

Abstract

ALTER-Math seeks to enhance middle school math learning by leveraging advanced AI technologies, specifically large language models (LLMs) and AI-enhanced teachable agents. Our aim is to double the rate of middle school math learning, particularly for students from low-income and minority households, by transforming passive learners into proactive teachers of AI. To validate our approach, we will conduct a 3-month two-level cluster randomized trial (RE-ALTER) involving at least 32 teachers and more than 1,600 students. RE-ALTER will leverage Florida's FAST assessment to measure mathematics performance and student log data to gauge engagement. Based on our theoretical groundings with notable effect size for STEM learning and our prior results, we expect the intervention to demonstrate significant improvements on math knowledge in both proximal and distal learning outcomes, particularly for underserved students. Specifically, we seek to answer the research question “How effectively does the AI-powered teachable agent engage students and improve students’ mathematical achievements?”