

Artificial Intelligence Chatbots in Medical Education: A Literature Review of Potential Benefits and Challenges

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Abstract

Introduction: Today, the use of artificial intelligence chatbots in education has changed the way students learn and interact with educational content. In this regard, the current review study examines the Benefits and Challenges of using artificial intelligence chatbots in medical education.

Methods: The data of the present narrative review was obtained by comprehensive search of articles available in reliable databases such as Web of Science, PubMed, Scopus, Google Scholar on May 3, 2024. The keywords used in the literature search included Chatbot, Medical Education, and Medical Training. The selection criteria included scientific articles that addressed the objectives of the study and were written in English and Farsi.

Results: The most important benefits of using artificial intelligence chatbots in medical education include personalized learning, increasing interest in education and simple and unrestricted access, and its most important challenges include the risk of bias, inaccuracy and invalidity of data, ethical issues and the limitations of technology.

Conclusion: The results of the study have shown that the use of artificial intelligence chatbots in the education of medical sciences has many advantages, although the use of these chatbots also brings challenges in the students' learning, so based on the results of the study, in order to balance the benefits and challenges of artificial intelligence chatbots in medical education and research, careful and responsible use of this technology is necessary.

Keywords: Chatbot, Artificial Intelligence, Medical Education, Benefits, Challenges

Introduction

In recent years, the integration of technology in education has transformed how students learn and interact with educational content. One specific innovation in this field is the implementation of artificial intelligence chatbots, which stem from advances in deep learning, natural language processing, transformers, and large language models (LLMs). These chatbots are designed to mimic interactive conversations where the user inputs a potentially complex request, and the chatbot provides a human-like response.¹ Since their inception, these chatbots have been used for various applications, including answering questions, generating explanations and summaries, translating between languages, and performing other natural language tasks. These applications have led to the integration of LLMs into industries such as consulting, IT, and education.² The

initial models recognized and accepted in this field were OpenAI's ChatGPT, GPT-3.5, and GPT-4. Subsequently, other LLM-based chatbots such as Google Bard, Facebook LLaMA, and Anthropic have been developed.

Early evaluations indicate that large language models possess strong semantic and syntactic understanding in many natural languages and can perform natural language processing tasks effectively.¹ These models also have the capability to answer questions related to mathematics, science, programming, logical reasoning, and the humanities.^{2,3}

In educational settings, artificial intelligence chatbots facilitate interactive and personalized learning. These chatbots can provide immediate feedback, answer questions, deliver educational content, and engage students in interactive learning activities.^{4,5} Recently,

these chatbots have also become a pervasive and popular tool among medical students and faculty. Equipped with AI, these chatbots can conduct natural language conversations with users, making it easier for students to understand complex medical concepts and ask pertinent questions.^{5,6}

AI chatbots have the potential to enhance medical trainees' engagement in patient education, assist with tasks such as generating health-related articles, and answer complex medical questions. These chatbots can serve educators, learners, and medical researchers in various capacities.^{7,8} They can generate text, translate languages, write various types of creative content, and respond to questions in an informative manner. However, it is important to note that these chatbots are not human and do not possess human-level understanding. Their use in education should be cautious and tailored to individual learning styles and objectives.⁹

The use of AI chatbots like ChatGPT in medical education comes with both advantages and challenges. These chatbots can simulate clinical scenarios, enhance diagnostic skills, generate exercises, quizzes, and patient-related cases, perform automated grading, and provide personalized support to students and instructors.^{10,11} They can also transform medical education by acting as virtual teaching assistants, increasing student engagement, providing relevant information, and offering interactive medical education simulations.¹² In the process of medical education, AI chatbots can aid in virtual patient simulations, exams, clinical decision-making support, and curriculum development.¹³ However, there are limitations, including the need to address ethical concerns, ensure the accuracy and reliability of information, and overcome challenges in understanding medical terminology and context.^{14,15} Another limitation is the inability of chatbots to fully comprehend the needs and understanding of students.^{14,16} Therefore, ensuring appropriate and informed use of AI chatbots in education and learning is essential to maximize their benefits while mitigating associated risks. This necessitates a comprehensive understanding of both the benefits and challenges posed by AI chatbots to effectively integrate them into educational environments in a way that supports and enhances the learning process. Therefore, the purpose of the current narrative literature review study was to investigate and

report the opportunities and threats of using artificial intelligence chatbots in medical education. Therefore, the study data was obtained in line with the objectives of the study by comprehensively searching the articles available in reliable databases such as Web of Science, PubMed, Scopus, and Google Scholar.

