Artificial Intelligence in UK Medical Education: A Framework for Curriculum Reform

Aditya Gaur, Muhamad Hamza Shah, Medha Sridhar Rao, Joecelyn Kirani Tan, Muhtasim Fuad, Taha Bhatti, Hareesha Rishab Bharadwaj, Khabab Abbasher Hussien Mohamed Ahmed

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[1] Yeovil District Hospital, Somerset NHS Foundation Trust Yeovil GB
[2] School of Medicine, Dentistry and Biomedical Sciences, Queen's University Belfast, Belfast, United Kingdom Belfast GB
[3] Faculty of Biology, Medicine and Health, University of Manchester, Manchester, UK Manchester GB
[4] University of Khartoum, Faculty of Medicine Khartoum SD

Corresponding Author:
Khabab Abbasher Hussien Mohamed Ahmed MBBS

University of Khartoum, Faculty of Medicine
Khartoum
Khartoum
SD

Abstract

Background: Artificial intelligence (AI) is increasingly transforming healthcare through improvements in diagnosis, predictive analytics, and workflow optimisation. However, there remains a significant gap in AI training within UK medical education, leaving future clinicians underprepared for AI-driven healthcare environments.

Objective: This review investigates global best practices for AI integration into medical education and proposes a structured framework for embedding AI into the UK medical curriculum. It aims to assess current attitudes, highlight existing knowledge gaps, and recommend practical implementation strategies.

Methods: An analysis of international case studies (e.g., Stanford, University of Toronto, CUHK) was conducted alongside a review of teaching methodologies, stakeholder perspectives, and UK-based surveys to identify core competencies and challenges in AI education.

Results: Effective integration strategies include the use of AI-powered simulations, interdisciplinary collaboration, elective modules, and faculty training. Major barriers include lack of AI-literate educators, insufficient ethical training, and limited infrastructure. Knowledge gaps persist among students and faculty in areas such as algorithmic bias, AI ethics, and clinical decision-making.

Conclusions: To meet the demands of modern healthcare, the UK medical curriculum must adopt comprehensive AI training. This includes practical exposure, ethical awareness, and stakeholder engagement. Proactive reform will ensure graduates are equipped to critically and ethically apply AI tools in clinical practice.

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1 - Yeovil District Hospital, Somerset NHS Foundation Trust, Higher Kingston, Yeovil, United Kingdom, adityagaur500@gmail.com

2 - School of Medicine, Dentistry and Biomedical Sciences, Queen's University Belfast, Belfast, United Kingdom; mshah03@qub.ac.uk, mrao01@qub.ac.uk

3 - Faculty of Biology, Medicine and Health, University of Manchester, Manchester, UK; joecelynkirani.tan@student.manchester.ac.uk, muhtasimfuad123@outlook.com, taha.bhatti@student.manchester.ac.uk, hareesha.bharadwaj@student.manchester.ac.uk

4 - Faculty of Medicine, University of Khartoum, Khartoum, Sudan, 11111, khabab9722@gmail.com, ORCID: https://orcid.org/0000-0003-4608-5321

Corresponding Author
Khabab Abbasher Hussien Mohamed Ahmed
Faculty of Medicine, University of Khartoum, Khartoum, Sudan, 11111, khabab9722@gmail.com, ORCID: https://orcid.org/0000-0003-4608-5321

Abbreviations:

AI, Artificial Intelligence; NHS, National Health Service;GMC, General Medical Council; DOPS, Direct Observation of Procedural Skills; HEE, Health Education England; CBL, Case-Based Learning; CUHK, Chinese University of Hong Kong; SSC, Student-Selected Component; A&E, Accident & Emergency; ML, Machine Learning; NLP, Natural Language Processing; VR, Virtual Reality; MD, Doctor of Medicine.

Abstract:

Background:
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Conclusion:
To meet the demands of modern healthcare, the UK medical curriculum must adopt comprehensive AI training. This includes practical exposure, ethical awareness, and stakeholder engagement. Proactive reform will ensure graduates are equipped to critically and ethically apply AI tools in clinical practice.

