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# The place of ChatGPT in the future of dental education

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## Abstract

**Objective:** ChatGPT's applications provide benefits in customer service by providing human-like responses, in creating unique content in different fields and subjects, in rapid language translation, in creating literature reviews and summaries in scientific research, in writing programming codes and analysing large clinical and genomic datasets, in education by offering different perspectives and causing a review of traditional methods, in healthcare applications by optimising workflow, reducing documentation burden and costs, and in the transition to personalised medicine. The objective of this research was to delineate the content produced by ChatGPT when prompted to outline the advantages and disadvantages of utilising ChatGPT in dental education.

**Materials and methods:** In the correspondence with ChatGPT, the place of ChatGPT in dental education, the advantages of using ChatGPT, the possible risks and difficulties that may arise, possible strategies to overcome the difficulties that may arise with the implementation of ChatGPT in the educational process were discussed.

EEÇ: What is the role of generative language models in dental education?

ChatGPT: Overall, dental students can use ChatGPT as a versatile and useful tool to improve their understanding of dental concepts, enhance their communication skills, and improve their writing abilities.

**Results:** The efficacy of ChatGPT in dental education can be linked to its capability to simplify intricate concepts and terminologies into more comprehensible elements, fortified by interactive explanations and demonstrations. The use of language models like ChatGPT in healthcare education requires cautious evaluation and an evidence-driven approach, as additional research is needed to overcome possible limitations resulting from their application.

**Conclusions:** ChatGPT can be used by dental students as a versatile and useful tool to better understand dental concepts, improve their communication skills, and enhance their writing abilities.

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## Introduction

In 1950, British computer scientist Alan Turing raised the question of whether computers can match human reasoning: "Can machines think?" (1). He subsequently proposed the Turing Test as a means of assessing computer or artificial intelligence. The Turing Test involves a human interrogator who is presented with responses from both a human and a computer (which is capable of generating written texts in real-time). If the interrogator cannot distinguish between the responses, the computer system is considered to have passed the Turing Test. While several computer programs and chatbots, such as Eliza, have successfully passed the Turing Test (2,3), it can be argued that these programs used certain techniques to pass the test (4), rather than demonstrating any significant intelligence. Due to the advancements made in machine learning and natural language processing (NLP), chatbots have garnered significant research attention and are being utilized for a wide variety of commercial and non-commercial applications (5-7).

ChatGPT OpenAI was released as a new chatbot supported by artificial intelligence in November 2022, and this robot, which can chat on many different topics and has a vocabulary of more than 300 billion words, attracted great interest from the public. In this way, it reached 57 million users in the first month and 100 million users in January 2023 (8).

Unlike previous chatbots, ChatGPT surprised the public with its ability to give coherent answers to various questions (9). It has also been the fastest growing consumer application to date (10).

ChatGPT's applications can be used in customer service, in creating unique content in different fields and topics, thanks to its human-like responses, fast language translation, in creating literature reviews and summaries in scientific research, writing programming codes and analysing large clinical and genomic datasets, in education by offering different perspectives and causing a review of traditional methods, benefits are provided in optimising workflow in healthcare applications, reducing documentation burden and costs, and transition to personalized medicine. In the past few studies, ChatGPT has been found to have useful applications in education, particularly within the realm of healthcare education, as noted in a recent review (11,12).

Studies have shown that ChatGPT can pass the United States Medical Licensing Examination (USMLE) (13,14), postgraduate ophthalmology examinations, and the University of Minnesota Law School examinations (15).

As a result, the objective of this research was to delineate the content produced by ChatGPT when prompted to outline the advantages and disadvantages of utilizing ChatGPT in dental education.

## Materials and methods

On April 3, 2023, a descriptive study was performed by employing a search strategy that utilized the default model of ChatGPT from OpenAI (OpenAI, L.L.C., San Francisco, CA, USA) (16). At the end of the literature review, in the correspondence with ChatGPT, the place of ChatGPT in dental education, advantages of its use, possible risks and difficulties that may arise, possible strategies to overcome the difficulties that may arise with the implementation of ChatGPT in the educational process were discussed (10-12,17). Due to the absence of human or animal involvement, ethical approval was not deemed necessary for this study.

