Creating a Simulation Lab in the College of Education to Develop XR and Agentic Simulation-Based Learning for Teacher Training

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Abstract: Digitally-mediated simulations are increasingly central to practice-based teacher preparation, yet most programs lack the infrastructure to implement them at scale. This paper describes the creation of a simulation research and development lab within a College of Education at a large Southeastern university, designed to provide faculty across teacher, counselor, and educational leadership preparation programs with accessible, varied simulation experiences. Drawing on the simulation-based learning literature, we describe the lab's three platforms (i.e., TeachLivE mixed-reality simulations, SchoolSims scenario-based simulations, and vibe-coded agentic simulations) and illustrate how faculty embedded them into coursework for pedagogical skill development, formative assessment, and curricular reform. Implications for scaling simulation-based learning across teacher preparation programs are discussed.
Keywords: Simulations, Teacher Preparation

Introduction to Simulation-Based Learning in Teacher Training

Research continues to confirm the efficacy of simulation-based learning in higher education (Chernikova et al., 2024). For teacher preparation, simulation is becoming an integral part of the practice-based approach to teacher training (Ledger et al., 2025), an approach that arose in response to criticism that teaching methods courses were too disconnected from the realities of teaching (Grossman et al., 2009). Simulations in teacher training reproduce real-life situations to help pre-service teachers develop responses they can then implement when they confront similar situations in their actual practice (Ade-Ojo et al., 2022). A variety of simulation typologies exist in teacher education, from face-to-face role-playing with an actor (Levin et al., 2025), to role-playing with actors on ZOOM (Randolph et al., 2024), to computer-based simulations (Reich, 2022), mixed-reality simulations (Dieker et al., 2014), virtual reality simulations (Nissim & Weissblueth, 2017), and, with the advent of large language models, now agentic simulations (Aperstein et al., 2025).

This paper focuses on digitally-mediated simulation platforms (i.e., computer-based, mixed-reality, and agentic simulations). It examines the creation of a simulation research and development lab within the College of Education at a large, research-intensive Southeastern university, dedicated to developing a variety of simulation-based learning experiences for teacher, counselor, and educational leadership training. We survey the literature on crafting and embedding such experiences in teacher preparation programs and then describe the creation of a dedicated simulation lab. We do this to provide ideas to other universities interested in taking up the mantle to scale simulations across their teacher preparation programs, thus bridging theory with practice. Practice-based teacher education creates a need for approximations of practice; digitally-mediated simulations offer scalable forms of those approximations; and the lab described here provides an institutional model for how faculty can select, design, embed, and study those simulations across programs.

Simulation as a Scalable Approximation of Practice

While traditional teacher training involves interrogating pre-service teachers' mental models of teaching through activities such as reading, discussion, and reflection, the practice-based approach to teacher training molds these mental models as teachers learn in, from, and through practicing the strategies, routines, and activities associated with teaching (Ball & Cohen, 1999; Grossman, 2018; Lampert, 2010; Mancenido et al., 2026). Due to the artificial nature of these activities, such as conducting an interactive read-aloud with actors or eliciting student thinking during a math discussion with virtual avatar students, participants and/or facilitators can pause the activity to bring attention to different features of the activity, pushing participants to reconsider their approach or contextualize their actions amid larger issues of equity and social justice (Cohen et al., 2025). In fact, a study by Mancenido et al. (2026) comparing traditional, practice-based, and mixed approaches to teacher education found that the practice-based approach most effectively improved teachers' responsiveness to students' thinking, arguing that the limited time within teacher training programs should be dedicated to that which has evidence proving its effectiveness.

Grossman et al. (2009) developed a framework for practice-based teacher education that includes "approximations of practices", or opportunities to enact pedagogies, "representations of practices", or high-quality models of pedagogical enactment, and "decompositions", or break downs of pedagogical enactments into distinguishing features (Cohen et al., 2025; Grossman et al., 2009). Digitally-mediated simulation platforms have been identified as capable of facilitating all three elements of Grossman's framework (Ledger et al., 2025; Ledger & Fischetti, 2020). In fact, in their review of practice-based approaches to teacher education, Cohen et al. (2025) found that digitally-mediated approximations of practice were more useful and realistic, and more anxiety-inducing, than face-to-face practice, likely because they better supported candidates' suspension of disbelief, kept candidates in character throughout the interaction, and provided better scaffolding using scripting logic.