Keywords:

Artificial Intelligence; Medical Education; Curriculum Reform; AI Literacy; UK Healthcare; Medical Students; Interdisciplinary Training; Digital Health; AI Ethics; Simulation-Based Learning

1. Introduction

Artificial intelligence (AI) is revolutionising healthcare, attracting substantial global investment and significantly impacting medical practice. In 2016, healthcare AI projects secured the highest levels of funding across industries, reflecting the technology’s transformative potential to enhance diagnostic accuracy, therapeutic interventions, and administrative efficiency [1]. Notable applications include AI-driven predictive modelling in medical imaging, where deep learning algorithms achieve performance comparable to human specialists, and patient triage systems that optimise resource allocation for large populations. For example, an AI-based model triaged 1.2 million individuals for

North London's Accident & Emergency (A&E) services, demonstrating its scalability and impact [2]. These advancements underscore the need to integrate AI education into UK medical curricula, ensuring that future healthcare professionals can effectively utilise AI tools.

A well-structured curriculum must encompass foundational AI concepts alongside ethical considerations, particularly in data use, to empower clinicians to critically appraise AI insights and mitigate risks associated with over-reliance on automated systems [3]. Training medical students to interpret AI-generated outputs in areas such as diagnostics, patient monitoring, and clinical decision support is pivotal for reducing errors and improving patient outcomes, thus facilitating the transition towards safer, data-driven healthcare practices [4].

Despite AI's rapid expansion in healthcare, there is a deficiency in structured AI education within UK medical training programs. A recent survey reported that nearly 90% of UK medical students recognised the importance of AI in healthcare, yet only a minority had received formal training, highlighting a significant educational gap [5]. This shortfall extends to medical trainees, as evidenced by another UK-based survey where 81% of respondents emphasised the necessity of formal AI education, but fewer than 10% felt adequately trained [6]. These gaps suggest that current UK medical education provides limited exposure to AI, leaving students underprepared for technology-driven clinical environments.

Addressing these deficiencies requires incorporating AI into formal medical curricula to ensure that graduates are equipped to engage effectively with AI systems and apply them safely in clinical contexts. Research consistently highlights the importance of equipping future clinicians with essential competencies to navigate the integration of AI into healthcare. These competencies, outlined in Figure 1, are critical to leveraging AI's potential for improved patient care [7]. This perspective review outlines strategies for enhancing AI literacy among UK medical students by focusing on curriculum development, practical implementation approaches, and associated challenges and benefits. By evaluating existing educational models and incorporating student perspectives, this review aims to present a comprehensive framework for developing an AI-literate medical workforce capable of navigating future technological advancements in healthcare.

