EDITORIAL

Moment in the Sun: MEDucation and MEDintelligence

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Clinicians predict that technological literacy will be the most important capability for doctors and nurses in 10 years' time. Technological literacy is indeed becoming increasingly vital in healthcare. As medical technology advances, doctors and nurses must be proficient at using various digital tools and systems to improve patient care.

Developing these technological skills will empower healthcare professionals to leverage technology effectively, ultimately enhancing patient outcomes and the efficiency of healthcare delivery.

Artificial Intelligence (AI) provides

- Real-time feedback,
- Accurate evaluation,
- Can be used to monitor teaching quality,
- A possible reason why AI has not yet been applied widely to practical teaching may be the disciplinary gap between developers and end-users. Therefore,
- It is necessary to strengthen the theoretical guidance of medical education to synchronize with the rapid development of AI,
- Medical educators are expected to maintain a balance between AI and teacher-led teaching, and
- Medical students need to think independently and critically.

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❑ **It is also highly demanded that research teams from a wide range of disciplines ensure the applicability of AI in medical education**

Clinicians predict that technological literacy will be the most important capability for doctors and nurses in 10 years' time. However, many report being overwhelmed by the sheer amount of data and information they are expected to take on, leading to concerns that increasing the role of health technology will take up more of their time than saving it. There is widespread support among clinicians to overhaul education and training to ensure they can keep pace with the rapid rate of technological advances. Fifty-six percent of clinicians globally predict they will base most of their clinical on using tools that utilize artificial intelligence; 69% report being overwhelmed with the current volume of data; 69% predict the widespread use of digital health technologies will become an even more challenging burden in the future; 83% believe training needs to be overhauled so they can keep pace with technological advancements.

❑ **Synergies and Overlaps in Generative AI and Transformative AI**

- Generative AI and Transformative AI are not mutually exclusive; they often intersect and complement each other. They can be used within Transformative AI applications to generate synthetic data for training AI models. Transformative AI, on the other hand, utilizes generative models to enhance data analysis and decision-making processes.

The synergy between Generative AI and Transformative AI leads to more robust and efficient AI systems with enhanced capabilities.

❑ **Medical graduates will be trained to bridge the gap between evolving technology in AI and Machine Learning (ML) and health care education and practice**

❑ **Evolving technology in Medical education**

- *Generative AI and Transformative AO*

Generative AI

Generative AI has significant potential to transform medical education by providing innovative and effective learning tools. There are several ways in which generative AI can enhance medical education

AI can create ***customized learning plans*** for students, adapting to their pace, strengths, and weaknesses, thereby enhancing individual learning experiences. Generative AI can create ***realistic virtual patients*** for medical students to diagnose and treat. These simulations can present a wide range of medical conditions, providing hands-on practice in a controlled environment. AI-driven ***interactive tutorials*** can engage students with adaptive learning pathways, quizzes, and real-time feedback, helping them grasp complex medical concepts more effectively. Generative AI can ***produce educational content***,

including lecture notes, summaries, and flashcards, tailored to the curriculum and student needs. AI can assist in **understanding and generating medical texts**, helping students with complex medical literature, summarizing research articles, and translating medical jargon into more comprehensible language. AI can **simulate clinical decision-making processes,** allowing students to practice diagnosing and creating treatment plans in a risk-free environment. These simulations can adapt based on the student's decisions, providing immediate feedback and alternative scenarios. AI can generate detailed **anatomical models and 3D visualizations**, aiding in the understanding of human anatomy and surgical procedures. Generative AI can **evaluate student performance in real-time, providing detailed feedback on clinical skills, diagnostic accuracy, and theoretical knowledge.** This can help identify areas that need improvement and track progress over time. AI can **facilitate virtual study groups** and collaborative projects, connecting students with peers and experts worldwide, fostering a collaborative learning environment. AI tools can assist students in research projects by **analyzing large datasets, identifying patterns, and generating hypotheses,** thereby enhancing their research skills.

By integrating generative AI into medical education, institutions can create more engaging, effective, and personalized learning experiences, ultimately producing more competent and confident healthcare professionals.

