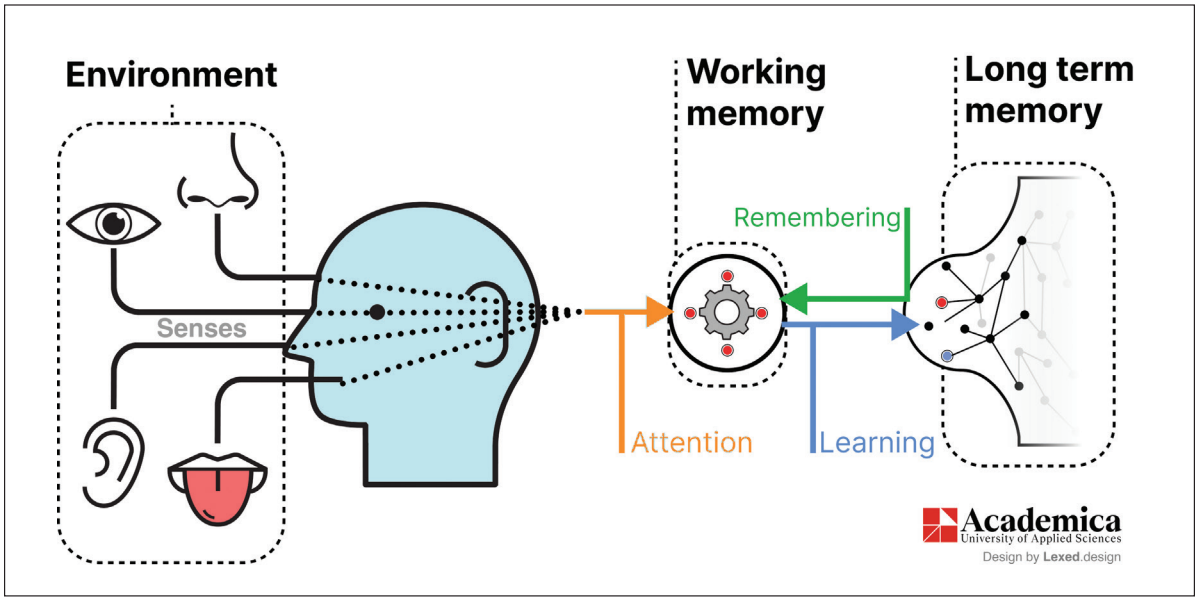
How understanding the brain improves educator learning

BY MARGARET LEE

Over the last 30 years, advances in cognitive science have allowed us to know more than ever before about how the brain encodes new information, connects it to what is already known, and makes it "stick" through durable storage in long-term memory. As of yet, much of this information hasn't made its way into the daily life of schools and educators. But proponents of the applied science of learning seek to change that. The applied science of learning refers to the cognitive science principles that can be reasonably and successfully enacted in educational practice and used to improve teaching and student outcomes. Professional learning is one of many areas where the applied science of learning can have a meaningful effect. When educators engage in professional learning aligned with the way the mind works, they can develop deep understanding of content as well as effective strategies they can implement in their classrooms immediately. Making this shift starts with understanding a simplified model of how learning happens,



Adapted from *Why Don't Students Like School? A Cognitive Scientist Answers Questions About How the Mind Works and What It Means for the Classroom* (p. 11), by D.T. Willingham, 2009, Jossey-Bass. Copyright 2025 by J. Heal and C. Hendrick. Adapted with permission.

which informs general principles of instruction, which in turn lead to teacher actions that improve classroom practice.

Daniel Willingham's (2017) simple model of the mind, which is depicted in the figure above, offers a helpful framework for understanding how the brain learns. We integrate information from the environment with facts and procedures we have stored in long-term memory and the processes of working memory that allow us to store and manage information temporarily. This allows us to make sense of new inputs. We then transfer what we have learned into long-term memory.

In this article I describe learning principles that are grounded in this simplified model of how the mind works and suggest professional learning strategies aligned with them. These strategies are consistent with the Learning Designs standard of the Standards for Professional Learning, which states, in part, "Educators use knowledge from cognitive science research about how people learn to help identify and select the learning design that will best impact the knowledge, beliefs, or practices to be changed, as articulated in their theory of action" (Learning Forward, 2022, p. 45).

SHARPEN ATTENTION AND FOCUS

Learning starts with filtering stimuli in the environment and focusing on the content at hand.

Consider a group of educators on a typical Wednesday afternoon. They are juggling a whirlwind of demands: papers waiting to be graded, Friday's lesson plan that needs adjusting, an item for tomorrow's staff social to pick up at the store, and evening responsibilities at home. Before they can attend to any of that, there's a professional learning session to join — one more task in an already packed day. How can professional learning vie for attention amidst these competing priorities?

The educators' attention must be focused first on the content of the professional learning and away from the myriad other things happening in their day, both in the learning setting and inside their brains. One strategy for doing this is a quick "stop and jot" at the beginning of the session that gives each learner the opportunity for some head clearing by creating a list of things that are on their minds at the outset but that will be set aside temporarily in order for learning to occur. Having three quiet minutes to write down things that need to be accomplished on the way home is likely to free up the brain to focus on the learning about to occur instead of the items needed at the store. Anything that can be done to eliminate environmental distractions, such as noise and clutter, is helpful too. The goal is to ensure the learners are

in the best possible frame to channel their attention directly to the content of the session, allowing the to-be-learned material to effectively enter working memory.