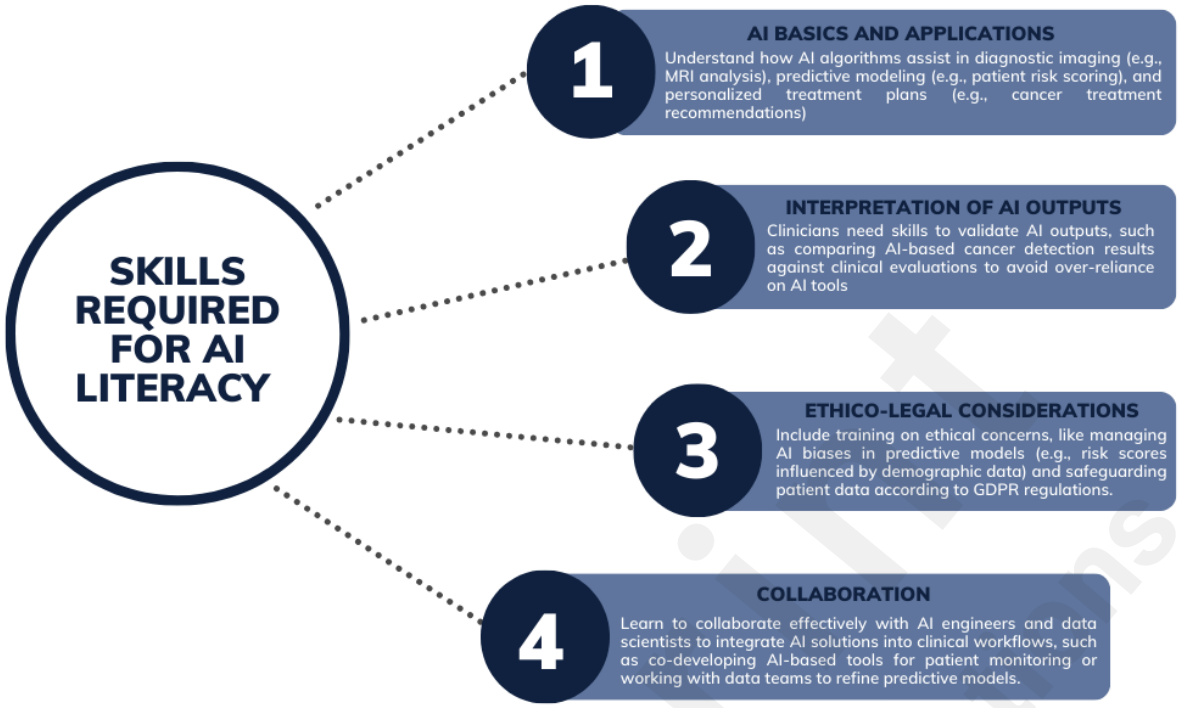

Figure 1: Essential Competencies for Equipping Healthcare Providers for an AI-Driven Future

2. Current Gaps in AI Literacy and Scope of Use

For AI to be effectively incorporated into healthcare education, existing gaps in AI literacy and the scope of AI applications must be addressed. The main gaps stem from a lack of access to AI tools designed for educational use, limited awareness of AI capabilities, fears surrounding AI-generated academic content, inaccuracies in AI outputs, and a shortage of knowledgeable educators. Additionally, there is currently no ethical framework from the General Medical Council or the NHS guiding AI use in UK medical education. While Health Education England (HEE) developed the “Digital, Artificial Intelligence and Robotic Technologies in Education” programme [8], it is not widely implemented in UK medical schools. However, the “Artificial Intelligence (AI) and Digital Healthcare Technologies framework” developed by HEE reinforces the national goal of enhancing AI capabilities among healthcare professionals [8].

Understanding the attitudes of healthcare professionals and students toward AI is instrumental in enhancing its use in medical practice. Tools such as ChatGPT can aid education by generating questions, flashcards, and writing assistance, enabling students and educators to focus more on learning. However, there is increasing concern about the misuse of AI for academic writing, where students may bypass critical thinking by generating entire essays [9]. This threatens academic integrity, prompting institutions to balance the benefits of AI with safeguards against misuse. Institutions must also establish clear guidelines distinguishing legitimate AI use from academic misconduct [10].

To integrate AI effectively, its role in healthcare must be aligned with literacy objectives in curricula.

Applications such as machine learning for imaging diagnostics, medical administration, drug discovery, and digital twins [11] illustrate AI's scope. Expanding AI literacy will help bridge the gap between these capabilities and clinical practice. However, disparities in confidence, such as those reported in Germany between male and female students [12], must also be addressed. The NHS HEE AI Laboratory offers tailored AI education for healthcare workers, a model UK medical schools could adapt to reduce disparities and ensure all students are equipped with necessary AI skills.

Despite these knowledge gaps, medical students generally express optimism about AI's potential to enhance patient outcomes, streamline clinical workflows, and reduce diagnostic errors [13]. Nevertheless, scepticism remains regarding the reliability and transparency of AI systems, with concerns over the risk of over-reliance on AI and its potential to perpetuate biases [14].

Faculty members, in particular, have raised apprehensions about AI replacing certain medical roles. However, this concern is less pronounced among students, who are more focused on whether their education adequately prepares them for an AI-driven healthcare system [15]. There is increasing demand among students for more comprehensive AI education, emphasizing the need for curricula that not only explain AI's functionality but also teach practical skills for evaluating and responsibly utilizing AI tools in clinical practice [5].