Embedding Simulation into Teacher Preparation Programs

For teacher educators interested in implementing these experiences in their programs, advice from the literature can guide this initiative, both in embedding within preparation programs at large and in individual classes. At a larger systems level, simulations have been recommended for teacher preparation programs not only to train teachers but also to make programs more rigorous and serve as evidence of program quality for state and federal agencies (Dove et al., 2023; Ersozlu et al., 2021; Fischetti et al., 2022; Piro & O'Callaghan, 2019). Furthermore, during a teacher shortage, researchers recommended using simulations, such as mixed-reality simulations, to recruit both national (Budin, 2024; Judge et al., 2013) and international students (Hartle & Kaczorowski, 2019). Budin (2024) designed a situation in which interested high school students participated in a mixed-reality simulation, and found that this experience was a contributing factor in 100% of participants enrolling in a postsecondary teacher preparation program after their senior year.

Faculty might be hesitant to use this technology, especially when they are worried about their ability to explain and prepare their students for these hands-on experiences and need help segmenting their learning activities within their curriculum (Hartle & Kaczorowski, 2019). Hartle and Kaczorowski (2019) recommend beginning this embedding process by first identifying faculty willing to go outside their comfort zone, believing that the faculty mindset is more important than technological competency. Keese et al. (2023) developed a faculty professional development plan to help faculty across teacher preparation programs embed simulated experiences into their programs using six critical strategies (i.e., determining needs; exploring technologies' affordances and limitations; scaffolding; sharing feedback, connecting technology, pedagogy, and content; and evaluating). Faculty credited having a faculty mentor who provided one-on-one support, helped develop course materials, and managed the scheduling of the technology to their ability to integrate the simulation technology (Keese et al., 2023). Still, once faculty began embedding simulated teaching experiences into their coursework, they noted how it changed their approach to teaching. Scarparolo & Mayne (2022) referred to this as authentic teaching for the professor, allowing the professor to teach in a situated context. Professors who watched their students perform in simulated environments also realized they were unaware of their students' capabilities, and some adjusted their course content and instruction after observing their students teach (Kelley & Wenzel, 2019; Landon-Hays et al., 2020).

Still, the cost of the technology continues to be problematic for the wide-scale adoption across teacher preparation programs (e.g., Dieker et al., 2014, 2023; Dove et al., 2023; Eriksson, 2022; Hartle & Kaczorowski, 2019; Kaufman & Ireland, 2016; Peterson-Ahmad et al., 2023; Qualls et al., 2024; Vasquez et al., 2017). Hartle and Kaczorowski (2019) provided many recommendations to reduce costs, including (1) utilizing small start-up grants, (2) adding reasonable course material/tech fees while offsetting this fee by using source materials instead of textbooks, (3) having students interact in small groups, (4) reaching out to other universities who site license the technology who might provide cheaper streaming options, (5) turn the work into a research study to access research funds.

Embedding into Individual Courses

Once teacher preparation program leaders have solidified their rationales for simulation use, identified faculty, and secured funding, it is time to embed simulations into actual courses. Kelley and Wenzel (2019) recommend identifying activities in faculty's courses to replace with simulated experiences (e.g., replacing a parent-letter writing task with an agentic parent-teacher conference). Driver and Zimmer (2022) provided step-by-step guidance on embedding simulations, specifically mixed-reality simulations, and offered recommendations relevant to all digitally-mediated simulations, advising teachers “not only planning for the scenario and technical integration, but also designing meaningful opportunities for feedback, reflection, and debrief” (p. 55). They recommend beginning the design process by designing a scenario that contains a scenario overview, specifies the ideal simulation configuration (e.g., the specific virtual environment and avatars), identifies the learner audience (e.g., preservice teachers), has a short synopsis, makes a learner challenge, explains the lesson learning objective (i.e., practicing a high leverage practice), and then specifies the materials needed for both the teacher, interactor, and students (Driver & Zimmer, 2022). This is followed by identifying the hits (e.g., actions the participant performed well) and the misses (e.g., actions the participant did not perform well), as well as the resulting avatar response (Driver & Zimmer, 2022). They also recommend an introductory session to help participants get to know the avatars, increase their comfort level, and understand their capabilities (Driver & Zimmer, 2022). Finally, they provided examples of participant schedules that future designers could reference, along with example questions to guide the debrief.