The interview has been presented in an entirely unedited format, with no alterations made to ChatGPT's responses, with the purpose of showcasing its current capabilities and demonstrating its potential for use in the fields of dental education, research, and practice.

## Results

**Question:** EEÇ: What is the role of generative language models in dental education?

**Answer:** ChatGPT: Generative language models, like the one I am built on, can be valuable tools in dental education. These models use natural language processing and machine learning techniques to generate text that is coherent and can be used to teach concepts and explain complex topics. One way that generative language models can be used in dental education is by providing students with access to online resources that contain detailed explanations of different dental procedures, techniques, and concepts. For example, a generative language model can be used to create interactive tutorials that walk students through the steps involved in performing a particular dental procedure. Another way that generative language models can be useful in dental education is by providing students with personalized feedback on their work. By analyzing the text that students produce, a language model can identify areas where they need improvement and provide targeted feedback to help them improve their skills. Overall, generative language models have the potential to be powerful tools in dental education, helping to enhance students' understanding of dental concepts and techniques, and improving their skills in the field.

**Question:** How can dental students use ChatGPT in the smartest way?

**Answer:** Dental students can use ChatGPT in several ways to enhance their learning experience. Here are a few smart ways that they can utilize ChatGPT: Ask questions: Students can ask ChatGPT questions related to dental procedures, concepts, and techniques. They can get detailed and accurate answers, which can help them better understand the topic. Practice communication skills: Dental students can use ChatGPT to practice their communication skills, such as taking patient histories and explaining procedures. They can use the language model to generate responses that mimic the types of questions and conversations they would have with real patients. Improve vocabulary: Dental students can use ChatGPT to learn new vocabulary related to dentistry. They can ask for definitions of unfamiliar terms and get examples of how they are used in context. Get feedback: Students can use ChatGPT to get feedback on their writing. They can generate text related to dental procedures, and the language model can evaluate the text for clarity, accuracy, and organization. This can help students improve their writing skills. Overall, dental students can use ChatGPT as a versatile and useful tool to improve their understanding of dental concepts, enhance their communication skills, and improve their writing abilities.

**Question:** In the ChatGPT era, could asking good questions become a more important skill than answering questions?

**Answer:** Yes, in the ChatGPT era, asking good questions is becoming an increasingly important skill compared to just answering questions. With the abundance of information available on the internet and the growing use of AI language models like ChatGPT, the ability to ask insightful questions has become critical for effectively navigating and understanding complex topics. Asking good questions requires critical thinking and the ability to identify knowledge gaps and areas that need further clarification. By asking well-crafted questions, individuals can engage in deeper learning and gain a more comprehensive understanding of the subject matter. Moreover, as AI language models become more sophisticated, the ability to ask targeted and specific questions will become even more valuable. ChatGPT, for example, can generate highly detailed and accurate responses to well-formulated questions. This means that students and professionals who are able to ask the right questions can leverage the power of these language models to enhance their learning and problem-solving abilities. In short, in the ChatGPT era, asking good questions has become an

increasingly important skill that can help individuals to gain a deeper understanding of complex topics and better navigate the vast amount of information available online.

**Question:** How will university education, especially teaching and assessment, change as a result of the rise of generative and dialogic AI tools such as generative language models?

**Answer:** The rise of generative and dialogic AI tools such as generative language models will likely have a significant impact on university education, particularly in the areas of teaching and assessment. Here are some potential changes we might see: Personalized learning: As AI language models become more sophisticated, they can be used to create personalized learning experiences for students. These models can be used to analyze student performance and provide targeted feedback and resources that address individual learning needs. Automated grading: AI language models can be used to automate grading and assessment, reducing the burden on instructors and providing more timely and consistent feedback to students. More interactive and engaging learning experiences: AI language models can be used to create more interactive and engaging learning experiences, such as chatbots that can answer student questions, or interactive tutorials that simulate real-world scenarios. More focus on critical thinking: With the rise of AI language models, the focus of education may shift from memorizing information to developing critical thinking and problem-solving skills. Students may be encouraged to ask more complex and nuanced questions that require higher-order thinking. Collaboration between AI and human instructors: AI language models can be used to supplement human instruction, providing additional resources and support to students. Instructors may also work alongside AI models to develop more effective teaching strategies. Overall, the rise of generative and dialogic AI tools such as generative language models is likely to bring significant changes to university education, from personalized learning experiences to more focus on critical thinking and collaboration between AI and human instructors.