The keywords used in the literature search included Chatbot, Medical Education, and Medical Training. The selection criteria included scientific articles that addressed the objectives of the study and were written in English. Excluded criteria included studies published in languages other than English and Persian, and literature articles that did not match the objectives of the present study.

Benefits

Personalized Learning

AI chatbots have the potential to provide personalized educational services to students, faculty, and staff in the university environment. AI chatbots make it possible to tailor educational content to individual learning needs and provide personalized feedback and guidance to students. By adapting to the needs of each learner, these chatbots increase the effectiveness of educational interventions and provide a more engaging and customized learning experience based on the user's requests and knowledge level, and provide educational content tailored to medical science.¹⁷⁻²¹ Also, artificial intelligence chatbots can provide personal explanations of medical terms for students at different levels and promote their learning.²²

Increasing Interest in Education

AI chatbots can increase students' interest in education, as Perksaitis and Rose have shown that learners showed significantly more interest in education when using a chatbot program.²³ Also, through interactions and real-time feedback, AI chatbots can increase student engagement, motivation, and knowledge learning and foster a more dynamic and stimulating learning environment, and simplify the learning process by providing immediate access to information and providing additional resources. They promote the acquisition of knowledge and efficient learning.²¹ These chatbots help students to identify and correct their mistakes quickly, this is especially necessary in medical education where accuracy is very important.¹⁹

Easy Access without Restrictions

AI chatbot applications provide easy access to educational content through the Internet and mobile devices, enabling learning anywhere regardless of time and location constraints. This accessibility promotes immediate responses and human interactions and facilitates self-directed learning.²⁰⁻²² Also, these chatbots can be designed to be accessible to students with disabilities to make medical education more inclusive and equitable.¹⁹

Interactive Learning and Simulation Tools

AI chatbots can provide appropriate support for students as interactive search engines, providing real-time feedback, guiding students through challenging concepts, and automating tasks such as converting lecture material to flashcards. These tools can also provide clinical scenarios for students to work through patient simulation, clinical management, decision-making skills, and personal feedback⁹ and thereby help improve student learning.¹⁹ These chatbots provide an interactive learning experience by engaging users in conversations and providing real-time answers to questions related to medical science topics.²¹ In this regard, Tangadulrat and colleagues have shown that artificial intelligence chatbots help students by creating sample scenarios, suggesting appropriate physical examination, and providing appropriate medical advice.²³

Medical Literature Support

AI-enabled chatbots can play an important role in classifying and categorizing research articles, helping students find relevant research articles based on topics of interest and creating summaries for quick reference. They can also help in the early stages of literature review by collecting related articles based on specific research criteria and identifying trends and future directions in this field.^{9,18,20}

Use as a Teaching Assistant

AI chatbots can help reduce instructor workload by automating routine tasks and providing more support to students, allowing instructors to focus on more complex, high-level tasks.^{19,24} Artificial intelligence chatbot can act as an efficient helper tool in medical education. By doing this, it is possible to help improve the quality of medical education and increase access to medical information.²⁵ These chatbots can be used to

supplement traditional teaching methods, provide additional support and resources for students, and help bridge the gap between theoretical knowledge and practical skills.¹⁹ Also, the results show that artificial intelligence chatbots respond to medical questions with high precision and provide explanations with high insight, and can be economical and efficient in medical education.²⁵

Support for Various Activities

Chatbots can support various educational activities such as providing training courses, teaching about applications and processing service desk requests in different university departments.^{17,21}

Emotional Support

Artificial intelligence chatbots can help reduce student stress by providing a supportive and non-judgmental learning environment, which is essential for effective learning in medical education.¹⁹ These chatbots can provide emotional support to users dealing with sensitive medical issues and create a safe environment for learning and discussion.²¹

Challenges

Risk of Bias, Inaccuracy and Invalidity of Data

AI chatbots are trained on human-generated data. Therefore, biases and inaccuracies in the data are repeated by these chatbots.²⁵ AI chatbots may also inadvertently disseminate false or misleading information, leading to challenges in distinguishing between real knowledge and unverified data.¹⁹⁻²¹

Also, students may face problems in checking the validity of information provided by artificial intelligence chatbots, which potentially leads to believing misleading or incorrect information.²⁰ Considering that artificial intelligence chatbots are widely trained in public fields or specific scientific fields, the answers produced by this tool may have a low accuracy rate in some other scientific fields.²⁵ Wang et al. have shown that ChatGPT can provide appropriate recommendations for general medical questions. However, for more specific subjects, it may not be accurate enough.²⁶ Thangadulart et al. also stated that the first concern in artificial intelligence chatbot programs was the lack of specific treatment plans for the patient, although it provides accurate and repeatable recommendations for general knowledge.²³

