



## **After the Fact** | [The Future of Learning: The Evolving Classroom](#)

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### **TRANSCRIPT**

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*[Classroom chatter]*

**Emily Hood, second-grade teacher at Walkersville Elementary School:** All right, friends. For Wonder Wednesday today, I'm going to read part of a fabulous book with you. Remember last week we talked about what was inside our brains? And we made a guess, right? What kinds of things were inside your brain?

**Student 1:** A filing cabinet?

**Emily Hood:** There was a filing cabinet, yeah. What was in your brain?

**Student 2:** Mostly science. A whole half of it was science.

**Emily Hood:** Yeah, you do love science. Emmett?

**Emmett:** Football.

**Emily Hood:** Football. Well, guess what, guys—today, we're going to start digging in deeper. We're going to actually look at what's inside of our brain. As we get to know more about our brain, then we'll know how it works a little bit better.

**Ray Suarez, guest host of The Future of Learning series:** That was Emily Hood and her second-grade students at Walkersville Elementary School in Frederick County, Maryland. A lot has changed since Emily was her students' age—even since she first started teaching more than two decades ago.

She's part of a movement by Frederick County Public Schools and other educators around the world to bring the best of neuroscience, cognitive psychology, and proven teaching strategies into the classroom.

Her quest? To shape her second-graders into flexible, motivated lifelong learners. Because today's rapid pace of change means the jobs and technological tools she's preparing them for have yet to be invented.

*[Transition music]*



**Ray Suarez:** I'm Ray Suarez. You're listening to "After the Fact," a podcast by The Pew Charitable Trusts. This is the second installment of our four-part series on The Future of Learning. In this episode, we're exploring how today's classrooms are preparing younger learners to meet the needs of the 21st century—and looking ahead to what the classrooms of the future might look like.

If you're a longtime listener of "After the Fact," you know each episode begins with a data point. For this story, we're focusing on 30 percent. That's the amount of jobs in the current global workforce that could become automated by 2030, according to the McKinsey Global Institute.

For the kids sitting in today's elementary school classrooms, that means looking to a new future of learning, rather than relying on older, what some call "factory style" models of education—kids sitting at desks all day as teachers drill facts into their heads.

But what's happening in schools today? What does science tell us about the best ways to learn? Are we setting our children up to succeed? To find out, we'll go back to Emily's classroom and meet some of her students—or, as she calls them, her "friends."

First, here's Pooja Agarwal. She's a cognitive scientist and former teacher who recently published a book aiming to help educators sort through the latest research and bring the science of learning into classrooms.

To understand how learning happens, Pooja spent 15 years as a researcher in the classroom with Patrice Bain, a middle school social studies teacher in Illinois. They took the best of available science and crafted ways to build it into a teaching routine that works. The pair created four techniques—what they call "power tools"—to help people at any age take in and remember information. She called into our studio from Boston to explain.

**Pooja Agarwal, cognitive scientist and author:** There are four strategies that I highlight in my book *Powerful Teaching*. The first one is called retrieval practice. The second one is spacing. The third one is interleaving. And the fourth one is feedback-driven metacognition. The first one, retrieval practice, is this simple idea of retrieving or getting information out of our heads.

As students, as adult learners in everyday life, we often focus on getting information into our heads. So sometimes, when you're meeting someone new at a party, you might meet them and say, "Hi, Michael." "Nice to meet you, Michael." "Thanks for the chat, Michael." And all it does is focus on getting information into our heads, as opposed to pulling it out.

**Ray Suarez:** The second power tool, spacing, is the technique of spreading lessons over time, giving learners the opportunity to retrieve information they may have learned several weeks ago. Pooja says this gives them time to rest and refresh, rather than trying to cram information into their heads all at once.

**Pooja Agarwal:** So a combination of retrieval and spacing would be after the conversation to take a moment and think to yourself, "Who was that person I just met and what was their



name?” And then to retrieve that information, pulling it out, remembering it helps our long-term memory in a much more powerful, long-term way.

The third strategy, interleaving, is the idea of mixing things up. It makes things a little bit more difficult when we learn. But that difficulty is a good thing. So a simple example is when students are using flashcards to study. We’ve all done it. When you’re using flash cards, students have a tendency to go through the deck of cards start to finish, start to finish.

