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ChatGPT and similar models in higher medical education of China: refuse or embrace?

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Abstract: The development of artificial intelligence (AI) technology is promoting the transformation of medical practice and medical education. Many countries including America and China have incorporated the development of AI into its national strategy, advocating and promoting the integration of AI education into medical education, enabling medical students to understand and accept the concept of AI and its technical advantages, as well as cultivating future medical personnel to use AI related technologies to assist clinical decision-making and improve the efficiency and quality of diagnosis and treatment. ChatGPT, one of the most popular AI programs at the moment and released by OpenAI company at the end of 2022, is a language model based on natural language processing (NLP) and machine learning. It is the latest achievement of artificial intelligence natural language processing tools and will be continuously updated. Once launched, ChatGPT quickly became the focus of global attention, and triggered discussions on college education in ChatGPT. This article looks forward to the potential role and limitations of ChatGPT and similar models in medical education in the future from its application scenarios and limitations.

Key words: artificial intelligence; ChatGPT; medical education

1 Introduction

Artificial intelligence (AI) has developed rapidly in recent years and has gradually been applied to various industries in society, especially in the medical field with broad prospects. AI assisted recognition and diagnosis technology has been applied in fields such as imaging, pathology, medical laboratory technology, and has shown strong technological advantages. On November 30, 2022, the artificial intelligence chat robot ChatGPT was launched, becoming popular worldwide in just a few months, with over 100 million users in only two months, much faster than other popular software such as Twitter, Meta and TikTok (Fig.1). ChatGPT is a natural language processing tool driven by artificial intelligence technology launched by OpenAI, a subsidiary of Microsoft Corporation. This tool was constructed based on the transformer neural network architecture, one of the most advanced deep learning models. It is an optimized model for processing sequential data, with language comprehension and text generation capabilities. It can engage in dialogue through learning and understanding human language, and is trained using real data and human feedback through reinforcement learning. ChatGPT has the knowledge reserve of "fount of all knowledge". It can learn and understand

human language, data, cases, information, etc. for dialogue and feedback, and communicate in chat scenarios that are nearly identical to those of real human beings. ChatGPT is not just a chat robot, but can also write emails, video scripts, copywriting, translations, code, and even research papers. Some similar tools such as "Bard" from Google, "Lex" from Amazon, "ERNIE Bot" from Baidu were launched, respectively. So far, ChatGPT has been used as a tool to generate draft outline and language translation for research manuscript written [1]. It can be predicted that ChatGPT and similar tools will inevitably have a profound impact on our life, learning and other aspects. Similarly, ChatGPT can be used in the fields of education and academic research, such as providing auxiliary teaching for students and natural language processing and data analysis tools for researchers. Medical education, as an important component of higher education, will also face new opportunities and challenges from ChatGPT and related tools.

Fig. 1. Time to reach 100 million users

Like the developed countries such as Unite States and Europe, Chinese governments and organizations at all levels have always attached great importance to medical education and issued a series of guidance documents (http://www. http://en.moe.gov.cn/) [2]. In 2017, the General Office of the State Council issued the *Opinions on Deepening the Collaboration of Medical Education and Further Promoting the Reform and Development of Medical Education*, which stated "Deepen the reform of medical education in universities,... promote the integration of information technology and medical education,... actively promote the reform of health vocational education and teaching, build a modern health vocational education system, adhere to the combination of engineering and learning, standardize and strengthen practical teaching links, improve the dynamic update mechanism of teaching standards, and promote the synchronous update of educational content and clinical technical skills". The implementation of the *Opinion* and the increasing integration of artificial intelligence in medical practice have put forward new and higher requirements for the cultivation of medical talents in the new century. Subsequently, in 2018, the construction of a "new medical discipline" was proposed, actively exploring and building high-quality medical education in the new era [3]. The connotation of the construction of "new medical science" is a new round of scientific and technological revolution and industrial transformation represented by artificial intelligence and big data as the background. With the integration of medical engineering, science and literature, new requirements have been put forward for the original traditional medical specialties, and new medical specialties such as "precision medicine", "translational medicine", and "intelligent medicine" have been emphasized for development. It can be seen that the country attaches great importance to artificial intelligence education. Developed countries such as Europe and America also attach great importance to artificial intelligence education in higher education institutions. Some universities in the United States have taken the lead in incorporating big data analysis and artificial intelligence courses into their training systems [4]. Since 2018, the United States has been integrating artificial intelligence, mobile healthcare,

