



AI-powered simulation drives teacher learning

BY RHONDA BONDIE AND ELIZABETH CITY

Along with many educators, we have been skeptical of technology tools that claim to make a teacher's job easier. After all, technology has yet to live up to the litany of promises we have

heard throughout our teaching careers. Now artificial intelligence is grabbing headlines, with many leaders claiming it has the power to transform education.

But new questions arise every day about the impact of AI in schools: How will teachers learn about AI and leverage

it in their classrooms? How might they use it to develop their own teaching expertise? Can AI for educators really lead to better teaching and learning?

Despite our natural skepticism, our emerging experience with AI-powered teacher learning suggests



Novice and experienced teachers engage with AI-powered students in the Teaching with Grace virtual classroom.

potential for benefits to teachers and students — when the tools are carefully designed and grounded in research and teachers’ deep knowledge and experience. In particular, we believe that AI can help teachers become more effective by providing consequence-free personalized teaching practice.

Traditionally, teachers develop their teaching practices by working in schools under the supervision of a mentor teacher, coach, or administrator. Because these situations occur in real classrooms with real children, they have high stakes for everyone involved. As a result, teachers have limited opportunities to experiment with new teaching practices or apply feedback to improve their practices.

In contrast, a virtual classroom allows teachers to pause, try again, and focus on specific parts of a lesson. AI can provide immediate feedback on teaching practices, such as the quality and equitable distribution of the teacher’s feedback to avatar students, so they can make changes in real time. This situation can provide the time and support for teachers to develop the quick-thinking skills they need to respond to students dynamically as learning unfolds in classrooms.

To explore AI’s potential for

supporting teacher development, we built an open-source, freely available AI-powered classroom called Teaching with Grace with financial support from several grants — Reach Every Reader, Computer Integrated Teacher Education, and Teaching with Primary Sources.

Teaching with Grace provides teaching simulations, where teachers can practice their instructional moves in much the same way that pilots, doctors, nurses, and military personnel use simulations to develop skills and problem-solving strategies.

We have found that this simulated classroom creates dynamic and personalized opportunities to practice teaching that can help teachers provide better and more equitable feedback and engage in more meaningful interactions with students.

RESEARCH-BASED LEARNING

During the last six years, we have been part of the leadership team of a research-to-practice initiative called Reach Every Reader, which creates research-based solutions to the complex challenges of ensuring every reader thrives. One major component of the initiative is providing professional learning, which we align with Learning

Forward’s Standards for Professional Learning, with a particular focus on equity practices and drivers, professional expertise, evidence, and learning designs.

As part of our professional learning, we have begun using immersive technologies that engage teachers in opportunities for practice and feedback that teachers can take back to their classrooms. These digital tools mirror and help us to model the types of personalized and differentiated learning that we hope pre-K-12 students experience. They enable us to reimagine teaching practice where teachers take risks, explore different approaches to learn from their experiences, and develop self-awareness of themselves as teachers.

Our AI-powered virtual classroom, Teaching with Grace, is built on the principles of instant data-rich feedback, learner control of personalized practice, and unlimited, anytime, anywhere practice. In this virtual classroom, teachers practice recognizing student strengths as the starting place for learning.

For example, teachers learn and deploy strategies to quickly perceive the effort, emotions, and histories that students bring to their learning

as assets. Practice sessions are also designed to help teachers think and respond to students in the moment — for example, prompting students to think deeply about themselves and their learning.

Teaching with Grace homes in on teacher-to-student feedback because research has found this to be one of the most impactful teaching practices on student learning (Hattie & Timperley, 2007). AI can be trained to use language models that quickly analyze and categorize the language teachers use to identify specific purposes and qualities of teacher feedback.

Teachers in the virtual classroom can pause their practice to see a visual timeline showing the frequency and quality of feedback they gave to each student. They can then reflect on those patterns, identify what they want to change, and try again. In this way, the data-rich, consequence-free environment powered by AI and machine learning encourages teachers to be present, imaginative, responsive, and precise, not just in their next simulations, but in classroom interactions with real students.

Our practice scenarios focus teacher attention on two aspects of feedback that teachers use in nearly every classroom lesson and that have a high impact on student learning when done well: adjusting teacher directions for partner discussions to increase the quality of the academic language students use to express their ideas and equity in discussion participation as well as responding to student misunderstanding when providing feedback.

HOW THE SIMULATION WORKS

We begin each practice session with teachers listening to student responses so that teachers must adjust their teaching immediately based on student understanding and learning. One scenario begins with students responding to comprehension questions based on a newspaper article about the equipment scientists use to

explore the moon. Each avatar student expresses a partial but incomplete understanding of the article.

Teachers are then directed to select a student to pull aside for individualized feedback, using the following steps. First, the teacher engages the student by taking a few deep breaths to relax and focus on learning. Then the teacher asks clarifying questions to better understand the student's thinking that led to the initial responses. And finally, the teacher fosters deeper learning by prompting avatar student metacognition (e.g., "How has your thinking changed?") and asking students to reflect (e.g., "What are you taking away from this experience?"), generalize (e.g., "What have you done before that looks similar to this task?"), or transfer their learning (e.g., "Could you try this approach on another assignment?").