**Question:** What will be the role of ChatGPT in teaching complex dental procedures in basic dental education?

**Answer:** ChatGPT can play a valuable role in teaching complex dental procedures in basic dental education. Here are a few ways that ChatGPT can be used: Providing detailed explanations: ChatGPT can be used to provide detailed explanations of complex dental procedures. Students can ask questions related to the

procedure, and ChatGPT can generate a response that breaks down the steps involved and explains the rationale behind each step. Simulating patient interactions: ChatGPT can be used to simulate patient interactions, which can help students develop their communication skills. Students can practice explaining procedures to ChatGPT, which can provide feedback and suggest areas for improvement. Generating case studies: ChatGPT can be used to generate case studies that illustrate complex dental procedures. Students can study these cases and learn from the experiences of others. Providing feedback on student work: ChatGPT can be used to provide feedback on student work related to complex dental procedures. Students can generate text related to a procedure, and ChatGPT can evaluate the text for clarity, accuracy, and organization. This can help students identify areas where they need to improve. Overall, ChatGPT can be a useful tool in teaching complex dental procedures to students in basic dental education. By providing detailed explanations, simulating patient interactions, generating case studies, and providing feedback on student work, ChatGPT can help students develop their understanding of complex procedures and improve their communication and problem-solving skills.

**Question:** What can ChatGPT do to improve the diagnostic and treatment planning skills of dental students?

**Answer:** ChatGPT can be a valuable tool for improving the diagnostic and treatment planning skills of dental students. Here are some ways that ChatGPT can be used for this purpose: Providing case-based learning: ChatGPT can be used to provide case-based learning opportunities for dental students. Students can ask questions about patient cases, and ChatGPT can generate responses that guide students through the diagnostic and treatment planning process. Generating differential diagnoses: ChatGPT can be used to generate differential diagnoses for complex dental cases. Students can provide information about a patient case, and ChatGPT can generate a list of potential diagnoses along with explanations and supporting evidence. Generating treatment plans: ChatGPT can be used to generate treatment plans for complex dental cases. Students can provide information about a patient case, and ChatGPT can generate a treatment plan that takes into account the patient's individual needs and medical history. Providing feedback on student work: ChatGPT can be used to provide feedback on student work related to diagnostic and treatment planning skills. Students can generate text related to a patient case, and ChatGPT can evaluate the text for accuracy, completeness, and organization. This can help students identify areas

where they need to improve. Supporting self-directed learning: ChatGPT can be used as a resource for self-directed learning. Students can ask questions about diagnostic and treatment planning skills, and ChatGPT can provide information and resources to support their learning. Overall, ChatGPT can be a valuable tool for improving the diagnostic and treatment planning skills of dental students. By providing case-based learning, generating differential diagnoses and treatment plans, providing feedback on student work, and supporting self-directed learning, ChatGPT can help students develop the skills they need to provide effective and evidence-based dental care.

**Question:** How will you approach issues that need to be supported by visuals, such as the diagnosis of caries type or typical images of some syndromes?