Transformative AI

Transformative AI in medical education goes beyond incremental improvements, fundamentally changing how future healthcare professionals are trained. Some of the examples are: **Adaptive Learning Systems; Immersive Simulations and Virtual Reality (VR)**; **AI-Enhanced Diagnostics Training; Advanced Data Analysis and Research; Natural Language Processing (NLP) for Medical Literature; Ethical and Professional Training; Continuous Assessment and Feedback; Global Learning Communities**: AI can connect students with peers and mentors worldwide, promoting the exchange of knowledge and best practices across different cultures and healthcare systems.

By integrating transformative AI into medical education, institutions can create a dynamic, interactive, and personalized learning environment that prepares future healthcare professionals to excel in an increasingly complex and technology-driven world.

☐ **Health care education and practice**
- AI in medical education can significantly enhance the processes of implementation, evaluation, and feedback, making them

more efficient and effective. Here's how AI can facilitate these aspects

Implementation involves
1. Curriculum Development: Content Customization and Resource Allocation
2. Interactive Learning Platforms
   o AI-Powered Simulations
   o Intelligent Tutoring Systems
3. Remote Learning
   o Tele-education
   o Learning Management Systems (LMS)

Evaluation involves
1. Automated Assessments
   o Objective Structured Clinical Examinations (OSCEs)
   o Multiple-Choice and Written Exams
2. Competency-Based Assessment
   o Performance Analytics
   o Skill Proficiency Tracking
3. Predictive Analytics
   o Performance Prediction
   o Outcome Analysis

Feedback involves
1. Real-Time Feedback
   o Instantaneous Responses
   o Adaptive Feedback
2. Comprehensive Feedback Reports
   o Detailed Analytics
   o Visualization Tools
3. Continuous Improvement
   o Iterative Feedback Loops
   o Peer and Self-Assessment

By leveraging AI in these ways, medical education can become more adaptive, efficient, and responsive to the needs of both students and educators, ultimately leading to better-prepared healthcare professionals.

☐ **Health Administration**
- AI and ML have the potential to significantly enhance efficiency and reduce costs in hospital administration.

☐ *Predictive Analytics for Patient Flow*
- ML algorithms can analyze historical data to predict patient admissions, discharges, and transfers. This helps in optimizing bed utilization, reducing wait times, and improving overall patient flow.

☐ *Resource Optimization*
- Fraud Detection and Prevention
- Supply Chain Management
- Automated Documentation and Data Entry
- Readmission Risk Prediction
- Clinical Decision Support Systems
- Patient Engagement and Remote Monitoring
- Operational Efficiency through Automation
- Efficient Diagnosis and Imaging Analysis

☐ **Specializing in a degree course on AI and ML can offer several advantages for a medical**

graduate. Here are some key benefits

- Advanced Analytical Skills
- Data-Driven Decision-Making
- Personalized Medicine
- Predictive Analytics
- Image and Signal Processing
- Automation of Repetitive Tasks
- Research Opportunities
- Interdisciplinary Collaboration
- Career Opportunities
- Continuous Learning and Adaptability: The field of AI and ML is dynamic and rapidly evolving. Pursuing a degree in this area encourages a mindset of continuous learning and adaptability, which are valuable qualities in any professional setting.

☐ **The next decade will see AI-ML-enabled healthcare professionals adept at the following**

- a) Efficient use of Electronic Health Records (EHRs) for accessing and updating patient information is critical for continuity of care and ensuring accurate patient data. b) The rise of telehealth requires doctors and nurses to be proficient in virtual consultation platforms to provide remote care. c) Familiarity with advanced medical devices, from diagnostic tools to wearable health monitors, ensures accurate patient monitoring and intervention. d) Ability to interpret data from various health technology tools can help in making informed decisions and predicting patient outcomes. e) Understanding how to use Artificial Intelligence (AI) and Machine Learning (ML) tools can aid in diagnosing diseases, personalizing treatments, and managing healthcare operations more efficiently. f) Knowledge of cybersecurity practices is essential to protecting patient data and complying with regulations like HIPAA. g) Ensuring different technological systems and devices can work together seamlessly to provide comprehensive care. h) Keeping up with the rapid advancements in medical technology requires ongoing education and adaptation.

It's important to note that integrating AI and ML into healthcare requires a deep understanding of both medical principles and technology. Therefore, combining a medical background with a specialization in AI and ML can position a professional to contribute significantly to the intersection of medicine and technology.