Following the practice session, teachers receive a visual display of the quality and frequency of their feedback to student responses. Teachers can also view an analysis of student responses showing the amount students expressed belonging and used academic language, knowledge, and thinking in their responses to the teacher. Taken together, this information can help teachers examine the extent to which their teaching was responsive to student learning.

Before we developed the AI-powered classroom, we tested simulations using a combination of software, scripts, and educator actors playing the roles of avatar students and professional coach. We analyzed recordings of over 200 teachers of different content specialties and grade levels and from urban and rural school contexts using the simulations to practice adjusting teaching in response to avatar student learning (for a detailed description, see Bondie et al., 2023). Both novice and experienced teachers found our simulated practice sessions relevant and useful for developing more effective and responsive daily teaching practices.

SIMULATION TAKEAWAYS

In our work in teacher education, we assign Teaching with Grace practice for both novice and experienced teachers to practice in-the-moment student interactions that are key to nurturing learning. Five takeaways from the simulations inform the way we now design teaching practice in our teacher preparation courses and ongoing professional learning.

Expect varied growth from repetition.

Improvement for teachers does not happen in a continuous upward motion. Repetition did not lead to linear and consistent teacher growth; teachers improved and then struggled when they tried something new, but then improved again.

We also found that the type of repetition matters: Teaching sometimes didn't improve when multiple practice repetitions were too similar and tedious. Expect to see both growth and backward stumbles on the path to teaching expertise.

Align expected outcomes to actual teacher goals.

When teachers were allowed to choose to repeat, continue, or move on to a new task, teachers chose the practice that matched their goals. For example, many preservice teachers sought repetition for automaticity, while experienced teachers tended to continue to push for deeper student learning, and early career teachers tended to try something new. These different goals for practice changed how we defined growth (e.g., improving through repetition versus expanding through skill transfer to a new task).

Prompt teacher self-reflection.

Following each simulated teaching practice, teachers used a survey to reflect on their learning in the practice session and plan next steps for using their learning in their daily teaching. Teachers reported increased awareness

of their thinking process and problem-solving that takes place during teaching.

Explore and play.

The virtual environment invites playful and experimental teaching practice. For example, veteran teachers reflected on how they enjoyed exploring teaching strategies in the virtual classroom because it is hard to try something new when what you are doing is working well, yet you know there could be room for improvement or creativity.

Without the pressure of caring for real students, teachers could experiment with their teaching approaches and explore new strategies without worrying about time constraints or possible missed learning for students if the technique was unsuccessful.

Focus on student equity.

Teachers gave richer and more specific feedback to students who gave longer answers. Sadly, students with shorter responses (e.g., “I got the same as my partner”) usually got less feedback from teachers at all experience levels, even though their minimal responses likely indicated lower levels of understanding and therefore more need for help.

Professional learning needs to draw teacher attention to habits that fail to nurture every learner and offer practical teaching practices that promote equitable engagement and learning opportunities for all students. We try to use student responses that are incomplete or partially correct to give teachers practice in responding to these challenging types of student responses.

NEW WAYS TO SUPPORT TEACHERS

The rapid development of AI technology has opened new doors for our work supporting teachers to improve their practice. Before this technology was available, it would take weeks for us to analyze the sessions and provide feedback to teachers about

their interactions with avatar students so they could reflect on their teaching. Now that we use AI to analyze the language spoken during virtual classroom interactions, teachers can pause the practice session at any time to receive instant feedback.

We continue to add new simulations and features of the virtual classroom. Although still in development, Teaching with Grace is publicly available through the Agile Teacher website at agileteacher.org. Videos on our approach to providing effective feedback are available at www.youtube.com/@agileteacherlab627.

The many ways educators and leaders can use these tools include:

- Teacher educators and professional learning facilitators might incorporate these free tools into teacher preparation and ongoing professional learning.
- Teachers can use the tools on their own to improve their teaching practices.
- Coaches and principals might refer teachers to the Agile Teacher website and tools to provide support for developing teacher provision of high-quality feedback to students.

Digital tools are not free from possible perils, of course. Digital representations of students lack human feelings and experiences, limiting teachers’ opportunities to practice learning about real contexts and the lives and identities of real (human) students.

Representation of identities and cultures in nonhuman digital constructions of any kind, such as avatars, involves great care and critical analysis to avoid stereotypes. It’s important to recognize that the makers of the technology tools bring their own cultural values, languages, and ties to funding sources that may shape the practice opportunities and measures of success that are promoted.

One way to confront and limit bias is to engage with teachers in creating practice scenarios and developing the

language models used to analyze the teacher language used in the virtual classroom.

Even with attention to diversity and representation, technology tools should not be used in isolation. The best learning is relational. Like students, teachers need human supervision, feedback, and coaching to make the best use of the tools and ensure that their interpretations and implementation reflect evidence-based teaching practices.

While these limitations require ongoing attention, new technologies are vital for developing accessible, affordable innovations in teacher education. Virtual teaching practice may transform the way teachers prepare to interact with students, ensuring that, from their first days in the classroom and throughout their careers, teachers feel equipped and confident and are ready to engage the brilliance of their students.

We invite educators and facilitators at all levels to try our tools and collaborate with us on furthering these technology innovations in teacher education. Through collaboration, we hope to continue to develop flexible, adaptive, and scalable teaching practice arenas to meet the needs of all teachers and students.

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