

The Past, Present, and Future of Medical Education: Technology Based Curriculum in the 21st Century

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Background and Current stance on Medical School Curricula of Medical Education

During the 18th century, paradigm shifts in methods of medical teaching and training have led to what medical teaching is classified as today: an emphasis on *nosology* and evidence-based treatment instead of only botany, anatomy, and physiology. The main concern that exists to today is lack of preparation of physicians to serve rural and minority populations. In the 20th and 21st centuries, expansion in technology and knowledge in biochemistry has resulted in sharper focus on detail, quality of patient care, and medical ethics. Currently, medical education is centered around understanding basic natural sciences, underlying pathology of diseases, and optimal management. Advancements in technology makes information and learning methods available for healthcare students and workers. Institutions and students can tremendously benefit by implementing artificial intelligence (AI) based teaching, learning, and training.

Technology In Medical Teaching and Care in the Current Millennium

Telemedicine in Healthcare education

- Delivery of healthcare services via communication technology by certified healthcare providers
- Provides healthcare services and medical education opportunities in underserved areas
- Train students with crucial clinical skills in partaking in technology-based healthcare

- "To have the effect of concrete existence without actually having concrete existence" (NASA)
- Alleviate patient safety concerns, improve students' practical clinical skills
- VR simulators can be used for self-evaluation and student-directed-feedback.

Virtual Reality (VR)

AI in ECGs

- Creating predictive models of patient electrocardiograms
- Enable the visualization of ECGs in the context of different pathological condition
- Showing ECG rhythm strips with captions of analysis in presentations can allow early skill acquisition

AI in Radiology & Pathology

- Detection of multiple lesions provided that the system receives a large number of training data (Transfer learning)
- Can provide a probability map for mitotically active sections and metastasis prediction rating
- Allows trainees to detect lesions and identify subtle histopathological changes

Internet of Things (IoT)

- Domain that incorporates technological and social sectors
- Can be implemented in healthcare quality and provision monitoring, and cancer diagnosis.
- Accurate behavior assessments and diagnosis can be made effectively with less error, can learn from patterns

AI in Medical Teaching

- Bridge knowledge gap between medical curricula and medical information by aiding physicians, alleviate increasing information load
- Shown to have better academic outcomes than traditional learning (Yang et al. 2019)
- Train interns in surgical and clinical skills to make them competent for day to day patient encounters

Principles and Evolution of Medical Education

Many question the "preclinical"- "clinical" dichotomy of teaching and curriculum design and imparting specific knowledge and skills on students. The teaching of an organ should be taught in its entirety, in regards to its function, location, normal and abnormal conditions, and specific disease manifestations in the organ. Conditions of organs and manifestations of diseases need to be continued to be taught throughout both preclinical and clinical years, more so for emphasis and proper integration of reasoning in medical decision-making.

References

Faculty from both preclinical and clinical years need to be integrated into both parts of medical school so that basic science concepts can be applied with further understanding in a clinical setting. Integration is necessary for students to fulfill an adequate understanding of all their concepts as a whole.



