What AI Can Teach Us About Effective Professional Learning

It's not what you think...

CA EDUCATION LEARNING LAB
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Learning Lab intro:

Dr. Son and Dr. Stigler, who co-wrote the guest commentary below, are both cognitive scientists who have studied for decades how students actually learn. They have also become expert at how faculty learning works. While much handwringing continues over the role of AI in many sectors, Son and Stigler posit that the way AI learns is an intriguing model for how teacher professional learning can work for the benefit of both students and instructors.

Ji. Y. Son, Ph.D., is a Professor at Cal State LA, and James W. Stigler is a Distinguished Research Professor at UCLA. They are co-founders of CourseKata.org, a nonprofit platform that pioneers new models for learning, teaching, and education research. CourseKata offers interactive online textbooks (currently in statistics and data science) and flexible supports for instructors. Their work has reached more than 20,000 students across over 120 institutions.

Guest commentary by Ji Y. Son & James W. Stigler

For decades, education researchers have studied highly effective teachers, classrooms, school systems, and even countries, hoping to distill their success into a set of best practices. The assumption has been: If we can just do what those teachers do, we can get the same student learning outcomes. This is what we call the "bits" model of teaching—a model where we focus on identifying the right discrete inputs: *Use think-pair-share! Use this textbook! Bring real data into class! Use AI!*—and expect the desired outputs to follow.

But real teaching and learning doesn't work this way. All the bits of teaching that have been identified as "best practices" do produce results, but only in certain contexts, sometimes. Understanding *when* to use a teaching strategy, and *how to adapt it* to a particular situation, requires more than just the ability to "do" the strategy. It requires a causal theory of how the strategy works, and what features of context are required to make it work. In short, it requires teaching expertise.

How is such expertise developed? Probably in a way similar to the way that AI systems learn. Neural networks, a prototypical example of AI systems, don't just take inputs and immediately produce perfect outputs. They refine their connections iteratively, using feedback to adjust the connections between inputs, internal layers, and outputs until they optimize for a particular outcome. This process, called backpropagation, allows AI systems to adapt their internal representations of what needs to happen between inputs and outputs.

Teacher professional learning (PL) should follow the same logic. Instead of handing teachers a curriculum or a set of teaching techniques or a tool (we will refer to all of these possibilities as "instructional materials") and expecting some consistent positive outcome (such as student learning) to result, effective PL should help teachers iteratively learn from their practice, building up sophisticated causal knowledge of *which* strategies will be most effective for helping students learn *what* in *which* situations.

The model is not one of training teachers on what to do, but of designing a professional learning environment in which teachers can learn most effectively from their own experience. We propose a three-step approach to PL based on this model:

Step 1: Engage Teachers as Learners First (Establishing Inputs)

Before teaching, instructors should experience instructional materials as learners themselves. Just as AI models need high-quality inputs, teachers need first-hand engagement with the content, pedagogy, and technology they will use in their classrooms. This is not intended to train them to implement instructional materials "with fidelity" but to help them develop an understanding of the materials from a student perspective.

Step 2: Support Teacher Implementation in Real Time (Forward Propagation)

As teachers begin implementing new instructional materials, they need structured opportunities for real-time insights where they can identify real teaching challenges as they arise. This mirrors how AI models establish initial input-output relationships through forward propagation—allowing for early testing of ideas for the purpose of figuring out what works and what does not work.

Step 3: Advance Teacher Expertise Through Collaborative R&D (Backpropagation)

Finally, effective PL should include opportunities for teachers to research, reflect, and refine their causal model of how, why, and when things work. This means facilitating collaborations between teachers as well as partnerships with researchers and developers to ensure that materials, pedagogy, and technology continuously evolve to meet student needs. This process might mirror the way AI models improve by iteratively adjusting internal connections based on feedback—backpropagation.

CourseKata: An Example of Iterative PL in Action

One example of this iterative approach is CourseKata, a research-based initiative aimed at modernizing the teaching of statistics and data science. Instead of training instructors to implement a one-size-fits-all curriculum, CourseKata engages teachers in an iterative learning cycle—first as learners, then as practitioners, and ultimately as co-researchers in improving teaching materials and methods.

1. Before implementing the materials, prospective teachers engage in study groups that immerse teachers in the student learning experience.
2. Daily office hours and teacher communities on discourse provide real-time implementation support.
3. Second-year teachers join Teaching Improvement Groups (TIGs), where they test and refine new instructional strategies in collaboration with researchers and developers.

Just as AI models improve by iterating on their predictions, teachers become better educators by continuously refining their understanding of how students learn. The future of PL must move beyond the "bits" model of teaching and toward a dynamic, iterative system where teachers strengthen their expertise over time through experience, feedback, and adaptation.

If we want to prepare teachers for a world shaped by AI, we should take inspiration from AI itself—by designing professional development that helps teachers build lasting, expert-like connections in their own teaching practice.

Comments