**Answer:** When dealing with issues that require visual support, such as the diagnosis of caries type or typical images of some syndromes, ChatGPT can provide additional context and information through natural language descriptions and explanations. However, it is important to note that visual aids are an essential component of dental education, and ChatGPT cannot replace them entirely. To support the diagnosis of caries type or other dental conditions, ChatGPT can provide relevant information and descriptions based on natural language queries or prompts. For example, a student could ask ChatGPT about the different types of caries, and the system could provide descriptions and images to help the student understand the differences and characteristics of each type. ChatGPT can also provide information on common symptoms, risk factors, and potential treatment options for various dental conditions. For typical images of some syndromes or other dental conditions, ChatGPT could access visual databases and provide descriptions and information about the visual characteristics of those conditions. However, it is important to note that ChatGPT cannot replace the value of direct visual examination and consultation with dental professionals. Students should still be encouraged to consult with their professors or other dental experts, and utilize visual aids such as radiographs, clinical images, and intraoral cameras when learning about dental conditions and their diagnoses. In summary, while ChatGPT can provide valuable information and descriptions regarding dental conditions and diagnoses, visual aids are still an essential component of dental education. Students should be encouraged to use both natural language descriptions and visual aids to gain a comprehensive understanding of dental conditions and their diagnoses.

**Questions:** Is ChatGPT useful for interactive education for dental students?

**Answer:** Yes, ChatGPT can be a useful tool for interactive education for dental students. Interactive education is an approach to learning that involves active participation, collaboration, and engagement with the learning material. ChatGPT can facilitate interactive education in the following ways: Real-time feedback: ChatGPT can provide real-time feedback to students as they ask questions or provide responses. This feedback can help students stay on track and ensure that they are understanding the material correctly. Personalized learning: ChatGPT can be customized to meet the individual learning needs of students. Students can ask questions related to their specific learning needs, and ChatGPT can generate responses that address those needs. Simulating patient interactions: ChatGPT can simulate patient interactions, which can help students develop their communication and problem-solving skills. Students can practice explaining procedures to ChatGPT, which can provide feedback and suggest areas for improvement. Collaborative learning: ChatGPT can facilitate collaborative learning by allowing students to ask questions and provide feedback to each other. This can help students learn from each other and develop their teamwork skills. Access to expert knowledge: ChatGPT can provide access to expert knowledge in real-time. Students can ask questions about complex dental procedures, and ChatGPT can generate responses that provide detailed explanations and guidance. Overall, ChatGPT can be a valuable tool for interactive education for dental students. By providing real-time feedback, personalized learning, simulating patient interactions, facilitating collaborative learning, and providing access to expert knowledge, ChatGPT can help students develop the skills they need to provide effective and evidence-based dental care.

**Question:** What is the benefit of ChatGPT for the faculty member in dentistry education?

**Answer:** ChatGPT can provide several benefits to faculty members in dentistry education: Efficient communication: ChatGPT can provide faculty members with an efficient way to communicate with students. They can use ChatGPT to answer questions, provide feedback, and provide guidance to students in a timely manner, without the need for face-to-face interactions. Enhanced teaching: ChatGPT can enhance teaching by providing faculty members with access to expert knowledge and the ability to provide personalized learning experiences for students. Faculty members can use ChatGPT to provide real-time feedback, generate case-based learning opportunities, and

simulate patient interactions to improve the learning outcomes of their students. Time-saving: ChatGPT can save faculty members time by automating repetitive tasks such as grading and providing feedback. For example, ChatGPT can be programmed to evaluate student work and provide feedback on areas that need improvement, allowing faculty members to focus on other aspects of teaching and research. Improved assessment: ChatGPT can improve the assessment process by providing more objective and consistent grading of student work. By using ChatGPT to evaluate student work, faculty members can reduce the potential for bias and ensure that grading is based on objective criteria. Collaboration: ChatGPT can facilitate collaboration between faculty members by providing a platform for sharing knowledge, discussing ideas, and exchanging feedback. This can lead to improved teaching practices, research collaborations, and professional development opportunities. Overall, ChatGPT can provide significant benefits to faculty members in dentistry education, including more efficient communication, enhanced teaching, time-saving, improved assessment, and collaboration.

**Question:** What problems may be caused by the inclusion of ChatGPT in dental education at all stages and what is your solution for this?

**Answer:** The inclusion of ChatGPT in dental education can bring several benefits, as we discussed earlier, but it can also create some potential problems. These problems may include: Overreliance on technology: Over-reliance on ChatGPT or any other AI tool may cause students to rely on technology instead of their own knowledge and problem-solving skills. This could lead to a lack of critical thinking and independent decision-making abilities. Data privacy and security concerns: As ChatGPT requires access to student data to function, data privacy and security concerns may arise. If the data is not adequately protected, it could be subject to cyber threats and compromise student privacy. Access to technology: Some students may not have access to the technology required to use ChatGPT, which could create disparities in learning outcomes.

