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The tools of the future are the challenges of today: The use of ChatGPT in problem-based learning medical education

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ABSTRACT

What is the educational challenge?

Incorporation of large language model (LLM) or generative artificial intelligence (AI) software poses a challenge to various areas of medical education, including problem-based learning (PBL). LLMs, such as ChatGPT, have incredible potential to transform educational systems and enhance student learning outcomes when used responsibly.

What are the proposed solutions?

ChatGPT can provide several ways to support students and assist facilitators with course responsibilities. Here we address factors of implementation and describe how ChatGPT can be responsibly utilized to support key elements of PBL.

How was the solution implemented?

Providing reasonable access is an essential element of novel software implementation. Additionally, training for both faculty and staff is vital to foster responsible usage, provide baseline proficiency, and guide users to critically evaluate the quality of output.

What lessons were learned that are relevant to a wider audience?

The use of LLMs or other generative AI is dramatically rising in the world. Appropriate and conscientious incorporation of AI into educational programs can foster responsible use and potentially enhance student learning.

What are the next steps?

Assessment of learning outcomes, student self-efficacy, group dynamics, and stakeholder feedback are required to measure the effects of ChatGPT in the PBL curriculum. Additionally, software programs competitive with ChatGPT are currently under development and will also need to be investigated for their potential role in education.

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What is the educational challenge?

The use of large language model (LLM) artificial intelligence (AI) or generative AI, such as ChatGPT, has recently arisen as a challenge affecting many areas of education. ChatGPT is a deep learning, neural network-based AI that uses natural language processing to generate human-sounding responses (Lo 2023). The focus of criticism on the use of AI in education is centered around two concerns described by Lo (2023). First, students could use ChatGPT to violate academic integrity standards by passing AI generated text off as their own or by entering assignment questions into the AI and using the generated answers. Interestingly, ChatGPT has been demonstrated to produce content that has bypassed detection from commercial plagiarism detection software (e.g., TurnIt In). Second, ChatGPT can produce inaccurate answers, content, or references that can lead to student mislearning. Implementation of AI in a manner that maximizes advantages, while minimizing potential harm, is part of the current challenge in education (Lo 2023). The age of AI is only in its infancy and learning how to adapt to the growing sophistication of software tools is critical.

What are the proposed solutions?

Problem-based learning (PBL) in the medical curriculum involves several student-centered processes including defining problems in cases, identifying areas of incomplete knowledge, performing self-directed learning, and group discussion to review learning objectives and solutions (Neufeld and Barrows 1974; Wood 2003). Faculty facilitators are typically limited to helping identify resources and guiding discussion in a non-didactic manner (Neufeld and Barrows 1974; Wood 2003). PBL is acknowledged as an effective approach in pre-clinical medical education, enhancing student knowledge, communication skills, teamwork, and problem-solving abilities, as well as cultivating well-rounded future physicians (Neufeld and Barrows 1974; Wood 2003). Here we describe several methods to incorporate ChatGPT into the seven key elements of the PBL curriculum as described by Cho et al. (2021):

Incorporation of real-life problem

Relevant clinical cases are time intensive to develop for PBL (Neufeld and Barrows 1974). ChatGPT can provide relevant chief complaints, realistic patient histories, dialogue

scripts, symptoms, test results, and treatment options in minutes with a high degree of complexity, which is required for PBL (Neufeld and Barrows 1974; Wood 2003) (Supplemental Material 1). It is critical to ensure that all generated content is contemporary in the medical field and must be corroborated to verify accuracy.

Collectiveness

Collectiveness refers to the social constructivist process of acquiring new knowledge through groups discussion (Cho et al. 2021). A significant concern is that ChatGPT could become an authoritative voice in the discussion group and undermine the collectiveness element of PBL. However, AI output would vary based on each student's prior knowledge and personal syntax. This would generate contrasts, subsequent comparisons, and lead to further discussion (Supplemental Material 2). Therefore, to successfully implement ChatGPT, a key element of the training needs to focus on how to use the software as another resource that contributes to the collaborative knowledge building process.

Solution formation

As a group, students can formulate potential solutions to case problems and ask ChatGPT to provide critical feedback that can elaborate on the student learning process, including revealing unidentified learning objectives or knowledge gaps (Supplemental Material 3).

