

Exploring Preservice Teachers' Perceptions and Experiences of Teaching Artificial Intelligence Students in Virtual Simulations

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Abstract: This case study explored preservice teachers' (PSTs) perceptions and experiences of teaching AI students in virtual simulations. Eighteen PSTs participated in a 2-hour AI-based teacher training individually. Data were collected from participatory observations, in-simulation student-teacher dialogue transcripts, field notes, and semi-structured interviews. The findings revealed that PSTs exhibited positive perceptions toward AI-based simulation, which both engaged and challenged them in active problem solving. The simulation also prompted authentic rehearsals and in-situ reflection.

Introduction

Simulation-based learning is increasingly adopted in teacher training, especially for preservice teachers (PSTs) who have limited opportunity to engage in systematic in-the-moment teaching decision making and problem solving (Ke et al., 2020). Simulation, the modeling and representation of real-life experiences, is a common technique for experiential learning across various disciplines. Experiencing simulations enables PSTs to act on their theories, assumptions, and thoughts without dire consequences (Dai et al., 2023).

Due to recent advances in artificial intelligence (AI), virtual students or AI-powered students are being integrated into simulation-based learning environments to provide authentic or personalized practice opportunities (Dai et al., 2024). Different from avatars puppeteered by humans, virtual students powered by AI can generate semantically meaningful responses that engage PSTs in authentic and open-ended problem solving (Lee & Yeo, 2022). While AI-based simulation presents new prospects for teacher training, the effective integration of technology and its impact on learning depend greatly on PSTs' perspectives and experiences (Mikeska et al., 2022). Identifying those beliefs and moves can generate insights into constructing productive training experiences and inform the design of AI-powered teacher training practices. As an emerging and promising topic, however, PSTs' perceptions and experiences of practicing teaching with AI students remain unexplored. Accordingly, the purpose of this study was to explore PSTs' perspectives by addressing the following research questions: 1) *what are PSTs' perceptions about teaching virtual students in a simulated environment?* 2) *how did simulations with AI students support PSTs' experiential teaching?*

Method

This study adopted a multi-case study approach to explore the contextualized interaction between PSTs and the simulation (Yin, 2009). Eighteen PSTs participated practicing teaching with AI students (on secondary science and math topics) in a participatory teaching simulation, which was designed and developed in a multiuser virtual world platform *OpenSimulator*. AI students were rigorously trained and fine-tuned with 10-hour authentic classroom interaction transcripts, leveraging a generative large language model from *OpenAI* (see more in Dai et al., 2024). These AI students were further enhanced with a cognitive-epistemic model that simulates students with different instantiations of engagement and knowledge levels. Data were collected from participatory observations, in-simulation student-teacher dialogue transcripts, field notes, and semi-structured interviews. We conducted systematic coding and thematic analysis, which entails open coding to generate initial codes, comparative analysis across cases to identify similarities and differences, and axial coding to identify relationships and extract themes. In this report, we used P1-P18 to indicate individual participants.

Findings

Thematic analysis revealed two themes relating to PSTs' perceptions and experiences in AI-powered simulation: 1) the duality of teaching: engagement and frustration 2) low risk, AI-based rehearsals and reflection

The duality of teaching: engagement and frustration

Participants generally held positive perceptions toward the AI-based simulation. 14 participants (78%) reported the experience as “engaging”, “enjoyable”, and “fun.” For example, P11 said, “*I think this was like a really good experience on starting out how to teach.*” As for virtual students, 11 participants (61%) believed AI students are realistic, while four believed the realism can be enhanced by enabling them to talk with each other and allowing more than one student to talk at a time. While enjoying the practice, it also posed a challenge to many of them. 13 participants (72%) described the experience as “frustrating”, “challenging”, or “stressful.” Ten participants experienced frustration due to limited epistemic resources for making in-the-moment decisions when students went off-topic (n=5), gave circular responses (n=1), or remained silent to questions (n=4). Four participants (22%) mentioned difficulty connecting ideas and move the discussion forward. However, those challenges engaged participants in active teaching problem solving. For example, P12 said, “*It’s challenging because Robert [virtual student], he was just silent. So I think I should not keep asking the same question.*”

Low risk, AI-based rehearsals and reflection

Most participants reported the AI-powered simulation is a useful learning tool that simulated authentic teaching scenarios for practice microteaching. 16 participants (89%) thought the simulation was “helpful” and “boosts confidence.” As P14 reflected, “*I try those strategies and notice how they work, so I can say that I can implement them more confidently.*” 15 participants (83%) reported that they expanded their teaching repertoire through learning by doing. Among them, 11 noted they practiced and acquired questioning techniques (e.g., from general to specific, ask scaffolding questions), 12 had developed ability to notice and attend to student ideas, three learned how to address off-topic comments, two became more confident in facilitating and orchestrating group discussion. As exemplified in P6’s interview, “*Sometimes you have to rephrase. Sometimes you have to make real life connections because they might not know that they do know something. So that was really helpful, because it made me realize there are a lot of different ways to teach about a subject.*” Moreover, AI students’ responses served as immediate feedback to PSTs’ teaching practices, which engaged them in reflection and adaptive teaching (n=11, 61%). For instance, P17 reflected, “*I think I could have started the conversation differently. Maybe moving to like, ‘What do you know?’*”

Discussion and conclusion

The findings of this study revealed that PSTs generally hold positive perceptions of AI-based simulations, suggesting the prospects of employing them as supplements to teacher education programs. While over half of the teachers found teaching AI students in the simulation challenging at times, grappling with these struggles purposefully engaged them in meaningful practice. Moreover, authentic teaching scenarios enabled in the simulation prompted PSTs to engage in in-the-moment decision making, demonstrating its potential to increase the capacity and independence of PSTs (Dai et al., 2023). Through repeated practice, PSTs were able to reflect on their talk moves voluntarily, which helps them structure questions more specifically and effectively, as well as develop strategies to elicit student thinking (Dai et al., 2024).

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Acknowledgments

This study was supported by National Science Foundation (grant no. 2110777).