

Exploring the AI Experiences of Rural Students and Teachers: A Sociocultural Perspective

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Abstract: Artificial intelligence (AI) education is especially needed for young rural students who have limited access to high-quality learning opportunities. We are developing an AI-centered learning environment that introduces rural middle grades students to AI concepts through digital game design activities. We interviewed students and teachers on their understanding of and background with AI. The results will guide the design of our professional development for teachers and game design activities for students.

Introduction and Theoretical Framework

Artificial intelligence (AI) education is increasingly seen as a critical endeavor for students to be successful in the world and workplace of the future where AI will be ubiquitous (Touretzky et al., 2019). It is essential to expand efforts to increase students' interest in AI and provide youth with early AI learning experiences, especially middle grades students who are developing their perceptions and dispositions toward STEM (English, 2017). Rural schools, which represent approximately 80% of North Carolina schools, are smaller and more isolated than their urban and suburban counterparts and face challenges with attracting and retaining high-quality teachers and student access to advanced coursework in STEM (Assouline et al., 2017). Game design holds potential for cultivating student interest and knowledge in computing (Comber et al., 2019), and game-based learning shows potential for teaching AI concepts to K-12 students (Lee et al., 2021). Our AI-centered learning environment, called AI PLAY, introduces AI concepts to middle grades students (ages 11-14) and teachers through camps and school-based programs in rural North Carolina. In this work, we present our initial findings from student and teacher interviews on their understanding and use of AI.

Sociocultural theories posit that all learning must consider social and cultural dimensions of human interaction and that these dimensions become internalized as children learn and mature (Vygotsky & Cole, 1978), indicating that childrens' surroundings—be they human or environmental—shape their knowledge and experiences. Our context, computer science (CS) in general and AI in particular, is not broadly accessible to all students. Rural students often have restricted access to innovative educational opportunities and their families and teachers are more likely to not have had these experiences either. As such, a goal of our work is to augment rural students' social capital by fostering their skills to learn and use CS and AI now and in the future.

Methods

We conducted interviews and focus groups with rural participants: nine students and two teachers. All interviews were conducted and recorded via Zoom video conferencing. We utilized a semi-structured protocol that queried participants on their background knowledge of AI, experiences with coding, and gaming interests. Two members of the research team individually open-coded the transcripts and met to discuss the codes. A third team member facilitated collapsing codes into themes, which we report below.

Findings

Teachers

Our teacher participants taught at rural, low-income schools and their courses focused on prescribed curricular materials that did not specifically target goals for in-depth CS or programming concepts. Both teachers acknowledged providing some time for their students to experiment with coding using physical computing with drones or robots, with one describing these experiences as an “incentive.” Both teachers had either limited or dated prior training with CS and programming. When asked about their knowledge of AI, both teachers candidly expressed that they knew very little; however, they were receptive to professional development (PD). One teacher noted “[AI is] obviously kind of trending in that direction in the future, so I think it’s important for students to

learn about it.” Both teachers felt that students would be motivated by an engaging game design-based learning experience to learn about AI.

Students

When asked to share what AI is, students’ responses included the following, under the theme of *programming and general computer usage*: “stuff that’s online,” “computers [are] robots,” and “a coffee machine.” Under the theme of *AI awareness and understanding*, students’ responses ranged from superficial awareness (i.e., “smart computers”) to more pronounced understandings of AI (i.e., “the doorbell camera... will pop on” and “drones can water plants”). When asked to share their background with programming and gaming, most students knew of Scratch and many had coded a game using Roblox. Students mentioned learning about programming from a parent, YouTube, or simply from playing online, and not in school. All students indicated they played digital games and when asked their interest for learning about AI through digital game design, students expressed a high degree by saying “if you know how to code you could essentially get a job that involves coding” and “it’d make the game more funner (sic) to play.”

Discussion, Conclusions, and Future Directions

We approached understanding what rural middle grades learners and educators know about AI by interviewing students and teachers. Despite having a limited number of participants, we surmise that their experiences are common across rural areas of our state. Sociocultural perspectives help us understand the role of a person’s immediate environment—people and devices—in what they know. We know that rural schools and families often lack access to the internet, suitable devices, and diverse learning opportunities. The students in this initial study have more of an understanding of AI, albeit often superficially, than their teachers, which has prompted us to consider the accuracy of what students know about AI and CS. North Carolina does not certify middle grades teachers as CS teachers; as such, middle grades students tend not to have teachers with specific training in CS and programming. One of our goals is to augment the training middle grades teachers receive in service of exposing more students to advanced technologies, programming, and AI. Additionally, teachers’ awareness of what students could learn about AI was limited and therefore, any professional development must explicitly teach these concepts to teachers. Students had high enthusiasm for playing and designing digital games; therefore, teaching advanced technologies through game design holds great potential for their learning and potentially their career trajectories. These initial findings are essential as we design a set of prototype activities on core AI concepts for students and PD activities and resources for teachers.

References

- Assouline, S. G., Ihrig, L. M., & Mahatmya, D. (2017). Closing the excellence gap: Investigation of an expanded talent search model for student selection into an extracurricular STEM program in rural middle schools. *Gifted Child Quarterly*, 61(3), 250-261.
- Comber, O., Motschnig, R., Mayer, H., & Haselberger, D. (2019). Engaging students in computer science education through game development with unity. In *Proceedings of the 2019 IEEE Global Engineering Education Conference (EDUCON)* (pp. 199-205). IEEE.
- English, L. D. (2017). Advancing elementary and middle school STEM education. *International Journal of Science and Mathematics Education*, 15(1), 5-24.
- Lee, S., Mott, B., Ottenbriet-Leftwich, A., Scribner, A., Taylor, S., Park, K., Rowe, J., Glazewski, K., Hmelo-Silver, C., & Lester, J. (2021). AI-infused collaborative inquiry in upper elementary school: A game-based learning approach. In *Proceedings of the Eleventh Symposium on Educational Advances in Artificial Intelligence*.
- Touretzky, D., Gardner-McCune, C., Martin, F., & Seehorn, D. (2019, July). Envisioning AI for K-12: What should every child know about AI?. In *Proceedings of the AAAI conference on artificial intelligence* (Vol. 33, No. 01, pp. 9795-9799).
- Vygotsky, L. S., & Cole, M. (1978). *Mind in society: Development of higher psychological processes*. Harvard university press.

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