

## Artificial Intelligence: Opportunities and Challenges in Health Professions Education

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Artificial intelligence (AI) refers to intelligent computer systems capable of performing tasks that require human intelligence through the applications of algorithms, data analysis and computations. In simple words, AI can perform cognitive tasks that generally require human intelligence.<sup>1</sup> Another significant aspect of AI is Machine Learning (ML), which can learn by experience, adapt to new inputs, and make autonomic decisions. Machine learning models use large datasets to identify patterns and accurately predict outcomes. This includes the recognition of objects and faces through cameras and sensors.<sup>2</sup> By mimicking human intelligence, AI can solve complex problems across various fields, learn from each application and provide a variety of solutions to mimic intelligent human behaviour. On November 30, 2022, OpenAI released ChatGPT (Chat Generative Pre-Trained Transformer), an advanced chatbot created using OpenAI's GPT-3 model of large language models (LLM) and has been meticulously fine-tuned through supervised and reinforcement learning techniques.<sup>3</sup> GPT-3 has advanced text-generation capabilities for tasks like answering questions, drafting emails, writing articles, creating poetry, generating code, and translating languages. Despite the ability of GPT-3 (and improved GPT-4) to comprehend context, make decisions and handle lengthy dialogue, faculty reactions were mixed with expectations for a more engaging and comprehensible AI tool.<sup>4</sup> Naysayers were concerned about missing references, inaccurate data, and scientific responses which lacked depth and needed further analysis. Others started embracing this tool, using it for their own academic roles, emphasising the importance of AI while exercising caution. In the field of health professions education,

this newfound interest and debate on AI have, in a short period of time, led to numerous publications either in the form of commentaries, reviews or research papers.<sup>5-7</sup> While there are several published articles related to medical education discussing the advantages and challenges of the use of AI in student learning and assessment, there is a noticeable absence of analysis on the role of AI in faculty development and Health Professions Education (HPE) research.<sup>8-10</sup> This editorial commentary, while adding to a number of publications, aims to provide a different perspective by highlighting the opportunities and challenges that AI brings to five areas of health professions education: student learning experience, assessment, healthcare, faculty development and HPE research.

### Student Learning Experience

#### *Opportunities*

AI has the potential to improve the student learning experience by improving the quality of personalised learning, offering an intelligent tutoring system, and providing immediate responses in checking grammar, getting the answers to questions, generating a set of games, analysing a paragraph, or translating languages. Intelligent Tutoring System (ITS) provides personalised step-by-step tutorials on structured subjects like math and physics. The system determines the most effective learning pathway by utilising expert knowledge and responding to student progress. A survey on the ITS between 2000 and 2018 showed that the ITS system consists of four types of models: knowledge, student, pedagogy, and user interface. The user interface part of ITS consists of interaction among the users and the domain knowledge, and it

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presents text and graphics in response to the user's input. Depending on the student's behaviour pattern, the pedagogical model adjusts speed, picks the right tutoring strategy, and gives appropriate feedback to students.<sup>11</sup> ChatGPT can provide personalised tutoring and feedback to students based on their individual learning needs. Chen *et al.* (2020) demonstrated that ChatGPT could provide personalised mathematics tutoring and explanations tailored to student's misconceptions.<sup>12</sup>

### Challenges

While guided by the ITS and following adaptive tests generated by the AI tools, students' responsibility and efforts toward learning the basic principles of foundational subjects are often minimised. Tailoring explanations or feedback to meet a student's individual needs can be challenging in an AI-based adaptive system due to the machine's lack of understanding of context. It is essential to guide the students by the teachers to interpret the feedback they receive in AI-based learning systems. While going through a study related to MathBot, it was found that the study did not follow the standard protocol of identifying samples from the students who only went through the MathBot. Convenience sampling did not exclude the students who went through the MOOC, videos, and online quizzes apart from the AI tool.<sup>13</sup> It has been argued that although ITS has benefited students through personalised tutoring, inquiry-based knowledge-gaining approaches practised in learning science, like guided discovery and collaborative learning, are being ignored. Mizumoto and Eguchi (2023) utilised the GPT-3 text-DaVinci-003 to

automatically score 12,100 essays of non-native written English (TOEFL11) and compared the scores with the benchmark level. The study concluded that although automated scoring using GPT can provide a certain level of accuracy, it still cannot achieve perfect agreement with human raters. To avoid the delay in scoring observed in human scoring, and observation of an acceptable level of reliability and validity in automated scoring, it was proposed that AI-based automated scoring should be used in conjunction with human evaluation.<sup>14</sup>

