Early findings on how upper-secondary students use chatbots in learning science

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Abstract. The current development of artificial intelligence is driving transformations of various sectors, including education. We focus on examining the use of chatbots in science education: especially, what proportion of students have experience with using chatbots in learning science, and what activities they use chatbots for. The survey was conducted with upper-secondary students ($N = 1175$) via an online questionnaire. Our research highlights that the vast majority of students incorporate chatbots into both their daily lives and school context, primarily when seeking information on unfamiliar topics. This underscores the need for educators to take this trend into account in their teaching.

Introduction

The current development of artificial intelligence (AI), and particularly large language models (LLM), has led to their integration into everyday life. Notable among these are chatbots, such as GPT-x by OpenAI, Gemini (formerly Bard) by Google, and Llama by Meta, which have become increasingly accessible to the public. These AI-powered assistants have the potential to revolutionize various areas, but they also carry certain risks; for instance, their answers, although very convincing, may be misleading or untrue. The popularity of LLM chatbots is transforming a variety of sectors, including education, where researchers are actively investigating the incorporation of LLMs into education [1], and how students perceive these innovations [2,3].

Research goals

Our contribution focuses on examining the use of chatbots in science education, and investigates the ways in which students engage with these tools, if at all, either out of their own curiosity or under the guidance of teachers. The questions we pose are as follows:

- What proportion of students have experience with using chatbots?
- How many of them use chatbots in their learning, specifically in learning science?
- What specific activities do students use chatbots for in science learning?

This contribution presents some of the preliminary results on these issues; a more detailed statistical analysis is now underway.

Methodology

The research utilizes a quantitative approach, employing a brief online questionnaire as the research instrument. The participants in this investigation were Czech upper-secondary students ($N = 1175$) who visited the Faculty of Mathematics and Physics while engaging in two out-of-school activities offered by our department: *Physics Demonstrations For Upper Secondary Students* (DEMOs), and *Interactive Physics Laboratory* (IPL); the activities are described in [4].

It is important to note that the sample cannot be considered representative of the entire upper-secondary population for several reasons. Firstly, the participants come primarily from elective schools, and secondly, they typically consist of students whose physics teachers are more actively engaged within the community.

Early findings

After data cleaning, the sample was reduced to 1120 students (54% girls, 41% boys, 5% non-specified). The respondents were divided based on their experience with using chatbots (Fig. 1) from the most general (any experience using a chatbot), to specifying context and purposes of use (chosen from the pre-specified options.). We found out that 82% of students do have experience with using a chatbot, and a similar part (80%) of them have used a chatbot in school-based activities. Almost two thirds of these students have used a chatbot as assistance in natural sciences.
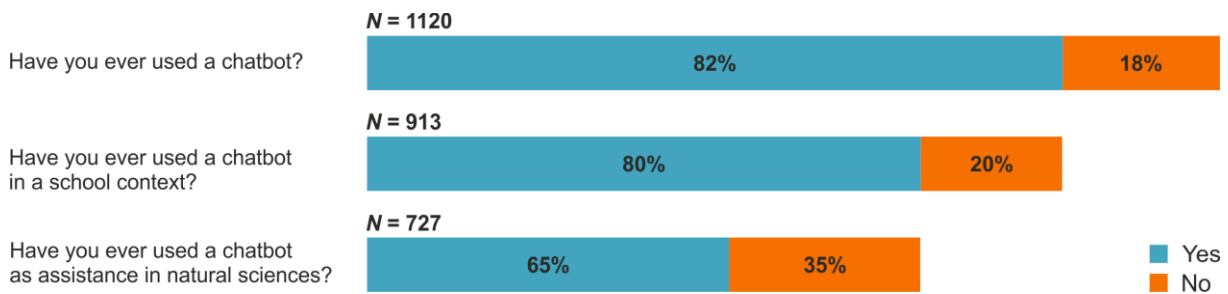

Figure 1: Students' experience with using chatbots. The percentage in bars relates to the current *N*, which also corresponds to the bar length.

Concerning purposes for using chatbots in natural sciences, students had a choice of six pre-defined options. The prevailing use of a chatbot is a quick gain of clear information about unfamiliar topics (70% of students). The two subsequent options reported by 50% of students are assistance with assignment and homework solving, and assistance with making presentations and reports. The remaining three purposes (preparing for tests and exams, verifying facts, text improvement and translation) are used by approximately a third of the students.

Discussion and conclusions

Our research highlights that the vast majority of students incorporate LLM chatbots into both their daily lives and school context. This underscores the need for educators to take note of this trend and integrate chatbots into their teaching.

Students turn to chatbots primarily when seeking information on new or unfamiliar topics, which emphasizes the importance of educating them on verifying the received information. Chatbots can be accurate, but the risk of getting the wrong information requires students' critical thinking skills to validate what they learn. How to develop these skills in students, however, is a challenge for educators not only in physics or science but remains beyond the scope of this study.

References

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