Lack of human interaction: ChatGPT is an AI tool, and therefore, it lacks the personal touch and empathy of human instructors. This could lead to a lack of emotional connection between students and instructors, which could negatively impact the learning experience. To address these potential problems, it is essential to adopt a balanced approach to integrating ChatGPT into dental education. Here are some possible solutions: Incorporating ChatGPT as one of many learning tools: It is important to encourage

students to use ChatGPT as a supplement to their learning rather than as a replacement for their own knowledge and problem-solving skills. Ensuring data privacy and security: Adequate measures should be taken to protect student data, such as using secure servers and adhering to data privacy laws. Providing access to technology: Efforts should be made to ensure that all students have equal access to the technology required to use ChatGPT, such as providing access to computers and high-speed internet. Balancing technology with human interaction: Instructors should aim to strike a balance between using ChatGPT and other AI tools and providing personal interactions with students. Instructors should also encourage students to interact with each other in person or through other collaborative methods. In summary, integrating ChatGPT into dental education can bring several benefits, but it is important to adopt a balanced approach to avoid potential problems. By incorporating ChatGPT as one of many learning tools, ensuring data privacy and security, providing access to technology, and balancing technology with human interaction, we can maximize the benefits of this innovative tool while minimizing the potential risks.

**Question:** Can student use and abuse of ChatGPT be prevented?

**Answer:** While it is impossible to completely prevent student use and abuse of ChatGPT, there are several measures that can be taken to minimize these risks. Here are some suggestions: Develop clear guidelines: Develop clear guidelines for the use of ChatGPT, including what is considered acceptable use and what is not allowed. This can include guidelines around plagiarism, cheating, and academic misconduct. Monitor usage: Monitor the usage of ChatGPT to detect potential misuse, such as excessive or inappropriate use. Provide education: Provide education to students on the appropriate use of ChatGPT and the potential consequences of misuse. Encourage critical thinking: Encourage critical thinking and independent problem-solving skills to reduce the reliance on ChatGPT and discourage the abuse of the tool. Use anti-plagiarism software: Use anti-plagiarism software to detect any instances of plagiarism or academic misconduct. Collaborative learning: Encourage collaborative learning and group discussions, as this can reduce the incentive to misuse ChatGPT and promote academic integrity.

By implementing these measures, it is possible to minimize the risks of student misuse of ChatGPT and promote responsible use of this powerful tool in dental education.

## Discussion

The present research was carried out amidst a fervent discourse regarding the suitability of ChatGPT as an AI-powered Language Learning Model (LLM) in the field of dental education. The objective of the investigation was to appraise the transformative potential of ChatGPT, an exemplar of Language Model Models (LLMs), as an inventive resolution for addressing the current challenges in dental education.

Healthcare education faces significant challenges, including but not limited to: firstly, in numerous countries, the number of healthcare students has increased rapidly without commensurate improvement in the quantity and quality of healthcare faculties; secondly, the ever-changing healthcare landscape driven by societal expectations and demands for healthcare services; thirdly, the unprecedented growth and accessibility of healthcare-related knowledge; fourthly, the rapid advancement of technological innovations that must be integrated into healthcare; fifthly, the necessity of improving the training of healthcare professionals in essential communication skills; and lastly, the ongoing need to enhance the assessment methods for healthcare students, to ensure credible, equitable, and valid results, which are integral goals of higher education curricula (18-22). As a result, the pursuit of continual improvement in healthcare education seems to be of paramount importance.

