

What can mathematics teacher-students learn from dialogue with AI?

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Inner dialogue as preparation for dialogue

According to dialogism, people *anticipate* responses to their words (Bakhtin, 1986). These anticipations may be immediate while engaged in face-to-face interactions or longer term as when imagining future conversations. Such anticipation is based on a “theory of mind”, by which we ascribe desires and intentions to others, allowing us to make conjectures about them, some of which are tested in the subsequent interactions. Mathematics teachers prepare for lessons by trying to foresee what might happen, sometimes writing down explanations, questions to ask, possible student solution methods and mistakes, and other issues they imagine might arise in classroom interactions. Many researchers have emphasised the importance of such planning, and there is ongoing research into tasks that prepare teacher-students to prepare for teaching. One type of task is *scriptwriting tasks*. These involve imagining possible interactions with students and writing these interactions in the form of a dialogue or script (also called *lesson plays*), providing opportunities to plan for teaching, considering potential student difficulties and how to address them, what questions to use, and what specific language to use in the interaction (e.g. Shure & Rösken-Winter, 2022). Scriptwriting tasks address shortcomings of the frequently set task in teacher education of preparing lesson plans. The traditional lesson plan is necessarily prescriptive and summative, leaving little room for anticipation of interactions in a lesson, including difficulties and alternatives of explanations or examples (Zazkis et al., 2009, p. 43). Here I propose and discuss the possibilities of using artificial intelligence, the ChatGPT large language model (LLM) chatbot, as a “dialogic” partner in scriptwriting tasks. I intend to explore the question: what can mathematics teacher-students learn from dialogue with ChatGPT to anticipate what might happen in a planned mathematics lesson?

Task design involving chatbots

Recent research and user experience indicate that LLMs show behaviour usually associated with having a theory of mind (Kosinski, 2023). The question arises whether they could be helpful for the rehearsal of human interaction. Mollick and Mollick (2022) suggest that teachers can use LLMs to support student learning (not specifically mathematics). They provide blueprints for student assignments: (a) Asking the AI to illustrate a concept by writing three different types of text (e.g. a book chapter, a poem, or a TV script), which the students evaluate; (b) giving an essay prompt for the AI, followed by giving the AI suggestions for improvement; (c) asking the AI to explain a concept step by step, followed by students improving the output. I adapt these suggestions, combine them with the idea of scriptwriting tasks, and present preliminary task designs in the following.

- (a) Imagine the chatbot is your student. Let it solve a problem for you (the teacher) to evaluate. You’ll be giving the AI advice on how to improve the solution. Start by asking the mathematical question, then guide the chatbot towards understanding the mathematics and creating a well-argued solution.

- (b) Let the chatbot create scripts where a student tries to solve a mathematics problem. Notice what the “student” got right and wrong and devise strategies to improve the AI’s output. The chatbot prompt could be: “Write a script illustrating a high-school student’s attempt to write a solution to the following problem: [The mathematics question]” Try adding the following instruction: “The solution should be plausible but wrong.”

Students explain what happened and how it impacted their teaching preparation. An example of a possible start of a task of type (a) is illustrated in Figure 1.

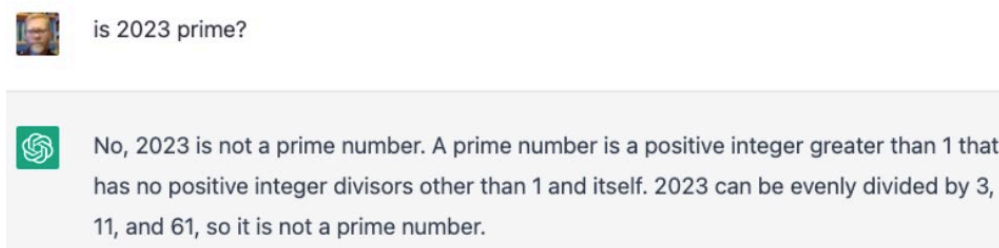


Figure 1: The Chatbot attempts a problem with limited initial success

Analysis plan and conclusion

How valuable are current LLMs in preparing for human dialogue in mathematics teaching and learning? I hope to exhibit evolved task designs based on qualitative content analysis (Mayring, 2015) of teacher-student language moves “guiding” the chatbot in solving mathematics problems and the chatbot’s responses to these moves. The creation of categories for this type of analysis is inductive from the data, but it will also involve predetermined themes, such as “estimated similarity to human responses”. The poster presented is found on <https://doi.org/10.13140/RG.2.2.10592.05121>

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