And interleaving is this idea of taking the deck and just shuffling it. And by doing this, by learning things out of order or in a different order, you don’t just remember things like the beginning of the song and the end of the song, but it helps you remember all the way through.

**Ray Suarez:** Pooja’s fourth power tool is feedback—a form of metacognition, which asks learners to reflect on their learning process.

**Pooja Agarwal:** Feedback is something we do every day. We do it in life. We do it in the workplace. It’s just to tell someone how they’re doing. In the classroom, you might take a quiz. You might answer a question. And the instructor typically informs you, provides feedback, with, “hey, you’re spot on,” or “here’s a misunderstanding that I want to help you with.” Feedback is very intuitive. And, yet in the classroom, there are ways to do it more effectively.

One thing that’s really important about providing feedback is to provide feedback on correct answers. So often when we receive tests or quizzes back, our first instinct is to look at what we got wrong and why we got it wrong. And research demonstrates that when students look at feedback for what they got correct, it solidifies that knowledge for them. Students don’t typically have this opportunity to reflect on their metacognition in the classroom. And how often do we do that in everyday life either?

So simply asking a student not just what’s the answer to a question, but asking a student, “how well do you think you did?” “Did you nail that question?” “Or are you not sure?” And research demonstrates that providing simple metacognition prompts to reflect on that thinking also helps boost long-term learning. There’s a lot of research that demonstrates these power tools work not just for classrooms and students, but across the age span from kindergartners to older adults. And they can take just a minute or less to use in everyday life and in classroom settings.

**Ray Suarez:** Pooja and other researchers have also unlocked a central part of the learning process that may surprise you—you have to forget, to remember.

**Pooja Agarwal:** Sometimes, we worry that forgetting is bad. I would say that that’s a misconception about learning. Forgetting is a key part to bringing things back to mind, to re-retrieving them in order to learn over the long term.

We want to help our students and children learn. So we’re not comfortable with watching them struggle. But we need to remind ourselves that that struggle, that forgetting, that wrong answer is a good thing, especially for long-term learning, not just in the short term.



**Ray Suarez:** For Pooja, the trick has been making sure discoveries in the world of science connect with the reality of learning.

**Pooja Agarwal:** What's different now is that a lot of that research just sat in cognitive psychology journals. A lot of it was basic with just bringing someone in, let's say, in the '70s or the '80s or the '90s, sitting them down, giving them a list of words, waiting five minutes, and then testing their memory. More recently, we're doing research in the field in applied settings—in classrooms, in hospitals, in the workplace.

There's also a lot of excitement going on with communicating that science for the general public and for practitioners and teachers.

*[Transition music]*

**Ray Suarez:** Meg Lee has been working in Maryland's Frederick County Public School System since 1996. She recently took on a new role, leading efforts to train all of the system's educators, including Walkersville Elementary teachers like Emily Hood.

**Meg Lee, director of organizational development for Frederick County Public Schools:** I think one of the most significant findings in the last 15 years in terms of research has been about how changeable the brain is and that's a term we use called neuroplasticity.

So, the brain is plastic. It's constantly making new neural connections. It's strengthening those connections as students learn things. And it's changed very fundamentally our beliefs about the possibilities for students.

It's also been very powerful for our teachers to look at a sea of young faces and realize that they are brain changers, and the work that they do opens doors for students moving forward and is changing the very wiring of those students' brains as they are struggling, as they are learning, as they are retrieving knowledge.

**Ray Suarez:** Frederick County applies something called a "growth mindset" to all its schools. That means learners are encouraged to think of themselves as *works in progress* with the ability to change and grow. Because, *guess what?* Learning is supposed to be hard.

**Meg Lee:** We're trying really hard to teach children to embrace struggle. Struggle shouldn't be a negative word. I like to think of learning zones. So there's the safe zone where things are too easy and the brain is relaxing. And it's OK to be in the safe zone sometimes. And then there's on the outside, the panic zone, which is a terrible place to be where I'm underwater, I've reached cognitive load, I really don't know what I'm doing.

But the sweet spot in the middle is the learning zone, where it's just a little beyond my current comfort level, but it's not so challenging that my brain is shutting down. That's where we want our learners to be.