By integrating AI into medical education through hands-on labs, simulations, case-based learning, and digital platforms, institutions can better prepare students for the future of AI-enhanced healthcare. However, addressing current knowledge gaps—particularly in AI literacy, ethical considerations, and interdisciplinary collaboration—remains essential for ensuring that future clinicians can effectively and responsibly utilize AI in medical practice.

3. Innovative Teaching Approaches and Knowledge Gaps in Preparing Medical Students for AI-Enhanced Healthcare

Medical education continues to evolve with diverse teaching methodologies aimed at equipping students with the theoretical knowledge and practical skills essential for patient care. As AI becomes increasingly integrated into healthcare, new approaches are required to ensure that future clinicians are proficient in AI applications. This section explores key teaching methodologies and highlights the existing knowledge gaps and attitudes in preparing medical students for AI-driven clinical environments.

3.1 Hands-on Labs

Hands-on laboratories remain a critical component of medical education, providing students with direct experience in anatomical dissection, surgical techniques, and diagnostic procedures. These labs enhance learning through experiential engagement, reinforcing conceptual understanding while developing essential clinical skills such as dexterity, coordination, and procedural proficiency [16,17]. However, hands-on training requires substantial resources, including specialized facilities, equipment, and skilled instructors, making it expensive and logistically demanding. Additionally, while these labs provide valuable technical training, they do not expose students to the AI-driven tools increasingly used in diagnostics and decision-making. The lack of AI integration in practical training may hinder students from fully understanding how AI can augment traditional clinical workflows [18].

3.2 AI Simulations

AI-powered simulations have become an essential tool in medical training, offering students an interactive and adaptive environment for clinical decision-making. These simulations employ advanced machine learning algorithms to replicate patient interactions, diagnostic challenges, and treatment planning scenarios, enabling students to practice without real-world consequences. AI-driven simulations are particularly beneficial for rare or complex medical cases, providing personalized feedback and allowing learners to refine their clinical reasoning skills [19,20]. Despite these advantages, the development and maintenance of high-quality AI simulations remain costly and technically demanding. Moreover, while simulations can enhance learning, they cannot fully replicate the unpredictability and complexity of real-world patient care, leading to concerns that students may become over-reliant on simulated experiences rather than direct clinical exposure [21].

3.3 Case-Based Learning (CBL)

Case-based learning (CBL) is widely used in medical education to encourage students to apply theoretical knowledge to real or hypothetical patient scenarios. This method promotes critical thinking, diagnostic reasoning, and problem-solving skills, facilitating a deeper understanding of clinical practice [22,23]. In the context of AI education, case studies can be adapted to include AI-assisted diagnostics and treatment recommendations, allowing students to critically assess machine-generated insights. However, the effectiveness of this approach depends on the quality and relevance of the cases presented, as well as the expertise of educators in guiding discussions. Some students may struggle with the complexity of AI-integrated cases, leading to varied learning outcomes [1].

3.4 Online Learning Platforms

With the rise of digital education platforms, online learning has become an increasingly important component of medical training. Online resources, including recorded lectures, interactive modules, and virtual discussions, provide students with flexible, self-paced learning opportunities. This approach is particularly useful for foundational AI education, allowing students to gain exposure to key concepts such as machine learning, natural language processing, and AI ethics [24,13]. However, a major limitation of online learning is the lack of direct, hands-on engagement, which is crucial for developing clinical and AI-related competencies. Additionally, online learning requires strong self-discipline and motivation, and it may not fully replace the collaborative and interactive aspects of in-person education [21].

3.5 Knowledge Gaps in AI Competency

As AI technologies become increasingly integrated into healthcare, it is essential to assess the knowledge gaps and attitudes of medical students and faculty regarding AI. Research suggests that many medical students and faculty possess only a superficial understanding of AI and its applications in clinical practice [25,26]. Fundamental concepts such as machine learning, data analytics, and algorithmic bias remain largely unfamiliar, highlighting a critical gap that must be addressed in medical curricula [26].

