

Medical Education in the Age of AI: Shaping Technologically Literate yet Humanistic Doctors

Rika Yuliwulandari¹, Ilham Kurniawan^{1*}, Laurentius Johan Ardian¹

¹ Faculty of Medicine, Universitas Pembangunan Nasional Veteran Jawa Timur, Surabaya, 60294, Indonesia

Preamble

A fundamental question facing medical educators today is this: *How do we prepare future doctors for a world where artificial intelligence is reshaping every aspect of clinical practice, without losing the humanistic core that defines the art of medicine?* This is no longer a theoretical debate it is an urgent pedagogical imperative.

As Editor of *Medicosphere*, we believe this question demands our immediate attention. AI is rapidly transforming healthcare reshaping clinical decision-making, diagnostic imaging, and patient care¹. Deep learning algorithms have demonstrated remarkable performance in tasks such as image classification, leading to improved diagnostic accuracy². Yet, paradoxically, at the very moment when technology offers unprecedented capabilities, the need for distinctly human qualities in medicine empathy, compassion, ethical reasoning, and clinical wisdom has never been greater. The challenge before us is clear: we must train doctors who are not only technologically literate but also deeply humanistic. This is not an either-or proposition. It is both.

The Urgent Need for AI Integration in Medical Curricula

The evidence is overwhelming that current medical education is not keeping pace with technological change. A recent review found that while AI is rapidly becoming an integral part of healthcare practice, current medical curricula do not adequately prepare students for its adoption³. Multiple structural and institutional barriers hinder integration curriculum overload, limited faculty expertise, lack of institutional support, and the absence of standardised frameworks¹.

Yet progress is being made. Stanford University has developed an open library of ready-to-use teaching materials for integrating AI into medical training, including modular curricula, hands-on web modules, and resources covering large language models, prompt engineering, clinical reasoning with AI, data security, and the legal and ethical dimensions of medical AI. Other institutions can adopt or adapt these materials directly^{3,9}.

In Sweden, all seven medical programmes have agreed to introduce a national AI

curriculum, with implementation planned for autumn 2026. The curriculum contains sixteen digital modules divided into four levels: introduction, theory, application, and specialisation⁶. As Johan Sundström, Professor of Epidemiology at Uppsala University, explains: “AI is an area where development is moving incredibly fast. The decision to implement the curriculum over the coming year is an important step towards accelerating the work to ensure a relevant and up-to-date syllabus”¹⁰.

However, a national cross-sectional study of AI integration in Spanish undergraduate medical education found that integration remains “incipient, fragmented, and uneven”⁴. This pattern is likely representative of many countries, including Indonesia, where the 2012 Indonesian Doctors Standard Competency (SKDI) has yet to evolve based on AI developments in medical education. The absence of AI integration into SKDI holds back the improvement of digital skills among future doctors, indicating that curriculum change is necessary based on innovations in healthcare today⁵.

Defining AI Literacy: What Future Doctors Must Know

What exactly should medical students learn about AI? Recent scholarship has begun to answer this question. A study proposed and validated an AI competency framework tailored for medical professionals, integrating UNESCO’s AI framework with Miller’s pyramid model⁶. This framework provides a structured approach to defining what competence in AI looks like for doctors.

A Chinese expert consensus on AI proficiency for medical students defines AI literacy as “a comprehensive attribute for integrating AI into professional knowledge, clinical practice, research, and health management”. The consensus structures AI literacy around knowledge, skills, and attitudes, with 21 core competencies that stress physician accountability and bias vigilance alongside medical humanism⁷. A competency-based interpretive framework for AI literacy in undergraduate medical education synthesised literature from 2020 to 2026, offering guidance for curriculum and assessment. The framework emphasises that students must be able to critique AI outputs, improve data literacy skills, and understand both the capabilities and limitations of AI tools⁸.

Crucially, AI curricula must align with existing medical education frameworks while addressing AI’s distinctive characteristics. As one analysis notes: “Curricula should not fixate on any one tool or technology; however, a core AI curriculum should provide all students and residents with the needed AI literacy and skills, enabling graduates to engage with, question, and responsibly use AI tools in their clinical practice”⁵.

The Humanistic Imperative: Preserving the Heart of Medicine

Yet technological competence alone is insufficient. The integration of generative AI into medical education raises critical concerns about “the potential erosion of empathy and humanistic values in training”. This is not a peripheral issue it strikes at the very identity of the medical profession. The concept of “philosophectomy” the systematic removal of philosophy from health curricula has been identified as a profound threat. This “intellectual amputation disarms future professionals, unpreparing them for the ethical and existential challenges posed by AI and advanced technology in healthcare”. Reintegrating philosophy is key to preserving humanistic healthcare practice.

A review on generative AI in medical education proposes a redefined framework for “AI-era professionalism one that integrates technological fluency with enduring humanistic values such as empathy, integrity, and accountability”. This framework prepares future doctors to use generative AI responsibly, ethically, and in service of patient-centred care. The growing importance of soft skills in medical education in the AI era cannot be overstated. Research demonstrates that soft skills improve patient adherence, satisfaction, safety, and trust; strengthen doctors’ professional identity, collaboration, and resilience; and enhance system-level outcomes¹⁸. While technological innovation is vital, soft skills are essential for preserving trust, ethical accountability, and humanistic care.

A balanced approach that integrates emotional intelligence (EI) and AI within medical curricula is essential. By harnessing AI’s efficiency and data-driven capabilities alongside EI’s human-centric skills, future healthcare professionals can achieve technical excellence and emotional resilience. As one analysis argues: “AI’s limitations must be acknowledged, and holistic, patient-focused care must be ensured”.

