EMBODIED AI FOR SOCIAL LITERACY ROBOTS

EMBEDDED ARTIFICIAL INTELLIGENCE ROBOT FOR FINANCIAL LITERACY: AN ANALYSIS OF THE SOCIAL IMPLICATIONS OF ARTIFICIAL INTELLIGENCE IN EDUCATION

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SOCIOTECHNICAL SYNTHESIS

With the rapidly growing popularity of artificial intelligence (AI) systems across many different fields, the vast majority of educational institutions have begun implementing these systems despite not fully understanding how these systems can impact those who use them. To address the growing demand for artificial intelligence in education (AIEd), as well as the proven need for improved financial education in the U.S., my technical project involves building an AI system for financial literacy educational usage, embedding the system into a humanoid robot, and testing with human subjects. However, in order to better understand the potential social consequences of such systems being rapidly implemented due to high demand, my STS research paper involves researching and reporting on the societal implications of AIEd, especially regarding potential for bias in AI systems and the competency of the existing research on the subject matter. The two projects are closely related, as the latter investigates the social consequences of the former in an effort to understand whether implementing these systems on a large scale is an appropriate course of action.

As the use of AI grows across the globe, it has further infiltrated our education systems, creating a demand for systems that will expose children to AI, aid educators in teaching, and improve students' learning experiences. An important area of study in which AI systems could stand to improve upon students' learning experiences is financial literacy, of which the lessons can be even more impactful when they are introduced at a young age. However, research shows that only 57% of adults in the United States are financially literate (Klapper et al., n.d.). To address both the demand for AIEd systems and the opportunity for improved financial literacy lessons, the aforementioned technical project involved creating an AI system embedded into a humanoid robot that is equipped with a lesson designed to teach fourth grade students about

credit and spending. In order to test the system's performance and identify areas in which improvement is needed, the prototype was tested in a classroom environment for its efficacy, robustness, and associated levels of enjoyment.

In analyzing the results of experimental testing, we found that both the treatment and control groups had a statistically significant, positive effect on the children's learning, as the treatment group showed a mean improvement of 0.82, compared to a mean improvement of 0.5 in the control group (on a 5 question quiz). However, we could not prove any statistically significant superiority of the treatment method over the control method. Results also indicated that students' struggled to interpret questions involving math problems when delivered from the robot, with evidence also implying the possibility that the more help a student received, the less likely they were to learn/improve. The students in the robot group reported greater satisfaction levels with the lesson, implying the robot was the more engaging tool of the two. These results show promise for the system to be an effective, robust, and enjoyable tool to introduce important financial literacy lessons to young students, while also highlighting the areas in which further research, testing, and improvements are needed in future iterations.

My STS research paper sought to answer the question of whether or not artificial intelligence systems should be implemented in K-12 education by evaluating the thesis that such systems are already being implemented without proper insight into the potential consequences, which could cause harm to marginalized groups in the future. This thesis was proven by researching the level at which AIEd systems have been implemented, the level at which they have been researched, the areas in which existing research falls short, and the existing issues in education that could be exacerbated by their implementation. An analysis of the social implications was conducted in

terms of the major stakeholders and the ways in which they stand to be impacted by implementation of these systems using the Technology and Social Relationships STS framework.

The research found evidence of existing gender and racial biases within modern day education, and also found evidence that such biases can, and in some cases already have been, embedded into AI systems. I came to the conclusion that it is important to give special consideration to the interests of students, educators, and marginalized people within both groups. Although current research mostly shows only the *potential* for harm to these people, rather than guaranteed harm, the recommendations should reflect the worst case scenario in order to prevent any irreversible harm to marginalized groups.

AI systems are exciting, new technologies sure to disrupt modern-day education as we know it. When it comes to their implementation in the classroom, both the results of my technical project and the findings of my STS research highlight a need for more research before widespread implementation, particularly in identifying the potential for harm and the likelihood of such occurrences. Because the largely unknown and potentially dangerous consequences of implementing systems without proper research will impact children, it is more important than ever to proceed with great caution to keep our society's young students out of harm's way and make strides towards a more equitable society.

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