**Ray Suarez:** Emily Hood attended a workshop this summer with other teachers to learn about the connection between neuroscience and education.

**Emily Hood:** So the concept of retrieval practice is so simple and yet so phenomenal to me. Thinking about, rather than, “here’s all of the things we’re going to do for unit 1. Let’s do unit 1. We’re going to take a test, and we’re going to put it on the back burner, and we’re going to forget about it.” Retrieval practice allows me to wait until things start to get a little bit rusty with my kids and then bring it back to the forefront and have them remember, “what did we just learn two months ago, two weeks ago, two days ago?”

**Ray Suarez:** Emily builds learning science strategies into a classroom activity Frederick County calls “mini math.” It sounds like this.

**Emily Hood:** Before we share our answers and check, we’re going to share our brain with our neighbor next to us. Remember that when we’re sharing our brain, do we just tell them what the answer is?

**Students:** No.

**Emily Hood:** No. What else do we need to talk about with our friend, Courtney?

**Courtney:** How you got there.

**Emily Hood:** Exactly, how you got your answer. What if Yeabekale and I were both partners and I tell them, for number one I got five. And he says he got—

**Yeabekale:** Seven.

**Emily Hood:** Seven. I tell him, you’re wrong! Is that how it works?

**Students:** No.

**Emily Hood:** No! We need to talk to each other and figure out, why did we get different answers? Think about what the strategy is behind it. Think about why you might have made a mistake. And then agree together on your answer, OK?

*[Sound of students discussing their answers]*

**Emily Hood:** Our mini math is one of the ways we’re doing interleaving with retrieval. It’s just a quick warm-up in the beginning of our math session. It may involve six different math concepts right now because it’s the beginning of second grade, but the retrieval practice goes back to, “what did I learn in first grade with that?” It was really interesting the first day we did it how much they struggled with that. They really didn’t have anything to retrieve. They’d forgotten.



But as we've continued to do this—we do it about three times a week—they're able to become much more fluent with it.

I wasn't trained in how the brain works. I wasn't given professional development opportunities up until recently on how it works. So my understanding as a teacher is I teach them this concept, I assess this concept, and then we move on. But what we're doing now is so much bigger than that. We're developing lifelong learners.

**Ray Suarez:** There's a lot of work ahead to bridge the gap between science and education, but Meg is optimistic.

**Meg Lee:** We see evidence all the time that the work that we do in schools is changing the minds of children. I got a message the other day from a parent of a first-grader who came home from school very excited, and told the mother that her neurons were connecting, and she knew it because she got this funny feeling and all of a sudden she could read *Amelia Bedelia* and it all made sense.

*[Transition music]*

**Ray Suarez:** In today's world, where information is at the tip of our fingers, learners can't just download information and retrieve it. They need to know what to *do* with it.

Faced with rapid change, the students in Emily Hood's second-grade classroom need to be able to take what they've learned and apply it to new situations—in short, they need to learn *how* to learn. Meanwhile, as artificial intelligence and machines grow more capable of carrying out human tasks, the abilities that remain uniquely human will be the key to success.

Enter “deeper learning,” a concept that is gaining ground with education experts in the U.S. and across the globe. I've known Pedro Noguera for more than 20 years. He's been studying and shaping the way kids learn for more than 30. He started as a classroom teacher in Providence, Rhode Island, in 1981, and is currently a distinguished professor at UCLA's graduate school of education. Pedro is one of many voices calling to bring deeper learning strategies to all classrooms and students.

**Pedro Noguera, distinguished professor of education, Graduate School of Education and Information Studies at University of California, Los Angeles:** So deeper learning is just a way of describing what we've always called using your higher-order thinking skills. We know that anyone can memorize—well, anyone with a functioning memory can memorize things and recall facts and information. But when you get students thinking deeply, critically about what they're learning, utilizing skills like the ability to apply what they've learned somewhere else to problem solve, that results in both tapping into parts of the brain that often aren't sufficiently tapped while you're in school. And it also results in greater retention of information. We want young people to focus much more on learning and less on simply passing courses or getting good grades.



**Ray Suarez:** Is there something about life in 21st century America—about the workplace—that is going to someday meet these children that makes deeper learning even more necessary or desirable than it would have been a hundred years ago?