The utilization of ChatGPT has the potential to be highly promising in dental education. In recent years, technology has been increasingly utilized in dental education to create a purposeful and captivating learning experience for dental students (23). In particular, the integration of Chatbot technology in dental education has been deemed exceptionally valuable by students for providing an interactive and personalized learning experience (24). This type of experience can be achieved through the provision of interactive content and detailed instructions, which are vital in dental education (25). The role of generative language models in dental education and the most rational use of students according to ChatGPT's own response are listed as follows; generative language models help students to better understand dental concepts and techniques and improve their skills in these field, and dental students can use ChatGPT as a versatile and useful tool to better understand dental concepts, improve their communication skills and improve their writing skills. Furthermore, for interactive education for dental students, ChatGPT can

help students develop the skills they need to provide effective and evidence-based dental care by providing real-time feedback, personalised learning, simulating patient interactions, facilitating collaborative learning and access to expert knowledge. Such a strategy could facilitate a holistic learning experience, incorporating interactive tools that have the potential to enhance the achievement of desired learning outcomes (26). Personalized learning has been shown to enhance the involvement of healthcare students and enrich their learning outcomes (27). Additionally, AI-based technologies can be advantageous in improving clinical reasoning skills among medical students by providing them with realistic case scenarios and immediate feedback on their diagnostic and treatment decisions (28).

Moreover, the efficacy of ChatGPT in dental education can be linked to its capability to simplify intricate concepts and terminologies into more comprehensible elements, fortified by interactive explanations and demonstrations (12).

Furthermore, the implementation of ChatGPT in conjunction with other Chatbots has the potential to yield economic benefits by reducing the costs and space required for dental students' training (24). The significance of ChatGPT is particularly relevant in the clinical training of dental students, as it allows them to practice their techniques in a controlled environment, thereby enhancing their skills (23,29).

Additionally, Chatbots that provide virtual reality experience with instant feedback on dental students' techniques enable them to access tailored and personalized dental training (24). Thus, ChatGPT holds promising potential for dental education by providing personalized and cost-effective learning experiences.

An essential aspect examined in this study is the challenges and concerns associated with the implementation of ChatGPT in dental education and the measures to tackle these potential issues.

ChatGPT listed these problems and solutions as follows; it is important to take a balanced approach to avoid potential problems. By including ChatGPT as one of many learning tools, ensuring data privacy and security, providing access to technology and balancing technology with human interaction, we can maximise the benefits of this innovative tool while minimising potential risks. In addition, in the question about misuse, it was seen that problems such as plagiarism, cheating, academic misconduct, misuse, decrease in critical thinking/independent problem-solving skills, impairment of cooperation and group

work skills may be encountered. The field of healthcare education requires the handling of confidential patient information. The use of AI-based tools such as ChatGPT must be subject to strict regulation to ensure the protection of data privacy, safeguard patient confidentiality, and prevent any adverse effects arising from breaches of data privacy, such as loss of insurance, employment opportunities, and personal relationships (30,31). Therefore, when evaluating the potential use of ChatGPT in healthcare education, careful consideration should be given to the significant ramifications that may arise for both patients and healthcare professionals, including potential legal liability issues (11). In addition, it is crucial to prioritize the continual advancement of critical thinking and communication abilities among healthcare students. This can be achieved through the incorporation of active learning strategies and fostering independent thinking.

## Conclusions

ChatGPT can be used by dental students as a versatile and useful tool to better understand dental concepts, improve their communication skills, and enhance their writing abilities. By providing detailed explanations, providing personalised learning, providing case-based learning, creating differential diagnoses and treatment plans, simulating patient interactions, creating case studies, and providing feedback on student work, ChatGPT can help students understand complex procedures and improve their communication and problem-solving skills.

It can also provide significant benefits to faculty members in dental education, such as more efficient communication, improved teaching, time saving, improved assessment and collaboration.

In addition to all these, there are issues where it is lacking. While ChatGPT can provide valuable information and explanations about dental diseases and diagnoses, visual aids are still an important component of dental education and there is no visual support. In addition, over-reliance on AI may impair the critical and independent thinking skills that are important for dentistry. The problems of ensuring data confidentiality, not being accessible to everyone at all times, and problems such as misuse and plagiarism have been thought-provoking aspects of ChatGPT in dental education.

The utilization of language models such as ChatGPT in the field of healthcare education warrants careful consideration and an evidence-based approach, as further research is necessary to address potential limitations that may arise from their implementation.

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