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Short Communication

Utilization of Artificial Intelligence in Undergraduate Medical Education

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Artificial Intelligence [AI] relates to the simulation of intelligent behavior in computers [1]. Open AI, an Artificial Intelligence research and deployment company, launched ChatGPT on November 30, 2022 [2] and since then, AI has become the buzzword. However, even before ChatGPT started creating waves, AI had already been becoming a part of our lives in multiple fields. We are familiar with AI voice assistants like Siri and Alexa and automated AI-powered chatbots that provide customer support by answering questions instantly and processing requests. AI is gradually becoming integral to many businesses, sports, and other industries. It was only a matter of time before AI's tremendous possibilities in education were recognized [3].

Medicine is traditionally considered a conservative field, and changes take a long time to become common usage. AI has tremendous scope in medicine, and intelligent 'smart' machines are fast becoming a part of gathering and recording data, analysis, and diagnosis, aiding busy hospitals and medical care providers. The need for medical students to be trained in utilizing AI is also being recognized [4] even though, medical education itself, for the most part, has remained conventional.

The United States Medical Licensing Examination [USMLE] is a three-step examination for medical licensure in the U.S. It is meant to assess "a physician's ability to apply knowledge, concepts, and principles, and to demonstrate fundamental patient-centered skills, that are important in health and disease and that constitute the basis of safe and effective patient care" [5]. While one may find it hard to imagine an AI software's ability to achieve these lofty goals, ChatGPT is known to have achieved passing scores on all three steps of the USMLE [6]. We are now aware of its potential and need to harness the same for the benefit of the students.

Online learning is just one of the ways AI could be useful. The Covid-19 pandemic resulted in virtual learning being accepted, and many aspects of online teaching have found their way into routine teaching even after the pandemic has waned [7]. This article examines the advantages and concerns of using AI-based teaching methods in undergraduate medical education.

There are various ways AI can be incorporated into medical education:

- **Curriculum development:** Software like Kajabi [8] and Teachable [9] can help develop courses based on the curriculum provided. Many medical schools have adopted a system-based integrated curriculum with modules integrating components of different disciplines, like Anatomy, Physiology, Pharmacology, Immunology, Pathology, and Medicine. It is necessary that the integration is seamless and redundancy is avoided to make this work effectively. This requires coordination among various departments and constant self-checks to ensure and maintain the quality of integration. This process can be streamlined using AI software to bring everyone on the same page. Any curriculum updates can be efficiently incorporated with less effort and significant time delays.