and other content into the assessment of professional physicians [5]. In 2017, the artificial intelligence robot "Xiaoyi" jointly developed by Tsinghua University and Iflytek (an AI company from China) passed the written examination of the National Medical Practitioner Qualification Examination with an excellent score of 96 points above the passing line for the first time internationally [6]. In recent years, numerous government agencies, including UNESCO and the Ministry of Education of China, have successively issued several policy documents supporting the development of artificial intelligence, strengthening the innovative application of artificial intelligence technology in education [7]. Integrating artificial intelligence education into medical education, enabling medical students to understand and accept the concept and technological advantages of artificial intelligence, and cultivating future medical personnel to use artificial intelligence related technologies to assist clinical decision-making, have important practical significance in improving diagnosis and treatment efficiency and quality.

Medical education has the characteristics of high complexity, strong systematicity, and the need for lifelong learning. ChatGPT and its similar models, through training using massive existing human data, has strong language generation and problem-solving abilities, and has good potential to assist medical education. Although some regions and universities have restricted the use of ChatGPT on campus or districts due to concerns about plagiarism and cheating in course paper or exams, ChatGPT will undoubtedly play an irreplaceable role in university medical education due to its unparalleled advantages.

This article provides a review and outlook by combining the characteristics of medical education and the possible application scenarios and potential limitations of ChatGPT and its similar models, in order to provide reference for understanding the application of artificial intelligence, including ChatGPT and its similar models, in medical education (Fig. 2).

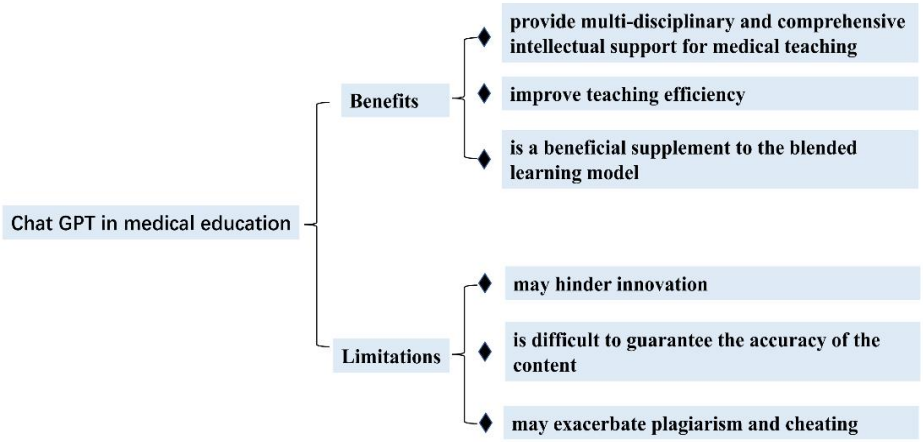

Fig. 2. The potential benefits and limitations of ChatGPT and its similar models in medical education

2 The advantages of ChatGPT and its similar models in medical education

2.1 ChatGPT and its similar models can provide multi-disciplinary and comprehensive intellectual support for medical teaching

Medicine is a complex and systematic multidisciplinary system. Medical education not only covers natural disciplines such as biology, physiology, anatomy, pharmacology, developmental studies, biochemistry, physics, pathology, but also covers humanities and social sciences such as psychology, ethics, and law. Each discipline is interrelated and interdependent, requiring systematic learning and understanding. The complexity and systematicity of medical knowledge place very high demands on teachers' teaching. For the same case analysis, different course teachers have different