What This Means for Medicosphere and Indonesia

For *Medicosphere* and the Indonesian medical education community, these developments carry specific implications.

First, curriculum reform is overdue. The 2012 SKDI must be updated to incorporate AI competencies. Indonesian medical schools should look to models from Stanford, Uppsala, and elsewhere while developing approaches suited to our local context. As one study notes, “Indonesia remains grounded in the 2012 SKDI which has yet to evolve based on the developments of AI in medical education”⁵.

Second, faculty development is critical. Many medical educators lack the training to teach AI concepts effectively. Institutions must invest in developing faculty expertise. Several

Indonesian medical schools have begun this work FK-KMK UGM has held workshops on AI in medical education, and UIB has conducted training for lecturers on AI and VR for medical learning. These efforts must be expanded and systematised^{11,12}.

Third, ethics must be integrated throughout the curriculum. Teaching AI without teaching its ethical implications is irresponsible. Students must understand issues of bias, privacy, accountability, and algorithmic transparency. As one scoping review concluded, ethical concerns raised in the literature centred on “privacy, bias, informed consent, and algorithmic transparency, with many offering implications for curriculum development”.

Fourth, we must resist the temptation to let technology replace human connection. AI can assist with diagnosis, streamline documentation, and personalise learning but it cannot hold a patient’s hand, offer comfort in suffering, or make a truly compassionate clinical judgement. These remain exclusively human domains. As one author argues, medical education must give doctors “what they need to survive; and second, what they need to properly care for patients in a changing industry, increasingly served by AI”.

A Call to Action

To medical educators: Integrate AI literacy into your curricula not as an add-on, but as a core competency. Develop faculty expertise. Teach not only how AI works, but also its limitations, biases, and ethical implications. Most importantly, never let technology overshadow the humanistic values that define our profession. To medical students: Embrace AI as a tool to enhance your practice, not replace your judgement. Learn to critique AI outputs, question their assumptions, and verify their conclusions. But never forget that your patients come to you not for algorithms, but for human connection, empathy, and compassion. To curriculum developers and policymakers: Update competency standards to reflect the reality of AI-augmented healthcare. The 2012 SKDI must evolve. Learn from international models while adapting them to Indonesian contexts and needs. To researchers: Investigate how AI is being integrated or not into medical education in Indonesia. Study the effectiveness of different pedagogical approaches. Examine how AI affects the development of clinical reasoning, empathy, and professional identity. To the broader medical community: Recognise that the physician of the future must be both technologically literate and deeply humanistic. These are not competing demands they are complementary dimensions of excellent medical practice. The physician who masters both will be the physician who thrives

Conclusion

The integration of AI into medical education is not a passing trend it is an evolving pedagogical necessity. The task now is to move from exploration to intentionality, from scattered enthusiasm to strategic planning and implementation. But we must do so without losing sight of what makes medicine a healing profession, not merely a technical one. The future physician must be able to harness the power of AI while never forgetting the human being at the centre of every clinical encounter. *Medicosphere* is committed to advancing this vision. We invite submissions on AI in medical education, the integration of technology and humanism, and the development of competencies for future doctors. We encourage dialogue between educators, clinicians, and technologists. And we call on our community to embrace both the promise of AI and the enduring value of humanistic medicine. The future of compassionate, competent, and trustworthy medical care depends on it.

References

1. Mendes JM. Reimagining healthcare education through nurturing AI-driven innovation. *BMC Med Educ* 2025;25(1):1644; doi: 10.1186/s12909-025-08254-9.
2. Saroha S. Artificial Intelligence in Medical Education: Promise, Pitfalls, and Practical Pathways. *Adv Med Educ Pract* 2025;16:1039–1046; doi: 10.2147/AMEP.S523255.
3. Ahsan Z. Integrating artificial intelligence into medical education: a narrative systematic review of current applications, challenges, and future directions. *BMC Med Educ* 2025;25(1):1187; doi: 10.1186/s12909-025-07744-0.
4. Janeiro AE, Pereira KP, Mayol J, et al. AI Integration in Spanish Undergraduate Medical Education: National Cross-Sectional Study. *JMIR Med Educ* 2026;12:e88511; doi: 10.2196/88511.
5. Rujito L, Muhaimin A, Pergodi MA, et al. Understanding AI adoption in medical education: Insights from students and faculty members in Indonesian medical schools. *J Educ Health Promot* 2026;15(1):121; doi: 10.4103/jehp.jehp_580_25.
6. Cai C, Duell J, Minghui Chen D, et al. Advancing AI Literacy in Medical Education: A Medical AI Competency Framework Development. In: *Lecture Notes in Computer Science*. (Cristea AI, Walker E, Lu Y, et al. eds) Springer Nature Switzerland: Cham; 2025; pp. 116–123; doi: 10.1007/978-3-031-98462-4_15.
7. Gong M, Pan H, Liu H, et al. Expert Consensus on the Artificial Intelligence Proficiency Competency List and Assessment Framework for Medical Students (2025

- Edition). *Acta Acad Med Sin* 2026;48(1):12–23; doi: 10.3881/j.issn.1000-503X.17210.
8. Fedorchenko Y, Zimba O. Ethical Use of Artificial Intelligence for Processing Medical Images. *J Korean Med Sci* 2025;40(48); doi: 10.3346/jkms.2025.40.e341.
 9. Stanford AI in Medical Education: Curriculum and Teaching Resources. AAMC. 2026.
 10. AI curriculum to be introduced in the Medicine Programme. Uppsala University. 2025.
 11. FK-KMK UGM Perluas Akses Pendidikan Kesehatan. UGM. 2025.
 12. UIB Gelar Pelatihan Dosen Bersama Nasco Healthcare. UIB. 2025