Many educators have raised concerns that students would most likely lose their ability to think critically when confronted with real-life complex problems with the continuous use of AI. When utilising ChatGPT for academic writing purposes, it is capable of producing content that incorporates evidence obtained from online search engines. Nonetheless, it lacks the capacity to analyse and delve into literary works comprehensively.<sup>15</sup> Interaction and emotional connection created by the teacher require examples from real life in the learning process to allow the students to apply the knowledge effectively. The assignments or projects require the generation of new ideas from the students, followed by feedback from the teachers. Learning style varies among the students, which requires the teachers to employ different types of teaching strategies to aim for optimal engagement of the students in the session.<sup>16</sup> The field of health professions education is gradually recognising that the emergence of AI may require teachers to adapt their roles. In order to enhance the education of students, it is important for teachers to collaborate and integrate AI systems into their teaching practices.

## Assessment

### Opportunities

Automated scoring using AI tools can improve the opportunities for improvement in feedback to the students. AI has been used to automate formative assessment and provide feedback and thus, aims to improve patient outcomes. Incorporating innovative formative assessment methods, AI can aid in continuing professional education by identifying knowledge and skills gaps and providing support for learning over time. Using ML algorithms can enhance the effectiveness of evaluating surgical skills. An algorithm was trained using surgeons' experience levels to differentiate between various levels of operative skills and identify the gaps in student's skills.<sup>17</sup>

Educators navigating the growing use of AI in assessment face a complex dilemma. AI tools could offer more efficient methods to tailor questions to match a student's skill level, monitor students, provide feedback, and perform grading. Meticulous use of big data analytics with AI could also profile students' backgrounds, monitor student progress, and predict the probability of dropping out.<sup>18</sup> These technological advancements can save educators valuable time and offer a highly personalised approach to student academic journeys.

### Challenges

Educators worry that relying on AI might compromise development such as problem-solving, critical thinking and creativity.<sup>19</sup> Role of AI in formative assessment is widely acknowledged, but there remains a query about whether AI might diminish students'

capacity for understanding their own weaknesses and compromise the learning that arises from uncertain and varied thinking. The concerns about plagiarism with AI tools have also challenged the principles of academic integrity. To mitigate the concerns, some universities have provided policies or statements on the use of AI in assessment, and these policies largely focused on use (permit to use or not to use), acknowledgement of use, referencing and academic misconduct penalties.<sup>20,21</sup>

## Healthcare

### Opportunities

The ability of AI to analyse vast data and recognise patterns has varied applications in healthcare. This is useful in medical imaging and diagnostics whereby AI can help in detecting and diagnosing diseases from medical images such as X-rays, MRI scans and CT scans. The applications of AI were previously limited to basic data analysis. Now, AI occupies a significant role in the field of diagnostics,<sup>22</sup> personalised medicine, and patient care. Notably, systems like IBM Watson have emerged as transformative solutions in the realm of cancer therapy. Machine learning and natural language processing have demonstrated significant transformative potential, contributing to advancements in several domains, such as radiology and genetic analysis.<sup>23</sup> We foresee significant advancements in patient monitoring, predictive analytics, and treatment alternatives as AI systems evolve. Despite the existence of ongoing challenges to data privacy and ethical concerns, there is a distinct trend showing a significant integration of AI within the healthcare industry.

### **Challenges**

The integration of AI into healthcare holds promise, but there is a need to overcome significant challenges. These include protecting patient data, addressing data bias, ensuring system interoperability, navigating complex regulations, addressing ethical and legal concerns, gaining clinical credibility, and allocating resources. The key concerns also include standardisation, the need for continuous learning, patient trust, and eliminating health inequities. Collaboration, creating ongoing education, and transparency with a focus on patient outcomes are crucial for a successful implementation. Food and Drug Administration (FDA) has already approved 40 AI-based medical devices. A few examples of the applications include medical imaging platform, retinal image-based diagnosis of diabetic retinopathy, cancer detection using the characterisation of cancer genomics, prediction of acute kidney disease and tools to assist emergency medical care. The pressing question that has not received enough attention is about the lack of informed consent in the capture of the data which has been used to build the AI tools. Are there enough precautions being taken to prevent the possibility of biases in the data being used by the AI tools while predicting the diagnosis? The term “black-box” is widely used to describe the non-interpretable machine learning algorithms behind precision medicine, which are beyond the understanding of clinicians.<sup>24</sup> A report recently discussed the use of “synthetic” cancer cases instead of real cancer cases, being used to train the IBM Watson oncology detection tool.<sup>25</sup>