Beyond technical knowledge, there is also a limited understanding of the ethical and legal implications of AI in healthcare, including concerns about data privacy, informed consent, and algorithmic transparency [27]. Uncertainty persists regarding AI's role in clinical decision-making and patient outcomes, particularly in recognizing its strengths and limitations and determining when AI-generated insights should be integrated into patient care [28].

4. Challenges and Barriers to Integration

Despite the potential benefits of AI integration in medical education, several challenges hinder its implementation. One of the primary obstacles is the lack of a structured AI curriculum in most UK medical schools. Medical education traditionally prioritises biological sciences, human anatomy, physiology, and clinical procedural skills, with a limited focus on AI-driven areas such as machine learning, data science, and AI ethics. Introducing AI comprehensively into medical training would require extensive curriculum restructuring, additional resources, and specialised faculty expertise—elements that are currently scarce in UK medical education [8].

Ethical considerations also pose significant challenges, particularly in areas concerning patient autonomy, data privacy, and algorithmic bias. Maintaining patient confidentiality is a core principle of medical practice, yet AI-generated data may not always align with existing ethical and legal standards. Medical students must be equipped to navigate these ethical dilemmas, but AI ethics training is currently insufficient in most UK medical curricula. The integration of ethics education into AI training presents logistical challenges due to the already packed nature of medical school programs, leaving students underprepared to critically evaluate AI's impact on patient rights and healthcare equity [29,30].

Another barrier is the shortage of AI-proficient faculty. Effective AI education requires instructors with expertise in both clinical medicine and AI applications, yet many UK medical schools lack such personnel. Recruiting or retraining faculty for AI instruction can be a time-consuming and expensive endeavour, further straining institutional budgets. Additionally, some faculty members may be resistant to adopting AI training due to unfamiliarity with AI concepts; this may slow the development of AI-integrated curricula [29,30].

Finally, financial constraints limit the widespread adoption of AI education in UK medical schools. Establishing AI-driven programs necessitates substantial investment in computational infrastructure, data storage, and software development. Moreover, ongoing costs for software updates and system maintenance add to the financial burden. For many institutions operating within tight budgets, securing these resources is challenging, making large-scale AI integration difficult in the immediate future [8].

5. Global Approaches to AI Integration in Medical Education: Lessons for the UK

As artificial intelligence (AI) continues to reshape healthcare, medical education systems worldwide are evolving to equip future healthcare professionals with AI literacy and practical skills. This section examines successful approaches in AI education across leading institutions, focusing on how AI training has been incorporated into medical curricula to bridge technological advancements with clinical practice. These international models provide insights that could inform the integration of AI into the UK medical curriculum.

5.1 United States: Stanford University and Mayo Clinic

In the United States, prestigious institutions such as Stanford University and the Mayo Clinic have pioneered AI integration into medical education. Stanford hosts the AI in Medicine and Imaging Symposium, an annual event featuring hands-on workshops in AI techniques, including machine learning applications for medical imaging. Furthermore, AI has been incorporated into the core MD curriculum through specialized electives, allowing students to apply AI methodologies to clinical cases, and fostering experiential learning [31].

Similarly, the Mayo Clinic has developed AI-focused fellowships for postgraduate trainees, emphasizing AI applications in diagnostic imaging and personalized medicine. This model promotes continuous professional development, ensuring that healthcare providers remain proficient in emerging AI technologies throughout their careers [31]. These initiatives illustrate a structured approach to AI education, where students transition from theoretical understanding to hands-on application in real-world clinical scenarios.

5.2 Canada: University of Toronto's AI in Medicine Initiative

The University of Toronto has established the AI in Medicine initiative, embedding AI training within both undergraduate and postgraduate medical programs. The curriculum covers foundational AI concepts, including machine learning, natural language processing, and AI ethics, equipping students with a comprehensive understanding of AI's role in clinical decision-making [32].

A distinguishing feature of this initiative is its interdisciplinary approach, where medical students collaborate with AI specialists from the Department of Computer Science. This partnership fosters a cross-disciplinary learning environment, preparing future physicians to navigate the complexities of AI integration in healthcare [32]. The success of this model highlights the value of incorporating AI education early in medical training, ensuring that clinicians develop both technical competence and ethical awareness.