New Framework

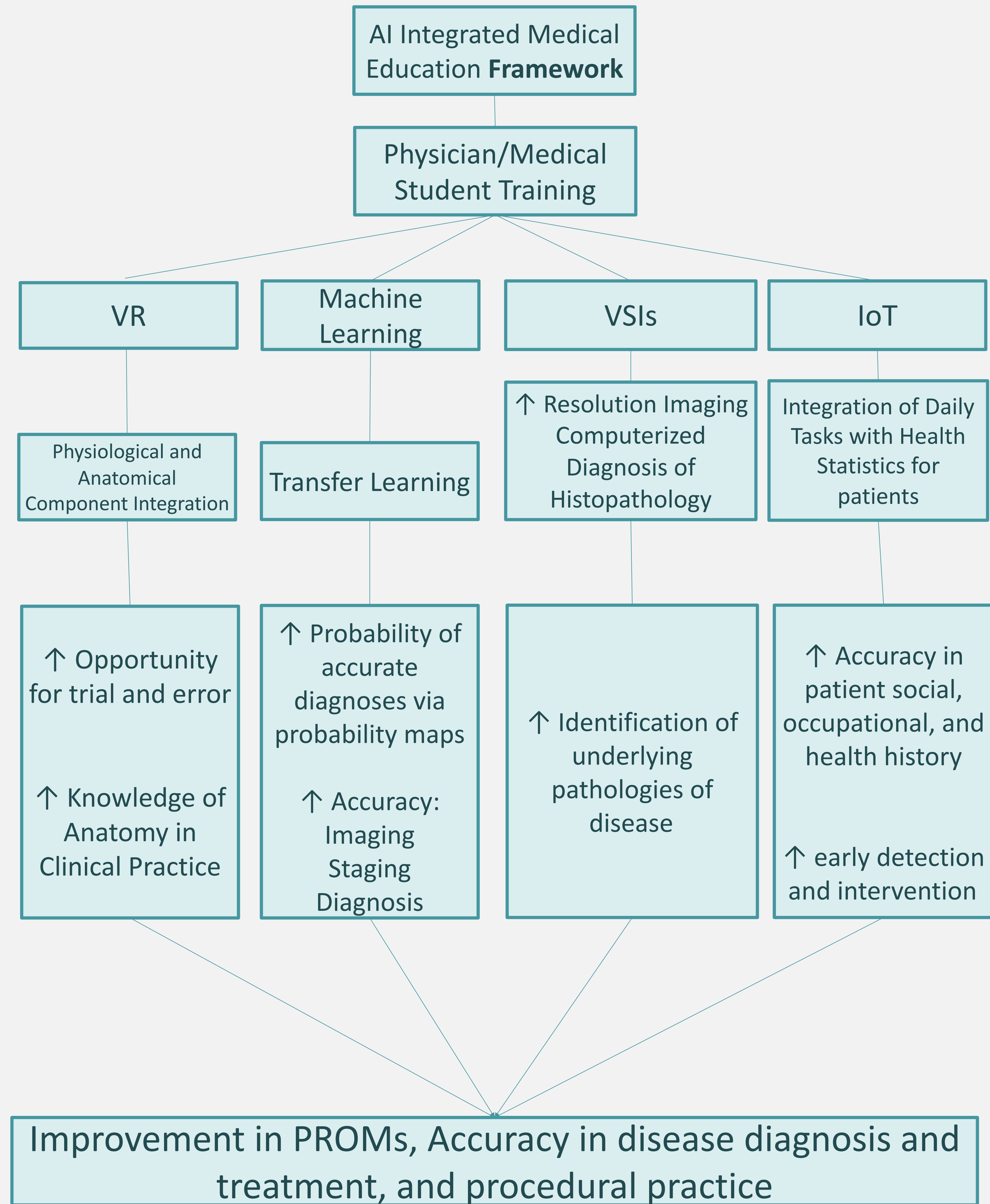


Figure 1: Medical Education Framework Mind Map

Shortcomings of Medical Education	Component of AI Technology Potentially Addressing Shortcoming
Lack of accuracy in acquisition of information	VR, CNN, VSI
Physical barriers to fair medical education	VLE, VR, IoT,
Patient safety and concerns	Telemedicine, VLEs, VR
Lack of training and consequent malpractice of medical students and trainees in health system technology	VR, Virtopsy, AI Training, CNN, IoT
Patient treatment and lifestyle modification	IoT, Telemedicine
Lack of methodical approach, accuracy of diagnosis, treatment, and prevention.	Virtopsy, VLE, VR, CNN, DLM, VSI

Figure 2: Potential Applications of Emerging Technologies to Address Unmet Medical Education and Healthcare Shortcomings

Key:

CNN: Convoluted Neuronal Networks; **VSI:** Virtual Slide Imaging; **VLE:** Virtual Learning Environments; **DLM:** Deep-Learning Models