- **Content creation and teaching aids:** AI can be a helpful aid in the development of course content and teaching aids. There is the technology that makes it possible to create a PowerPoint out of an essay in just a few clicks. Animations and videos can be created out of images or even text content. Using interactive modules, teaching faculty can receive instant feedback on students' conceptual understanding and implement remediation measures accordingly. Such innovations can enhance student interest and engagement and improve understanding, retention, and recall.
- **Learning aids for students**: AI can assist in creating notes, flashcards, or memory aids, which many students increasingly resort to improving their academic performance. AI can also improve the learning experience from recorded lectures. For example, Panopto has a smart search option that utilizes Automatic Speech Recognition [ASR] and Optical Character Recognition [OCR] technology to search for spoken words on videos or slides [10].
- **Personalized learning:** Students from diverse backgrounds and training enroll in medical schools. Some students already have a background in medicine or related fields, having completed their nursing training or other paramedical courses like a physician's assistant or Emergency Room tech. On the other hand, some students have no previous exposure to medicine. It is also well established that every student learns differently and has different strengths and challenges compared to their peers [11]. However, teaching faculty often are limited by time and other constraints to provide personalized training to all students [12]. The curriculum usually offers something for everyone, but not everything for everyone. These challenges can be addressed using AI-based intelligent tutoring systems, including AI chatbots and tutors to help with instruction and training. With a virtual tutor, students are less likely to feel embarrassed to share their concerns and gaps in knowledge [13]. Students who are naturally shy and reluctant to participate publicly would benefit greatly. Customized lessons will allow students to learn at their own pace. AI can analyze students' learning patterns and provide appropriate counseling and feedback regarding study skills. This could create an equitable learning experience for everyone.
- **Virtual reality:** Virtual labs in Pathology, Histology, and Microbiology, provide the students with a more comprehensive selection of cases and unlimited practice [14]. Even anatomical dissection is now simulated [15]. Virtual reality headsets have been shown to provide an immersive learning experience [16]. Immersive virtual environments can be designed for students to visualize hospital settings while seated in the classroom. They can also tremendously enhance the learning experience of integrated case-based discussions and problem-solving exercises.
- **Clinical skills teaching**: Standardized patients [SP] are increasingly being used as simulated patients instead of actual patients for students to practice their clinical skills, but they can make some students very anxious or nervous. Some students may require more time or interviews to achieve the required competency. Standardized patients cannot always be available, but virtual patients can be. Students can practice as many times as needed. Knowing that the patient is virtual would also help reduce their anxiety and allow them to develop their communication skills more naturally. AI can generate not only the hospital environment but also abnormal clinical findings in a virtual patient, allowing a student the extent of experience and practice which is not otherwise possible in a usual clinical lab setting. Some centers are even employing SPs as examiners during OSCE clinical skills assessments [17]. However, there is concern that SPs are not trained well enough to judge clinical skills. AI is already being used in surgical education [18] and can be used to simulate patients and procedures.
- **Assessment and grading:** AI can be used for exam generation, evaluation, and results posting [19]. It can also correlate statistical analysis of the question items to individual student performance and the overall success of the class. It can help teachers to identify the more troublesome concepts and help develop more effective teaching strategies. AI can recognize the student's learning ability and offer customized approaches for them to understand the topics better [20]. Practical examinations and OSCEs can utilize virtual reality to enhance the simulated settings otherwise used.
- **Research:** AI can assist with data research, collection, and processing, although this must be tempered with the need for a solid computational and AI bioethics framework [21]. It can be advantageous in both medical research as well as research on the learning

behavior of students. It can also check for plagiarism. There have been concerns about students using ChatGPT to generate essays, but ChatGPT itself can be used to verify if the essays were generated by itself, and it seemed to detect plagiarism better than the traditional detection tools [22].

Concerns

Although AI might have many of the answers to almost every issue in medical education, like any other tool, one must be aware of the indications and limitations of its use [23].

Accuracy: In medicine, any AI software must be constantly updated. The popular AI ChatGPT has been trained on information available until 2021; thus, a student depending only on that might miss significant recent developments. There is also a need to develop specific reporting guidelines for diagnostic accuracy studies assessing AI interventions [24].

Technology dependence vs. reluctance: Another drawback could be how an individual student might take to technology. While AI is meant to assist with learning, it should not become a crutch or habit such that students cannot develop their critical thinking or lose the ability to delve deep into a concept and reason out the answers for themselves. For example, automating simple processes like creating flashcards or writing notes could interfere with the learning that occurs during the very process of creation. Some students might not be comfortable with technology and feel handicapped instead of helped with AI-assisted sessions.

Bias: One also needs to be conscious of possible biases of an AI developer, which might affect the results or answers provided by an AI assistant, and any conflicts of interest must be noted.

Emotional intelligence: An AI software might pass USMLE, an MCQ-based exam. Medicine, however, is as much of an art as science. One needs to be cognizant that USMLE tests exam-taking skills. However, we need to train our students to be wholesome physicians with empathy, compassion, and efficient and kind communication skills, while using their clinical judgment and common sense in diagnosis and management, not just blindly following protocols.

Faculty and students must understand the limitations of whichever AI is used. AI should be considered a complement and not a replacement for conventional teaching, it should remain an assistant and not the master. We need to be mindful of the dire consequences of basing decisions entirely on machine learning based systems because sometimes algorithms can fail.

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