Learner proactiveness

Learner proactiveness is focused on students' intrinsic motivation to learn and feelings of responsibility for their learning tasks (Cho et al. 2021). To preserve learner proactiveness, incorporation of ChatGPT must include appropriate student training, strong group dynamics, and/or a competent facilitator who ensures that students treat ChatGPT as only one of many resources.

Evaluation

Self-evaluation is one method for students to gain knowledge of their own strengths and weaknesses. ChatGPT can provide potential solutions that students can compare to their individual or constructed group solutions as a form of self-assessment (Supplemental Material 4A). Additionally, ChatGPT can be used to generate formative and summative assessment questions based on learning issues (Supplemental Material 4B).

Involvement of planning process

Students, as part of self-directed learning, need to select adequate resources to address learning issues (Cho et al. 2021). Selection of ChatGPT as one resource allows for step-by-step contributions to the medical workup process. Although the free version of ChatGPT (i.e., GPT-3.5) cannot provide accurate references (e.g., correct article or book citations), it can assist students in generating learning objectives which can be used for informed selection of other resources (Supplemental Material 2).

Facilitation by instructor

One cited challenge of PBL is the demanding faculty resources needed to develop, administrate, and maintain a PBL-based medical curriculum (Wood 2003; Taylor and Mifflin 2008). For example, faculty are often responsible for creating engaging cases that mirror real world problems while still being appropriate to the students' level of understanding (Wood 2003; Taylor and Mifflin 2008). Although ChatGPT cannot replace the role of a facilitator, its capabilities provide facilitators with many resources. ChatGPT can assist in developing realistic case elements (e.g., complaints, symptoms, dialogs, test results, diagnosis, and treatment plans) (Supplemental Material 1). Additionally, well-worded prompts can provide framework learning objectives that can be used to assist in meeting educational core competencies (Supplemental Material 2). Moreover, ChatGPT can rapidly generate board-style questions for formal assessments (Supplemental Material 4B). Finally, ChatGPT can generate auxiliary Socratic lines of questioning that the facilitator can use to lead the students to self-identify any potential gaps in understanding (Supplemental Material 5).

How was the solution implemented?

Two key components for implementation are providing access and training. Access to ChatGPT requires at least one computer device (e.g., desktop, laptop, or smartphone) with an internet connection. In low resource settings (e.g., no computer or stable wireless connection readily available), a smartphone can provide access *via* an application and service provider. The creation of a free account at OpenAI (<https://openai.com/blog/chatgpt>) is also required. However, there are some limitations of the free account including no functionality with images (Lo 2023). OpenAI offers a subscription-based model to ChatGPT (i.e., GPT-4) with a monthly fee. The relatively low cost for access may change as the technology and marketplace evolve, potentially leading to difficulties, especially for low-resource settings.

Training is an important element for successful implementation as not all users will start with the same proficiency or understanding of the strengths and weaknesses of the technology. The goal of training is to ensure users: (1) understand how to enter and refine prompts to improve output quality; (2) are cognizant of output limitations; and (3) remain compliant with institutional rules and regulations. Additionally, due to the inherent risk of inaccuracy on the part of AI (Lo 2023), students should be trained to critically review AI output, a task that may add to higher levels of learning. Medical education curricula must incorporate guidance (e.g., workshops, manuals, and/or seminars) to accomplish these goals.

What lessons were learned that are relevant to a wider audience?

The guidance presented here highlights how implementation of ChatGPT in a PBL curriculum can be accomplished. However, these ideas are not limited to the ChatGPT and

the PBL curriculum but can be informative for any generative AI and curriculum that makes use of similar educational elements.

What are the next steps?

Next steps are numerous and include hypothesis-driven comparisons of different generative AI programs (e.g., Bing, Jasper, and/or Bard), as well as student learning outcomes, student self-efficacy, and group dynamics. Additionally, obtaining feedback from faculty and administration is critical for refinement of these systems. Although this article focused on overcoming the challenges of AI incorporation in the context of PBL, educators will need to deeply consider how to appropriately use these powerful, new educational tools in all current and future curricula.

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