MANAGE COGNITIVE LOAD

Just like the educators in our Wednesday afternoon example, participants often come to professional learning sessions with lots of things on their minds, so it is important to be aware of cognitive load. Cognitive load refers to the amount of bandwidth the brain has to process information — that is, the capacity of working memory at any given time (Sweller, 2011). In order for the participants to get the most learning possible out of the session, the facilitators need to eliminate as much extraneous cognitive load as possible. A variety of strategies can help.

At the outset, the professional learning planners need to consider the volume of new learning in the session and how participants are likely to experience it in the context of other demands. For example, a group of experienced educators learning about a new resource may be able to process more information without becoming overwhelmed than a group of first-year teachers, because the novice teachers are actively processing more new information and inputs. To manage cognitive load, facilitators should also know how to "chunk" content. Chunking means combining pieces into logical structures or units to aid the brain in organizing the content (Kirschner & Hendrick, 2024).

A paper note-taking guide can help reduce cognitive demands from external tasks by focusing attention on key information and eliminating the distraction of a device riddled with incoming email and other tasks. Handwritten notes have other benefits as well (Mueller & Oppenheimer, 2014). When writing notes by hand, learners have to make decisions about what is most important to capture, how to organize it, and often how to summarize it in their own words. The thinking involved in this process is much different from just typing words verbatim.

ACTIVATE PRIOR KNOWLEDGE

As learners encounter content, new knowledge enters working memory. Because working memory is a short-term storage location, it can't hold a large amount of information at any given time. The goal is to move the essential content into long-term memory, which requires the brain to actively process and wrestle with the content.

At this point, research shows, professional learning facilitators should consider activating and building on participants' prior knowledge (Richter & Richter, 2024). As psychologist David Ausubel said in his 1968 book *Educational Psychology: A Cognitive View*, "The most important single factor influencing learning is what the learner already knows" (p. vi). This is certainly true for educators, because they come to professional learning with a wealth of existing expertise (Kirschner et al., 2022) and a set of well-developed schema, or mental frameworks, for teaching their subjects and grade levels. These schema help them anticipate where students will struggle with a topic, when they may need more time, how to handle a classroom disruption, and more.

For adult learners, it is important to activate this prior knowledge in a variety of ways. Often, providing a big-picture view of the content in relation to other knowledge is helpful, as is taking time to provide a scaffold or framework for the new learning. Cueing the participants to place the new material in the context of what they already know is essential. For instance, if the professional learning is related to a new curricular resource, it would be important to highlight what the materials should replace, how they are similar to or different from what the teachers are used to, and when to use them within teachers' existing schedules.

The facilitator of the professional learning must be very deliberate in explicitly communicating the outcomes of the session. More than just valuing the educators' time, providing this overview of the session content allows each participant to situate the new learning within a broader context and helps to bring together various pieces of knowledge into a unified, logical framework (Kirschner et al., 2022). This gives all learners the best opportunity to focus attention on the to-be-learned material and tie it to their existing schema.

DEDICATE TIME FOR PROCESSING

In order for information to move from working memory to long-term memory, it must be encoded and stored. The learner must think deeply about the content, and this requires time to process (Berlin & Heal, 2022). The quality of the prompts and questions used to stimulate reflection are important because we are more likely to remember things when we engage with them fully. To aid processing, professional learning facilitators should build in plenty of opportunities for participants to think and write down ideas or sketch out quick notes. Sharing with colleagues can also be helpful, but it is important to allow for individual processing first, then time for unpacking that thinking with a partner or two, and maybe then a larger group conversation to hear others' ideas. Each one of these strategies comes with a time cost. It's important to remember, though, that if the goal is meaningful learning, allowing time for processing and ensuring that the time is effortful pays off in the form of better memory.

RETRIEVE INFORMATION FROM LONG TERM MEMORY

Durable learning requires remembering. It's important for adult learners to retrieve learning from their long-term memory and engage with it again to reinforce the learning (Rosenshine, 2012).

Read about how Frederick County Public Schools in Maryland applies the science of learning as part of its improvement plan in a recent article by Holly Korbey in *The 74*. Korbey reports that in recent years, the district has seen steady progress in student achievement, including a 5-year jump on the state assessment test from 49.5% to 60% proficient in English language arts, and from 38% to 43.8% proficient in math.

Korbey, H. (2024, September 24). What happens when a 48K-student school district commits to the 'Science of Learning'. *The 74*. the74million.org/article/what-happens-when-a-48k-student-district-commits-to-the-science-of-learning/

There are many ways to incorporate retrieval in professional learning, such as beginning a new session of an ongoing series with several quick questions about content covered in a prior session, asking participants to summarize their learning at the end of the session, and engaging participants in action planning to retrieve the information in the coming weeks and months. For example, facilitators can ask participants to send themselves an email or a calendar invitation to connect with a colleague (who can also serve as an accountability partner) the following week for a 5-minute review of what they learned. This follow-up serves as a scheduled opportunity for the participants to recall the learning, share it with others, and activate it in their own context.

MAKE LEARNING STICK

Professional learning for educators must move beyond traditional models to incorporate what we know about how the brain learns best. By designing sessions that focus attention, intentionally reduce cognitive load, build on prior knowledge, and integrate opportunities for encoding and retrieval, we create learning experiences that truly stick. For facilitators, this means becoming learners themselves so they can adapt and refine their methods to meet the needs of adult learners in real time. When everyone understands and leverages the science of learning, the result is a positive cycle of high-quality professional learning, instruction, and student achievement.

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