Another study has also shown that artificial intelligence chatbot models may be inadequate in terms of basic medical science content, and the accuracy of artificial intelligence chatbots is heavily dependent on human capability and judgment, so these factors can lead to low accuracy in responding to medical questions.²⁵ It can also be stated that training artificial intelligence to understand the context of user queries, especially in medical sciences, can be challenging due to the complexity and variety of medical information, which causes low accuracy in the answers provided.¹⁹

Data validity is another point of concern in the use of artificial intelligence chatbots in medical education. Due to the increasing number of emerging predatory publications and publishers, ChatGPT may rely on unreliable and fraudulent sources.¹⁹

Ethical Issues

Ethical concerns include authorship, plagiarism, copyright infringement, misinformation, and inherent bias in the model.^{18,27-30} For example, AI chatbots should not be used to provide medical advice or diagnoses or to create harmful or offensive content.²⁵ Ensuring the ethical use of artificial intelligence in medical science, including data privacy, bias and accountability, creates challenges that need to be addressed.²¹

Technological Limitations

The data of AI chatbots is not up-to-date^{15,25,28,31} and these chatbots were trained up to a certain date about six months to a year ago. Therefore, they are unable to provide up-to-date medical scientific information. The lack of publicly available educational data for medical education limits the reliability and effectiveness of educational tools such as ChatGPT.³² It also shows concerns about data protection and personal contact with the patient with limitations due to the small sample size.³³ AI chatbots should be trained to handle open or unstructured input from users, especially on emotional or sensitive topics in medical science.²¹ In general, there are still significant technical challenges in the development of artificial intelligence chatbots for educational purposes, which require more work to effectively address these issues.¹⁸ According to the stated challenges, there is a need for deep understanding of artificial intelligence algorithms and

techniques by doctors.³⁴

Inequality of Access

Limited access to artificial intelligence technologies and generative artificial intelligence tools and language models may prevent some learners from fully benefiting from the educational opportunities provided by artificial intelligence chatbots and increase the educational gap between individuals.²⁰

Negative Effects on Learning

Possible negative effects of using chatbots in medical education include the following:

- Lack of ability in critical thinking and solving complex problems: There is a possibility of excessive dependence on this technology that may reduce the ability of students to think critically and solve complex problems.¹⁸
- Reducing human interaction: the possibility of reducing human interaction and participation, which are very important factors for learning and strengthening clinical skills.¹⁸
- The need to teach evaluation skills: there is a need to teach written and visual evaluation skills for students in order to check the accuracy and quality of the resources used.¹⁸
- Limited impact on knowledge acquisition: While AI chatbots can increase interest and self-directed learning, they may not have a significant impact on knowledge acquisition. In Preiksaitis and Rose's study, both experimental and control groups showed similar improvement in knowledge, which indicated no significant difference in knowledge acquisition between groups.²²

Discussion

In the present study, the role of artificial intelligence chatbots in the field of medical education has been investigated. Artificial intelligence chatbots, as an artificial intelligence language model, provide many possibilities and advantages for this field. Benefits include quick and easy access to large amounts of medical information, clinical decision-making assistance, and providing personalized learning experiences for students. Also, these tools are capable of data analysis, literature review, decision support, patient participation and clinical trial design in medical research. However, the use of artificial intelligence

chatbots in the medical field also raises concerns. These concerns include information accuracy, over-reliance on technology, the possibility of plagiarism, limitations in critical thinking, and data privacy issues. Based on this, past studies have emphasized the need for continuous evaluation of programs related to artificial intelligence chatbots, necessary adaptations and thorough research to maximize its benefits while preventing or reducing its challenges in its use in the medical community.²⁰ Another study has also emphasized that the use of artificial intelligence in medical education and medical informatics can improve the learning experience and strengthen artificial intelligence skills. It is also necessary to consider the development of educational content related to artificial intelligence and the use of new methods such as computer games and gamification to improve the education process.³⁴ In order to reduce the challenges associated with the inaccuracy and validity of responses, Wang et al. have recommended that the development of a dedicated chatbot may be beneficial. For example, the SnehAI chatbot was developed to educate adolescents in India about sexual health and has shown promising results.²⁶

Conclusion

In general, in order to balance the benefits and potential limitations of AI chatbots in medical education and research, cautious and responsible use of this technology is suggested. To ensure the accuracy of information, protect patient privacy, and prevent abuse, it is necessary to use artificial intelligence chatbots with specific standards and in cooperation with relevant organizations. These actions will make this technology be used more effectively in improving medical education.

Conflict of Interest

The authors declare no conflicts of interest.

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