**Pedro Noguera:** Because of the way the economy is constantly changing, the labor force is changing. And increasingly, we're not going to just have one job that we keep for our entire career. We live in a gig economy, with people changing jobs many times. And those who can't change because they lack the skills often become obsolete and unemployed. And so what we need is the ability to teach kids how to adapt to change, and most importantly, how to continue to learn because if you're good at learning, then you can adapt to new technology, adapt to new approaches to doing things.

**Ray Suarez:** Pedro says deeper learning can help all kids become motivated and excited to learn.

**Pedro Noguera:** Just about every child when they're about 2 or 3 years old starts asking, why? They want to know why things work the way they do: "Why is the sky blue?" "Why are there shells on the seashore?" "Why do I have to eat my vegetables?" And it's not simply why, but it's like, "what will happen if I don't eat my vegetables?"

And I think that natural curiosity children have, if it is encouraged and cultivated, can result in children becoming more motivated independently as learners, which is what we're after. So the reason why I try to remind people that 3-year-olds do this is because we sometimes are led to believe that only our most advanced students are capable. And that's not true. All kids are capable. It's a question of whether that curiosity is tapped into, and developed over time, and nurtured.

**Ray Suarez:** We can't talk about the classrooms of the future without talking about tech. In 2013, the Pew Research Center found that 92 percent of teachers surveyed said the internet had a "major impact" on their ability to access content, resources, and materials for their teaching.

Meanwhile, the rise of AI, massive open online courses (MOOCs) and other teaching software introduces the question of whether learners of the future will need human teachers at all. Faced with teacher shortages, 106 schools in Mississippi signed up to use online learning platforms during the 2017-18 school year. Pedro says technology can be a useful tool to meet students at an individual level, but it can't replace the human element.

**Pedro Noguera:** I think the ideal role for technology is to provide opportunities for personalizing learning for kids. We know that kids come to us with different abilities, different interests. The challenge for teachers in serving 30 kids in a classroom—and some classrooms are even larger—is how do I meet the individual needs of my students? And technology can facilitate that and allow us to tailor. It can't replace the teacher.

**Ray Suarez:** Back at Walkersville, I asked Emily Hood how she brings technology into her classroom.



**Emily Hood:** It's definitely an interesting balancing act. Children spend so much time on technology at home that I want to make sure that, when I'm using technology in the classroom, it's used for the purpose of enhancing the lesson. You know, are they listening to reading and answering questions about that rather than playing a game? I do use blended learning in my classroom, both in reading and in math. We have opportunities to engage on technology. I know by the time they get to middle school, a lot more is expected of them. So I want to make sure that I'm preparing them for that, but also remembering that—pick up a pencil and learn how to write as well.

**Ray Suarez:** We started this episode by asking what the classroom of the future looks like. While there are all kinds of innovations and trends when it comes to design, experimental techniques, and technological tools—from AI to virtual reality—what we heard from educators is that the future of learning doesn't just lie in technology, surface-level change, or some magic bullet. It's a little more old-fashioned, a little more complicated, and it needs a human touch.

**Pedro Noguera:** I come from a family, neither of my parents graduated from college or high school, but my father was an avid reader, and read all the time, and encouraged us to read. But on Saturdays, he'd make us go to the library after we did our chores. And you know, there was a librarian there, Miss McDonald, who would speak to each one of us to find out what we were interested in, and then recommend a novel or a book to us. And I remember I read *A Wrinkle in Time* at 8. And that was all I needed to become hooked as a reader.

You know, kids come to us ready to learn. The question is do we feed that desire to learn by nurturing curiosity and giving them experiences that encourage them to see the value and the power of learning? That's what we should be doing. That's what we should be focused on.

*[Transition music]*

**Ray Suarez:** Join us next week as we hear about the learning curve in the working world. Meanwhile, you can visit Emily's classroom through photos on our website at [pewtrusts.org/afterthefact](http://pewtrusts.org/afterthefact).

And we want to hear from you. Send us your questions and stories about learning. What do you remember about your early classroom years? What's changed? Email us at [podcasts@pewtrusts.org](mailto:podcasts@pewtrusts.org) or leave us a note on Twitter at Pew Trusts.

*[(Female voice over music) After the Fact is produced by The Pew Charitable Trusts]*