As discussed in the Briefing-Scenario-Debriefing cycle, preparing students for their simulated teaching experience is also an integral part of the design process, and inadequate preparation can lead to negative experiences (e.g., Dalinger et al., 2020; Dittrich et al., 2022; Lindberg & Jönsson, 2023). Students need to be briefed on the technical limitations of the technology, such as with mixed-reality simulations, so they do not attempt to interact with the avatars in ways beyond the avatars’ capabilities (e.g., showing work, giving high-fives, clapping, rearranging their seats) (e.g., Dittrich et al., 2022; Lindberg & Jönsson, 2023). They need guidance on accessing the simulation beyond simply booking their time, as well as reminders about what to bring to their simulated session (Fischetti et al., 2022). They must be provided with the scenario well ahead of their simulation experience date and reminded to arrive early to avoid feeling “thrown into” the MRS learning experience (Dalinger et al., 2020, p. 11). Another way faculty can prepare their students to suspend their disbelief is to refer to the simulated characters by name, interests, and likes, without divulging too much about what happens behind the technology (Driver & Zimmer, 2022). Finally, as this embedding process occurs, Hartle and Kaczorowski (2019) recommend ongoing communication and collaboration with department heads, keeping students informed about the projected process/outcomes, and continually using student feedback to iterate the experience.

Creation of a Simulation lab

Since there is a need for simulations within the practice-based approach to education, our institution built a lab to work with faculty within the College of Education to help faculty identify where simulation could be integrated to enhance traditional pedagogy. The college’s Dean identified a first-floor room that could be transformed into a simulation lab. The room had originally been outfitted to serve as a hybrid face-to-face/online classroom at the beginning of COVID, with TV monitors on opposite walls and a 180-degree camera to track a speaker’s movement. However, after COVID, the existing technology was rarely used, so it was repurposed for the simulation lab. and, through an internal tech fees grant, funds were allocated to secure a variety of existing simulation platforms (e.g., TeachLivE mixed-reality, SchoolSims, various generative AI subscriptions). Furthermore, decorative lighting (e.g., Govee LED lamps) was installed to give the room a sci-fi look. So now, faculty have a variety of options to provide their students with simulated experiences, from asynchronous experiences they can link to their LMS to synchronous experiences through Zoom or all together, face-to-face in the lab classroom, as seen in Figures 1 and 2.

Figure 1. Picture of simulation lab: before.

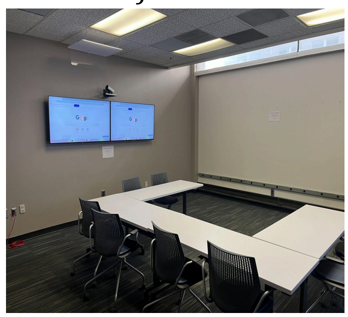
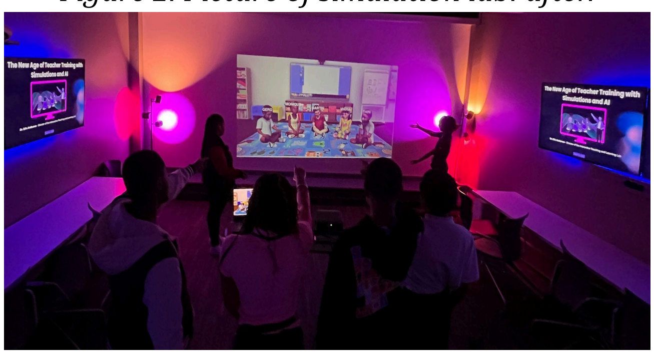


Figure 2. Picture of simulation lab: after.



TeachLivE Mixed-reality Simulations

First, the lab allocated money for TeachLivE simulations. TeachLivE, and its corporate counterpart Mursion, are the most widely used mixed-reality simulation platforms in teacher education (Ireland, 2021), and research shows that ten minutes of practice within a simulator is equivalent to forty-five to sixty minutes of real-world practice (Dieker et al., 2014). TeachLivE uses a pay-to-play pricing model — our institution's rate averaging around $200 an hour to stream with a two-hour minimum.