teaching focuses, which inevitably leads to a lack of comprehensiveness. Taking a patient infected with COVID-19 as an example, in the same case, etiology teachers will generally focus more on explaining the etiology characteristics, transmission routes, prevention and control strategies of COVID-19; immunology teachers often focus on explaining the antigen structure of viruses, antigen antibody recognition, immune storms, vaccine design, etc; similarly, pharmaceutical course teachers generally pay more attention to antiviral drug design, drug target search, and so on. Therefore, limited by their knowledge background, teachers in any subject often habitually focus on the explanation of their own subject knowledge during the teaching process, or intentionally or unintentionally neglect the transmission of knowledge from other subjects, making it difficult for students to think about problems from multiple disciplines. Medical education needs to impart multidisciplinary medical knowledge to medical students and cultivate their comprehensive qualities to think and handle diseases from a macro and comprehensive perspective. It is believed that ChatGPT is a train with at least 45TB of data through billions of parameters, and its database contains a vast amount of open source information, which is constantly increasing. This allows ChatGPT and its similar models to have a vast reserve of medical knowledge, which can comprehensively answer many medical problems. In addition, the questioner can also conduct questioning, and ChatGPT can understand the content of continuous questioning and continuously provide more accurate, scientific, and humanized content according to the requirements of questioning. Therefore, ChatGPT and its similar models can provide multi-disciplinary and comprehensive intellectual support for medical teaching, empowering the construction of "new medical disciplines".

2.2 ChatGPT and its similar models can be fully referred to as participating in teaching to improve teaching efficiency

In order to adapt to the development trend of higher education in the new era, the Central Committee of the Communist Party of China and the State Council have issued the *Opinions on Strengthening and Improving Ideological and Political Work in Higher Education Institutions under the New Situation*, which clearly states that we should adhere to the education of full members, whole process, and the full range (hereinafter referred to as "Three-wide Education"). The concept of "Three-wide Education" requires universities to follow the laws of teaching and students' learning and growth, and participate in the entire process before, during, and after each course to effectively improve the quality of teaching. Firstly, in the pre-class session, ChatGPT and its similar models can answer students' questions in real-time based on the difficulties encountered during their preview. For complex or difficult to grasp problems, they can be recorded and verified with the course teacher. At the same time, ChatGPT and its similar tools can also generate teaching materials such as courseware and classroom notes, helping teachers quickly prepare course content. Secondly, ChatGPT and its similar tools can improve classroom efficiency. After teaching the course content, teachers can reserve a few minutes for students to interact with ChatGPT and its similar models. Through multiple rounds of interactive Q&A, ChatGPT and its similar models can help students better understand the course content. In addition, these tools can help teachers provide personalized learning advice and homework in class. Students can improve their learning efficiency by using these models after class, and can also communicate with other students to improve the effect of cooperative learning. By evaluating students' learning situation, teachers can adjust the teaching content in a timely manner and improve the effectiveness of classroom teaching. Meanwhile, through the evaluation report of students, teachers can also understand students' learning difficulties and provide assistance to improve their academic performance in a timely manner.

2.3 ChatGPT and its similar models are a beneficial supplement to the blended learning model

The online and offline hybrid teaching mode integrates two teaching methods, organically combines the "what is learned and what is used" of the course, and integrates abstract theoretical knowledge learned online with offline teaching activities, enabling students to more efficiently and deeply understand and master the connotation of knowledge. In recent

years, in addition to conventional offline teaching, various innovative online teaching models have also flourished. As we all know, due to the impact of the "COVID-19" epidemic and the teaching requirements of "classes suspended but learning continues", online teaching has been carried out in all kinds of schools at all levels, which provides a rare practical opportunity for online education, objectively promotes the rapid development of online education, spawns a variety of teaching modes such as online live teaching, video teaching, MOOC, virtual simulation, and effectively guarantees the advancement of teaching progress. But at the same time, some objective problems of the online education model have also been exposed in practice, such as the lack of face-to-face communication opportunities with teachers, poor teaching effectiveness, lack of teacher-student interaction, frequent teaching emergencies, and difficulty in supervising students. ChatGPT can serve as a teacher assistant through online communication, providing opportunities for students from different places to communicate face-to-face with teachers, and improving students' learning outcomes. ChatGPT can provide problem-solving services to students 24 hours a day, without being limited by time and location, and can temporarily compensate for the lack of guidance during the absence of teachers. In addition, ChatGPT can enhance students' interest in learning, increase their participation, enhance classroom interactivity, and ultimately improve teaching effectiveness through voice and text interaction.

3 Limitations of ChatGPT and its similar models in medical education

The emergence of ChatGPT is an inevitable technological innovation for medical teaching and a powerful promotion for the upgrading of the education field. It should be noted that any technological progress can be a double-edged sword, and while we see its technological progress, we cannot ignore the many potential challenges it brings.