5.3 Hong Kong: Chinese University of Hong Kong

The AI in Medical Education program at the Chinese University of Hong Kong (CUHK) exemplifies an innovative approach to AI training. Supported by funding from Mr. Li Ka-shing, this initiative utilizes an AI-powered chatbot to guide students through clinical case studies, enabling personalized, interactive learning [33]. The program also emphasizes practical AI applications in healthcare management and decision-making, while addressing key ethical considerations, such as data privacy and doctor-patient interactions.

To further enhance AI literacy, CUHK has invested in faculty training and established a state-of-the-art digital laboratory, equipped with VR tools, AI-driven software, and curated medical datasets. Regular workshops and academic conferences ensure that both students and faculty remain engaged with the latest AI-driven innovations in healthcare [33].

5.4 Comparative Insights and Implications for the UK Medical Curriculum

The integration of AI into medical education varies across institutions, ranging from elective-based models (e.g., Stanford) to fully embedded curricula (e.g., University of Toronto and CUHK). These approaches highlight key components essential for AI education: practical exposure, interdisciplinary collaboration, and continuous professional development.

For the UK medical curriculum, these international case studies provide valuable insights. The introduction of AI-specific electives, structured fellowships, and interdisciplinary collaboration with AI researchers could enhance AI competency among UK medical students. Additionally, investment in faculty training and AI-driven simulation tools could facilitate hands-on learning, bridging the gap between theoretical AI concepts and real-world clinical application. By adopting these global best practices, the UK can develop a forward-thinking curriculum that prepares future healthcare professionals to harness AI's full potential in clinical practice. A list of the above countries and their methods of AI integration into curricula are displayed in table 1 below.

Country	Institution	Key Initiatives	Highlights
United States	Stanford University	AI in Medicine and Imaging Symposium- Specialized AI electives in MD curriculum	Hands-on workshops- Clinical case application- Experiential learning
	Mayo Clinic	AI fellowships for postgraduates	Focus on diagnostic imaging and personalized medicine- Emphasis on professional development
Canada	University of Toronto	AI in Medicine Initiative- Integrated AI training in undergrad and postgrad programs- Collaboration with Computer Science department	Interdisciplinary learning- Covers ML, NLP, and AI ethics- Focus on clinical decision-making and ethical awareness
Hong Kong	Chinese University of Hong Kong	AI-powered chatbot for clinical case learning- Faculty training and VR-equipped digital lab- Regular workshops and conferences	Personalized, interactive learning- Focus on healthcare management, ethics, and data privacy- Investment in infrastructure and faculty development
Comparative Insights- UK		Models vary from electives to fully embedded curricula- Emphasis on hands-on, interdisciplinary learning, and	The UK curriculum can benefit by integrating electives, fellowships, AI-research collaboration, and

		continuous development	simulation tools based on these models

Table 1: International Models of AI Integration in Medical Education

6. Integration of AI into Medical Education in the UK

A crucial initial step in integrating AI into medical education is assessing the current attitudes of medical students toward incorporating AI into the curriculum. Additionally, the most effective methods of teaching AI, whether through didactic lectures or practical, skills-based instruction, must be determined. Sit et al. (2020) [5] conducted a survey across 19 UK medical schools to evaluate students' perspectives on AI and radiology, revealing that 88% of respondents recognized AI's importance in healthcare. However, a significant proportion of students also acknowledged their lack of knowledge and confidence in utilizing AI-based healthcare tools [5].

One approach to introducing AI into the UK medical curriculum is the development of AI-focused student-selected components, intercalated degrees, and elective modules. This would allow a subset of students to engage deeply with AI concepts, improve their AI literacy, and explore AI's applications in both current and future healthcare settings. These smaller-scale initiatives could serve as pilot programs, generating insights that would inform the design of broader AI education strategies within medical schools.

