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Evidence in Action

A K20 Center Research Brief

Large Language Models as a Homework Tutor can Improve Student Engagement and Learning Outcomes

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Introduction

This intervention brief explores the research article titled "GPT-4 as a Homework Tutor can Improve Student Engagement and Learning Outcomes" by Alessandro Vanzo, Sankalan Pal Chowdhury, and Mrinmaya Sachan, published in 2024. The study addresses the challenge of providing effective and scalable homework support to students. Traditional homework often lacks timely feedback, which is crucial for maximizing its educational benefits. The authors highlight the limitations of current solutions like private tutors and Intelligent Tutoring Systems, which are either too costly or difficult to scale. Recent advancements in Large Language Models (LLMs) offer a promising alternative by providing interactive and dynamic educational content with minimal human intervention. The study aims to evaluate the effectiveness of LLMs as a homework tutor in improving student engagement and learning outcomes in a real-world educational setting.

Methodology

Research Design:

The study employed a Randomized Controlled Trial to compare the effectiveness of GPT-4 as a homework tutor against traditional homework methods. The research was conducted in an Italian high school, focusing on English language learning for high school students.

Sample:

The sample consisted of four classes from a technical institute, with two classes in the 3rd year (median age 16) and two in the 5th year (median age 18). The total number of participants was 76 students, divided into treatment and control groups. The treatment group received interactive homework sessions with GPT-4, while the control group continued with traditional homework assignments.

Data Analysis:

Data was collected through pre- and post-tests to measure learning outcomes, as well as weekly and final questionnaires to assess student engagement and satisfaction. The analysis focused on comparing the learning gains and engagement levels between the treatment and control groups.



Results

The study found that students in the treatment group, who used GPT-4 for their homework, showed significant improvements in learning outcomes, particularly in grammar. They also reported higher levels of engagement and satisfaction compared to the control group. The results suggest that GPT-4 can effectively provide timely feedback and interactive support, making homework more engaging and beneficial for students. Importantly, students expressed a desire to continue using GPT-4 as a homework tutor even after the study concluded.

Application into Practice

To replicate this intervention in a school context, the following steps can be taken:

1. **Preparation:** Teachers need to prepare the seed exercises, including the purpose, description, and example of each homework assignment.
2. **Implementation:** Use a dedicated platform to host the LLM interactive sessions. Students can access the platform using their personal devices outside of school hours.
3. **Monitoring:** Collect feedback from students and monitor their engagement and learning outcomes through pre- and post-tests, as well as weekly questionnaires.
4. **Support:** Provide initial training for teachers to familiarize them with the platform and the process of entering homework assignments.

Work Cited

Vanzo, A., Chowdhury, S. P., & Sachan, M. (2024). GPT-4 as a Homework Tutor can Improve Student Engagement and Learning Outcomes (Version 1). arXiv.
<https://doi.org/10.48550/ARXIV.2409.15981>