### **Faculty Development**

#### **Opportunities**

The capability of AI to personalise the learning process can assist in meeting the specific needs of the digital learners. The adaptive instructional content delivered by AI would be suitable to facilitate deeper comprehension of complex concepts. Compared to discussing difficult concepts with peers, the faculty would prefer less intimidating interaction with AI-based tools to understand complex concepts. AI can be used to analyse faculty members’ past development activities, learning needs, preferences, and performance data to predict their future needs and preferences and create personalised development plans.<sup>26</sup> AI-based digital tools can help capture the diverse activities of an educator and facilitate building a portfolio aligned with the needs of the reflection of teaching scholarship. To integrate AI technology into curriculum development and instructional delivery, HPE educators need to be trained to adopt the skills of data analysis.

#### **Challenges**

Despite the potential of utilising AI for faculty development activities, it can also present several challenges that need to be addressed. Key challenges include data privacy and security, bias and fairness, trust and acceptance, limited customisation and personalisation, and need for continuous evaluation and improvement.<sup>26</sup> As AI relies on large amounts of data to make informed decisions and recommendations, ensuring the privacy and security of faculty members’ personal and sensitive data can be a significant challenge. The algorithm of machine learning often

fails to identify the context and biopsychosocial aspects of the data. Hence, numerical data dependency may reduce the quality of instructional content and may create confusion among the educators. Lack of availability of adequate and diverse data on the parameters of faculty development is a serious impediment to the development of trustworthy AI tools. Therefore, it is important to strike a balance between automation and customisation to ensure that faculty members' specific requirements are adequately addressed. AI systems need to be continuously evaluated and improved to ensure their effectiveness and relevance. This requires ongoing monitoring, feedback collection, and analysis of the AI algorithms and their impact on faculty development outcomes. Faculty developers need to have mechanisms in place to assess the performance and efficacy of AI systems and make necessary adjustments.

## **HPE Research**

### ***Opportunities***

AI can be utilised in the research process in various ways, offering numerous benefits and opportunities. Besides its significant role in managing and analysing large datasets in research, AI can also help write research projects and articles for publication. Multiple AI tools have been shown to help with the review of literature, data collection, analysis and even interpretation.<sup>27</sup> Medical education literature has been dominated by authors from English-speaking countries and language has been perceived as a barrier. LLMs can be used to translate and correct manuscripts, facilitating authors from non-native English-speaking countries in their publications. LLMs can replace the role of librarians in facilitating systemic reviews.<sup>28</sup>

### ***Challenges***

While AI presents exciting opportunities for research, it also raises important ethical considerations. Many publishers have banned LLMs from authorship and have implemented regulations forcing the researchers using LLMs to document such usage in the methods section. Publishers are working on developing LLM detection tools to identify non-human authorship. The controversial use of AI tools has led to their ban in some educational institutions.<sup>29,30</sup> Many educational institutions have come up with guidelines to ethically use AI in research. Although AI has the capacity to increase efficiency and create novel insights for university research, it is essential to remember that these AI-generated outputs are based on algorithms trained on large datasets, for which bias is unavoidable. While AI-generated content can be beneficial, it also introduces unique challenges in the context of plagiarism. Researchers using AI tools must be cautious about the content generated and ensure it is appropriately attributed to its original sources.

While AI is indeed efficient and fascinating, it must be used carefully taking into account the ethical considerations. Potential risks and challenges may arise with the use of AI in HPE, including data gathering, anonymity, privacy, consent, data ownership, security, bias, transparency, responsibility, autonomy, and beneficence.<sup>31</sup> Since the introduction of generative AI (e.g., the release of ChatGPT at the end of November 2022), many have jumped on the bandwagon without understanding its pitfalls. It is clear from the feedback received after the AI workshop held at International Medical University (IMU), that some faculty members get thrilled about

the potential of the AI tools to assist them with their daily academic tasks, including lesson planning, assessments, research, and administrative tasks. There appears to be a lack of consideration regarding the ethical concerns and potential risks associated with widespread use of AI. This article highlights the need for policy on the use of AI for education, training and support for students, as well as guidelines on the management of academic integrity breaches, at all higher education institutes. There is a need for improvement in equipping the educators with digital literacy and assessment design skills to keep up with the rapid advancements of generative AI.

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## Conflict of Interest

The authors declare that no conflict of interest is involved in this editorial article.

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