For AI to be fully integrated into the core UK medical curriculum, consultation with key stakeholders is essential. This includes representatives from the General Medical Council (GMC), clinicians within the NHS, the Medical Schools Council, medical educators, and students themselves. The UK medical curriculum, particularly its competency framework, must be updated to incorporate AI education while ensuring that medical students develop confidence in using AI-driven technologies. One potential avenue for this integration is the inclusion of AI-related competencies within the Direct Observation of Procedural Skills (DOPS) framework, requiring students to complete a specified number of AI-related assessments to demonstrate proficiency.

An additional challenge in incorporating AI into medical education is the diversity of curricula across UK medical schools, each with its unique teaching methods and structures. The integration of AI must be carried out in a manner that aligns with these existing frameworks, ensuring that AI education is seamlessly embedded into medical training while remaining holistic and relevant to students' learning experience. The proposed framework for integrating AI into the UK medical curricular has been listed below in table 2.

Component	Description	Key Actions
1. Needs Assessment & Baseline Evaluation	Evaluate current student attitudes, awareness, and confidence regarding AI in healthcare	Conduct nationwide surveys (e.g., Sit et al., 2020)- Identify knowledge gaps and misconceptions- Assess

		demand for AI training among students and faculty
2. Pilot Program Implementation	Introduce AI through selective, optional learning pathways	Develop Student-Selected Components (SSCs), intercalated degrees, and elective modules- Use these as test beds for broader curriculum integration
3. Stakeholder Engagement & Consultation	Collaborate with governing and educational bodies to ensure curriculum alignment and accreditation	Engage GMC, NHS clinicians, Medical Schools Council, educators, and students- Form AI curriculum advisory committees
4. Curriculum Design & Competency Mapping	Define core AI competencies and integrate them into existing training frameworks	Update GMC's outcomes for graduates- Embed AI skills into assessments like DOPS- Ensure competencies align with clinical practice and patient safety
5. Teaching Methodology Development	Choose optimal instructional strategies for teaching AI in medicine	Combine didactic lectures with hands-on training (e.g., simulations, case studies, coding basics)- Use blended and interdisciplinary learning models
6. Integration with Existing Curricula	Embed AI content into diverse medical school structures while maintaining consistency	Map AI topics onto existing modules (e.g., radiology, diagnostics, ethics)- Customize integration based on each institution's teaching approach
7. Faculty Development &	Equip educators with the	Provide AI literacy

Support	knowledge and tools to teach AI effectively	workshops for faculty- Develop centralized teaching resources and toolkits- Foster collaboration with computer science departments
8. Evaluation & Continuous Improvement	Monitor implementation and adapt based on feedback and evolving technologies	Collect feedback from students and faculty- Review learning outcomes regularly- Iterate based on advances in AI and educational best practices

Table 2: Framework for Integrating Artificial Intelligence into the UK Medical Curriculum

7. Conclusion

The integration of artificial intelligence into healthcare is no longer a theoretical consideration—it is an immediate and necessary evolution that demands an educational response. This review has highlighted the widening gap between the growing application of AI in clinical practice and the limited AI training currently available to UK medical students and faculty. While students overwhelmingly acknowledge AI's importance, they lack the confidence, structured training, and ethical framework needed to interact responsibly with AI technologies in clinical settings.

International models from institutions such as Stanford, the University of Toronto, and CUHK illustrate how AI can be effectively embedded into medical education through interdisciplinary collaboration, hands-on learning, and strategic curriculum design. These examples provide a valuable foundation for building an AI-ready UK medical curriculum.

Several pedagogical approaches—ranging from AI-powered simulations and online modules to case-based learning and student-selected components—demonstrate potential for equipping students with both theoretical and practical competencies. However, knowledge gaps remain significant, particularly in areas such as algorithmic transparency, ethical governance, and interdisciplinary teamwork. Overcoming these challenges requires not only the integration of AI-related content into existing teaching frameworks but also investment in faculty development, infrastructure, and stakeholder collaboration.

To ensure that future UK clinicians are prepared for AI-enhanced healthcare environments, medical schools must act decisively to reform their curricula. Doing so will enable graduates to critically evaluate, ethically apply, and effectively use AI technologies to improve patient care, safety, and system efficiency. Only through proactive and coordinated efforts can medical education fulfil its responsibility to produce a workforce ready for the realities of 21st-century healthcare.

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