With these types of simulations, it is easy to create a consistent, virtual experience for pre-service teachers to practice enacting pedagogies, receive immediate feedback, and collect ongoing data to refine their performance (Dieker et al., 2008). Pre-service teachers can either stand in front of a large screen to practice pedagogical strategies with various virtual avatars, as shown in Figures 1 and 2, or engage in the same experience via Zoom, as shown in Figure 3. Teacher educators have used these simulations to help pre-service teachers develop a variety of pedagogies and affective states, from eliciting student thinking (Pena et al. 2020) and delivering behavior-specific praise (Dawson & Lignugaris/Kraft,

2017) to improving nonverbal immediacy behaviors (Rosati-Peterson et al., 2021) and their metacognitive awareness (Ford et al., 2023).

Figure 3. Practicing pedagogies with TeachLivE avatars on Zoom.

SchoolSims

While mixed-reality simulations afford real-life practice and immediate feedback, another option that we chose to offer is SchoolSims, a scenario-based simulation platform that provides participants with realistic, scripted situations to get experience with common challenges and difficult decisions inherent in their practice (Cumming, 2024). Rather than using avatars, SchoolSims uses videos and narrations to guide participants through the simulated learning experience, providing feedback to help them reflect on their decisions (Cumming, 2024). This platform was purchased at the request of our educational leadership faculty, who chose to embed one to two simulations into their semester coursework for students to complete asynchronously, then use class time to collectively deconstruct difficult decisions. Since SchoolSims relies on pre-scripted video, narration, and decision trees, it trades the real-time interactivity and decision-making possibilities inherent in TeachLivE with consistency and the ability for faculty to have their students repeatedly try different simulations.

Vibe Coding Agentic Simulations

Finally, we purchased professional subscriptions to AI tools like Claude to craft our own simulations through vibe coding, a practice in which users create AI-generated code through intuition and trial-and-error without expertise in the underlying code (Fawzy et al., 2025). We did this because Ledger et al. (2025) systematic review of simulations in teacher preparation concluded that, though digitally-mediated simulations prove highly effective in developing teachers' pedagogies, most teacher preparation programs do not utilize them, perhaps because they are costly or because of the operational hurdles involved in distributing them. Thus, agentic simulations could be a way to develop more tailored and accessible learning experiences for faculty’s contexts. However, since our simulation lab lacks a dedicated developer, we currently use Vibe coding to craft these simulated experiences.

Vibe coding is a term coined by Karpathy (2025) in a Twitter post, referring to a new programming approach in which people use AI code-generation tools to “fully give in to the vibes, embrace exponentials, and forget that the code even exists.” This term took off as programmers and non-programmers alike embraced these tools (e.g., chat interfaces like

Claude/ChatGPT, local development assistants like Cursor, and cloud development environments like Loveable and Replit) to create applications without necessarily knowing or reviewing the underlying code (Kobiella et al., 2026). Vibe coding dramatically lowers the barrier to entry for non-technical users to transform ideas into actionable front-end software prototypes through natural language processing, while collapsing traditional development workflows into a single, accessible workflow for novice developers (Kobiella et al., 2026). While vibe coding can help novice developers prototype ideas, many do not engage in quality assurance practices, which could result in problematic code (Fawzy et al., 2025). This aspect of the simulation lab is promising but also comes with challenges.

Scaling Simulations in the College of Education

With the various simulation platforms secured and a lab area established, our college marketing team created email advertisements to encourage interested faculty to contact the lab director to access the following: (1) review faculties' syllabi to identify areas where simulation can complement traditional coursework, (2) identify way simulations can be used as formative/summative assessments, (3) help faculty come up with research agendas using simulations, and (4) discuss how simulation learning experiences could be critically designed with their students.