3.1 ChatGPT and its similar models may hinder innovation

Medical education should not only help build a solid and systematic medical knowledge system for medical students, but also cultivate their critical and innovative thinking. Due to the fact that ChatGPT is based on existing data, similar questions raised by different classmates will ultimately result in duplicate text generation, which cannot be answered from different perspectives like a real person, ultimately leading to a lack of creativity. Over reliance on ChatGPT may reduce students' enthusiasm for exploring knowledge, discourage positive thinking, and trigger lazy thinking. In medical schools and universities across the country and even around the world, simple automatic text generation may also reduce students' participation in course assignments.

3.2 ChatGPT and its similar models are difficult to guarantee the accuracy of the content

Medicine is a discipline that pursues rigorous knowledge to the extreme, and incorrect medical knowledge may lead to irreparable serious consequences. Due to the fact that ChatGPT is trained through a large amount of text, like other large language models, a large amount of literature data needs to be re-read every time the information content is updated. As it is difficult to update frequently, the information stored in the model is relatively lagging behind. Moreover, its knowledge comes from the internet, making it difficult to guarantee the accuracy of its sources. Some people are concerned that text generated by artificial intelligence may be inaccurate or contain incorrect information. Moreover, the current version of ChatGPT does not provide any evaluation of content accuracy. In addition, artificial intelligence models are trained on a large amount of data, which may include biases. The text generated by artificial intelligence may continue or amplify biases, resulting in adverse effects. Therefore, during the use of ChatGPT, it is necessary for the instructor to verify the generated text, especially the answers to complex medical questions, for evaluation and revision to avoid misleading students.

3.3 ChatGPT and its similar models may exacerbate plagiarism and cheating

The powerful text generation ability of ChatGPT has also raised concerns in the education industry: will school

assignments become meaningless from now on. A survey conducted on an education website study.com among over 1000 students showed that over 89% of students use ChatGPT to help complete homework. Anthony Orman, a philosophy professor at the University of Michigan, once told the media that he found that the best course paper in his class was created by ChatGPT. At present, foreign education authorities generally take a cautious attitude towards ChatGPT. The education department in New York, the United States, believes that this tool "will not cultivate critical thinking and problem-solving ability", so it issued the "ChatGPT Ban", which also means that neither teachers nor students can use ChatGPT on the network and equipment of public schools in New York City. At present, universities and research institutions around the world have issued clear bans on artificial intelligence, restricting the use of ChatGPT and all other AI based tools to complete learning and exam tasks. Several journals and publishing institutions, such as Science and Nature, believe that the text generated by ChatGPT lacks originality and does not have the responsibility of being a paper author [8]. Therefore, it is prohibited to consider ChatGPT as a co-author of the paper [9] [10]. In response to possible plagiarism and cheating, some institutions are developing a detection tool for ChatGPT generated content. By inputting the content to be tested, it can quickly determine whether the text is ChatGPT generated within a few seconds.

4 Conclusion

AI technology is developing rapidly, and some believe it will completely change people's work and lifestyle, possibly marking the beginning of the next technological revolution. Carrying out artificial intelligence education in medical education, cultivating the ability of medical students to apply AI related knowledge and skills to analyze and solve problems, using AI to assist clinical decision-making in future medical practice and improve medical quality, are important driving forces and lever for medical education reform. ChatGPT is a language model tool based on natural language processing (NLP) and machine learning. At present, it interacts in the form of text. In addition to interacting with people through dialogue, it can also be used for relatively complex language work, including text generation, automatic question answering, automatic summary generation, etc. ChatGPT can serve as a teacher assistant in medical education to assist teaching, which can promptly answer students' questions and provide them with more in-depth and detailed medical background knowledge; help students quickly sort out problem-solving ideas and check their homework errors; timely follow up on the latest medical progress and research results, making the teaching content more practical and cutting-edge. Although ChatGPT currently has restrictions on China and cannot be used by domestic users, with the follow-up of companies such as Google and Baidu, the trend of ChatGPT and its similar products entering the education industry is difficult to reverse.

Overall, although language models driven by artificial intelligence such as ChatGPT are powerful tools that can assist teachers in completing some teaching tasks, we should evaluate the applications of ChatGPT and its similar products in the education field in advance, fully consider its advantages, limitations, and potential risks, and be proactive.

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Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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