

Prospective physics teachers' perceptions and evaluations of ChatGPT in didactical tasks

Farahnaz SADIDI, Thomas PRESTEL

TU Dresden, Faculty of Physics, Physics Education Department, 01062, Dresden, Germany

Abstract. Chatbots like ChatGPT represent new tools for generating text. This study aims to investigate their potential incorporation into prospective physics teacher training programs. An exploratory study involving prospective physics teachers (n=39) was conducted to explore their perceptions of ChatGPT's use in educational contexts. Qualitative analysis of students' evaluations of ChatGPT3.5-generated responses to didactical tasks revealed its dual function as a tool for assessing students' didactical knowledge and critical thinking skills, while also teaching them media literacy. This could lead to the improvement of teacher training programs.

Introduction

The public release of ChatGPT3.5 at the end of 2022 provoked significant interest from both the media and the public regarding Artificial Intelligence. This digital tool has elevated discussions about the impact of digital media on education, prompting research in this area. In physics education, ChatGPT's ability to address complex problems has garnered attention [1, 2]. Discussions have emerged regarding ChatGPT's role in high school and teacher education [3]. However, there is limited understanding of prospective teachers' perspectives on ChatGPT and its impact on teaching and learning. This study aims to explore prospective physics teacher's perception toward its use in educational contexts. Given that critical reflection on ChatGPT-generated content requires both familiarity with the subject matter and evaluation skills, identifying any challenges in these areas emphasises the need for improved training for prospective physics teachers.

Theoretical framework and research questions

The study employs a criterion-based evaluation approach to assess explanations, focusing on verbal reasoning skills within the Critical Thinking framework [4]. In the context of teaching physics, explanations must meet criteria such as clarity, correctness, appropriateness, and precision to enhance students' understanding [5]. These criteria are essential in developing media literacy, enabling teachers to critically evaluate technology use. Investigating how prospective physics teachers interact with ChatGPT3.5-generated content in specific didactical tasks provides valuable insights into integrating this tool into their training. The overarching question guiding this study is: How can ChatGPT be incorporated into the training of prospective physics teachers? To address this, an exploratory study was conducted to answer the following research questions (RQs):

RQ1: How do prospective physics teachers assess the quality of ChatGPT3.5-generated content for tasks like “developing context-oriented teaching in acoustics” and “formulating learning goals”? **RQ2:** How do prospective physics teachers evaluate the quality of ChatGPT3.5-generated content for specific didactical tasks using criteria such as clarity, correctness, appropriateness, and precision? **RQ3:** How does engaging prospective physics teachers in evaluating ChatGPT3.5-generated content impact their perception of ChatGPT's helpfulness and its answer quality? **RQ4:** How do prospective physics teachers perceive and interpret the functionality of ChatGPT?

Methods and findings

The study involved 39 undergraduate prospective physics teacher students, including 9 females, in exploratory research. Data collection methods comprised pre- and post-questionnaires using a 5-point ranking scale, open-ended questions, and discussions. Initially, participants rated the helpfulness and quality of ChatGPT3.5-generated content and provided explanations for their rankings. Subsequently, they evaluated ChatGPT3.5-generated content within a didactical task involving developing context-oriented teaching sequences for grade 10 students. As homework, students utilized ChatGPT3.5 to address a new didactical task and assessed the response's quality using criteria including clarity, correctness, appropriateness, and precision. In a subsequent session, students re-ranked the helpfulness and quality of the ChatGPT answer and discussed their evaluation results and perceptions of its impact on teaching and learning in groups. Qualitative data analysis revealed that students acknowledged ChatGPT's difficulty in formulating learning goals due to operational verb failures but did not notice its failure to consider context in task formulation (**answering RQ1**). While completing the homework with ChatGPT, most students critiqued the response for lacking clarity, correctness, appropriateness, and precision (**answering RQ2**). Evaluating ChatGPT answers based on specific criteria led to a decrease in students' perception of ChatGPT's helpfulness and answer's quality, on average. Students became aware of ChatGPT's limitations in formulating didactic tasks, particularly evident in a decline in perceived usefulness among those who initially found ChatGPT helpful (**answering RQ3**). The conceptual understanding of ChatGPT varied widely, from highly simplified terms such as "It's just a database" to more detailed descriptions of the underlying artificial neural network. Additionally, the AI tool was attributed a personality, as evidenced by sentences such as "He knows..." (**answering RQ4**).

Conclusion

Based on the findings, ChatGPT serves a dual function in the training of prospective physics teachers: evaluating didactical knowledge and critical thinking skills, while teaching media literacy. The study revealed that students overlooked deficiencies in ChatGPT's answers when formulating context-oriented teaching, highlighting the need for special attention in the introduction to physics didactics course. Involving students in evaluating ChatGPT-generated content based on specific criteria led to a negative change in their perception of its usefulness and quality, highlighting the effectiveness of this approach in enhancing students' media literacy. Insights from this study on the indicators students use to evaluate ChatGPT's helpfulness and answer quality before engaging with tasks can inform targeted scenarios for university and high school students, fostering critical thinking and media literacy.

References

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