Interested faculty immediately began contacting the director to make appointments to embed simulations into their practice. Since the literature contains comprehensive histories of using simulations to support pedagogical development, each meeting with individual faculty began with the director surveying how simulations have been used in the faculty's discipline to ground the conversation, followed by a discussion of the faculty's syllabus, students, and areas of interest. If faculty wanted a more tailored opportunity for their students to practice a pedagogy and get feedback, we suggested TeachLivE simulations. Working with TeachLivE throughout the first year, we created simulations to allow pre-service teachers to practice informal assessments, help students make text-to-self/text-to-world connections, deliver dyslexia training, practice job interviews, enact play-based teaching strategies, and implement co-created, co-taught lessons. For one Special Education methods course, we had students practice using effective conversational skills to convince an unreasonable parent to allow his child to be evaluated for an IEP in a Claude-coded simulation, followed by practice in a TeachLivE simulator. We were going to do the same format with a faculty's counseling methods course (i.e., practicing with an agentic simulation before practicing live with TeachLivE) but the professor took so such pleasure with the agentic simulation, in which her students completed in pairs during class, that she decided she did not need the TeachLivE session.

Furthermore, we used TeachLivE simulations to develop formative and summative evaluations. For example, one faculty used TeachLivE simulations at the middle and end of their course to see how students used instructor feedback to revise and redo their lesson plans. Another faculty member in instructional technology created an end-of-course TeachLivE simulation in which her pre-service computer science educators practiced facilitating conversations on challenging computing concepts while pre-scripting avatars to ask probing questions or present misleading statements to surface content knowledge gaps. A third faculty in educational psychology used simulations to demonstrate social interventions covered in the course, where her students came into the lab for an end-of-course party and took turns demonstrating their intervention in a variety of TeachLivE environments. Interestingly, the students in both the instructional technology and educational psychology courses were fully online, so coming together to watch each other teach also transformed the activity into a community-building event.

Future Direction of the Simulation Lab

We are one year into establishing our simulation lab. However, the future is rich with possibilities. First, we want to help faculty and the field of simulation-based learning by strengthening the research scope of simulation in teacher education. Researchers frequently decry the lack of research on the longitudinal outcomes of simulation, despite it being a best practice identified in the Bondie and Dede (2021) principles for digital puppetry. So, Sellberg and Lindwall (2026) recommend moving beyond measuring outcomes in simulation-based learning experiences to “analysing how those outcomes are constituted in practice and sustained over time” (p. 9). Furthermore, while there are plenty of studies researching the efficacy of scenarios to improve pedagogical outcomes, there is little research examining the role of mimicry in simulation-based learning environments, for example, when faculty use the fishbowl approach to simulations, where individual students take turns stepping into the hot seat and performing an objective while their peers watch. Piro and O’Callaghan (2019) cautioned that preservice teachers could mimic preprofessional behaviors (e.g., greeting the avatars, using formulaic expressions to manage behavior, taking attendance by having students call out their names, getting stuck or freezing, discontinuing the teaching) that they witness their peers exhibiting. Future activities might include having the professor model skills before student attempts, or prefacing simulated activities with microteaching videos or teaching exemplars.

Furthermore, we hope to expand the simulation lab's scope beyond the College of Education, across departments and institutions. Researchers have already leveraged the virtual nature of TeachLivE and Mursion simulations to bring together participants across different university disciplines (Peterson-Ahmad et al., 2023) and even countries (i.e., DeSantis et al., 2023; Liaw & Wu, 2021). As a lab at a relatively resource-rich institution, we hope to continue this tradition by partnering with other institutions to enable their teachers to collaborate across cultural and geographic boundaries.

Conclusion

The research in simulation-based learning, along with a narrative description of the simulation lab presented here, comes together to offer a practical model of what is possible when institutions commit to initiatives that bridge the gap between theory and practice in teacher education. Our lab houses multiple simulation modalities under one roof (e.g., TeachLivE, SchoolSims, agentic simulations) to help faculty identify how simulation can enhance their teacher-training courses. Beyond being a space for pre-service teachers to develop their pedagogies in safe, controlled environments, digitally-mediated simulations can aid in curriculum reform, be an additional source for assessments in this AI-mediated world, and a serve as a tool to help faculty and students come together to craft their own learning experiences, either through the design and evaluation of scenarios, and hopefully, through the creation of their own agentic simulations. The work ahead, from strengthening research scopes to expanding partnerships and technological proficiency, is substantial, with lots of room for growth. However, within that future work lies the potential to transform how teacher educators themselves learn to teach.

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