the convergence of AI and the hidden curriculum in medical education to illuminate its revolutionary potential and ethical dilemmas. Solutions are proposed to ensure that AI is used to enhance learning while preserving the humanistic elements that are essential to medical practice.

Balancing AI Benefits and Risks in Medical Training

AI is increasingly shaping medical education, influencing not only what students learn but also how they learn and the values they internalize. By mediating experiences through adaptive learning platforms, virtual simulations, and automated feedback systems, AI increasingly interacts with the hidden curriculum—the informal norms, behaviors, and professional values transmitted through institutional culture, role modeling, and peer interactions (7). While these technologies can enhance educational efficiency, their integration may also influence students' priorities and perceptions of professional practice, underscoring the need to preserve humanistic values alongside technical competencies (8).

Excessive reliance on AI-driven diagnostic algorithms, for instance, can foster a technocentric mindset in which students focus more on computational accuracy than on patient narratives (9). Similarly, highly automated feedback systems, while efficient, may limit opportunities for mentorship and reflective discussion, potentially impeding the development of critical thinking, empathy, and emotional intelligence (10). Over time, these dynamics may shape professional values and priorities, potentially emphasizing technical performance over ethical reasoning and interpersonal sensitivity (11).

Furthermore, the normalization of AI in decision-making may lead students to view AI outputs as infallible, undermining trust in human judgment and diminishing the mentoring role of educators (12–13).

Despite these concerns, AI offers substantial educational benefits. AI-enabled adaptive learning systems can personalize learning pathways, provide individualized feedback, and support learner engagement (14). Immersive virtual reality can provide repeatable, fail-safe environments for practicing clinical and procedural skills and may enhance learners' competence and confidence (15).

Learning analytics can help educators monitor learner progress, identify educational gaps, and inform program evaluation and instructional decision-making (16). These applications may also expand access to scalable and adaptable educational resources, although implementation remains constrained by infrastructure, cost, and faculty capacity, particularly in resource-limited settings (17). When integrated thoughtfully, AI can augment human teaching, enhance feedback, and support independent learning, aligning with contemporary educational goals (18).

Although AI-based simulations can provide valuable opportunities for repeated practice, they should complement rather than replace authentic clinical encounters and supervised interaction with patients (19).

AI integration into medical education may enhance personalized learning and feedback, but concerns remain regarding reduced human interaction, mentorship, and the relational dimensions of learning. Similar concerns have been raised in healthcare, where patient perspectives highlight the importance of human oversight, trust, transparency, and patient engagement in AI-mediated care (20).

Another significant concern is bias in AI algorithms, which can arise from skewed or selective training data and replicate disparities, potentially leading to misdiagnoses, especially among underrepresented populations (21). For instance, datasets that underrepresent certain gender or ethnic groups may produce outputs that reinforce existing inequities. Similarly, excessive reliance on AI-mediated communication may alter the physician–patient relationship and reduce opportunities for empathy, trust, and meaningful interpersonal interaction (22).

AI may also affect critical thinking, as students increasingly depend on machine-generated content rather than developing their analytical skills (23). The inherent opaqueness of AI decision-making, often called the “black box” problem, can further undermine trust and accountability, as both students and instructors may be unable to fully understand how AI reaches its conclusions (24).

Additionally, reduced opportunities for mentorship may adversely affect students’ professional identity formation and development (25). Educators must ensure that AI supports, rather than replaces, human judgment and empathy, preserving the humanistic core of medical education.

Strategies for Human-Centered Integration

To ensure that AI enhances medical education without compromising its humanistic and ethical foundations, a human-centered integration approach is essential. Educators should involve teachers, clinicians, and students in AI-informed decisions to maintain human oversight, allowing AI to support rather than replace human judgment. For instance, emerging medical curricula increasingly emphasize AI literacy among medical students, including foundational knowledge, critical appraisal, and responsible use of AI, illustrating how AI can be incorporated without displacing human-centered clinical training (26).

Complementary activities such as patient interviews, reflective writing, and narrative-based exercises can support reflection on patients’ emotions, values, and experiences and may strengthen empathy and communication skills alongside AI training (27). Actively engaging students, patients, and instructors in the design and deployment of AI tools ensures alignment with learning objectives and clinical needs while incorporating diverse perspectives (28). Integrating AI ethics into the curriculum, through case studies and workshops on algorithmic bias and transparency, encourages critical reflection and responsible use of technology (29).

Maintaining face-to-face mentorship is critical to support professional identity development and preserve the relational aspects of medical training (30). Collaborative and interprofessional learning environments can foster communication, shared problem-solving, and teamwork, helping preserve the relational dimensions of medical education (31). Furthermore, promoting critical AI literacy empowers students to evaluate AI outputs thoughtfully, integrating human judgment with algorithmic suggestions, and ensuring informed decision-making (32).

By adopting these strategies, medical education can leverage AI’s transformative potential while preserving empathy, ethical reasoning, and professional values. A thoughtful, human-centered approach enables technology to enhance both learning outcomes and the cultivation of compassionate, ethically grounded physicians.

Conclusion

AI is poised to reshape medical education, including its often-overlooked hidden curriculum. Although AI offers powerful opportunities to enhance personalization, efficiency, and access to learning, its integration also raises concerns about the potential erosion of empathy, ethical reasoning, professional identity, and human connection. To realize AI’s benefits while mitigating these risks, medical institutions must adopt a human-centered approach to its implementation. This includes embedding ethics and professionalism within AI education, incorporating the perspectives of students, educators, patients, and other stakeholders, and developing mentorship frameworks that preserve meaningful human relationships. We therefore call on educators, policymakers, and technologists to collaborate in designing and implementing AI systems that reinforce, rather than displace, the humanistic foundations of medicine. By doing so, medical education can prepare future physicians to navigate a technologically advanced healthcare environment while remaining compassionate,

ethically grounded, and deeply responsive to the human needs of their patients.

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Authors' Contribution

LM drafted the initial manuscript and conceptualized it. MDT reviewed and finalized the manuscript. Both authors revised and approved the final article.

Conflict of Interest

The authors declare that they have no conflicts of interest.

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Availability of Data and Materials

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