

# What Is Working Memory and Why Does It Matter?

By Annie Stuart

1 Comment



Remember the day when someone rattled off a phone number while you just hoped against hope you'd recall the string of digits as you were dialing? That was working memory toiling away. With the advent of cell phones, you may no longer use it this way very often. But working memory still plays a central role in learning and our daily lives.

If working memory is weak, it can trip up just about anyone. But it really works against a child with learning disabilities (LD). You can take steps to help a child with weak working memory, whether or not LD is a part of the picture. Start by understanding what working memory is all about.



## What Is Working Memory?

Working memory is your brain's Post-it note, says Tracy Packiam Alloway, PhD, assistant professor of psychology at the University of North Florida in Jacksonville, Florida. "It makes all the difference to successful learning," she says.

You can think of working memory as the active part of your memory system. It's like mental juggling, says H. Lee Swanson, PhD, distinguished professor of education with the Graduate School of Education at the University of California, Riverside. "As information comes in, you're processing it at the same time as you store it," he says. A child uses this skill when doing math calculations or listening to a story, for example. She has to hold onto the numbers while working with them. Or, she needs to remember the sequence of events and also think of what the story is about, says Swanson.

Brief by design, working memory involves a short-term use of memory and attention, adds Matthew Cruger, PhD, neuropsychologist with the Learning and Diagnostics Center at the Child Mind Institute in New York City. "It is a set of skills that helps us keep information in mind while using that information to complete a task or execute a challenge," he says. Working memory is like a foundation of the brain's **executive function**. This is a broad and deep group of mental processes. They allow you to do things like plan ahead, problem solve, organize and pay attention.<sup>1</sup>

"Working memory helps us stay involved in something longer and keep more things in mind while approaching a task," says Cruger. "And, how can you plan ahead if you don't use working memory to keep your goal in mind, resist distractions and inhibit impulsive choices?"

But if you struggle with working memory, pieces of information may often evade your grasp like a quickly evaporating dream. You find yourself stripped of the very thing you need most to take action.

## Types of Working Memory

“You can’t overemphasize how often working memory is used in the classroom,” says Cruger. Children (and adults) use two main subtypes of working memory throughout the day. Both develop at a similar rate during childhood, and often reach their highest level in early adulthood.<sup>2</sup>

**Verbal (auditory) working memory** taps into the sound (phonological) system. Silently repeating that phone number while dialing makes use of this system. “And anytime kids are expected to follow a multi-step set of oral instructions, they are using these working memory skills,” says Cruger. If there’s a weakness, however, they may not be able to keep the instructions in mind while working with them, he says. This is true even when they fully understand what to do. Other tasks that require use of this type of working memory are learning language and comprehension tasks.<sup>3</sup>

**Visual-spatial working memory** uses a kind of visual sketchpad of the brain. It allows you to envision something, to keep it in your “mind’s eye.” Students use this skill to do math and to remember patterns, images and sequences of events.<sup>4</sup>

They might use it to visualize the layout of the classroom during the first couple of weeks of school, says Cruger. “A teacher says, ‘Once you’re done with this, go to the center area, take something to do and then go to this table and work on this,’” he says. “That involves multiple steps where the child is negotiating himself in the world.” If not identified, a deficit of this type is ripe for misunderstanding, he says. For example, it might seem as though a child is simply not paying attention.

## How Is Working Memory Linked With Learning and LD?

Working memory can be a central problem for many people with [Attention-Deficit/Hyperactivity Disorder \(ADHD\)](#), says Cruger. Or, it may be one of many things that is weak among a set of attention and executive functioning problems.

Those with weak working memory are likely to have learning disorders, too. In a government-funded study, Alloway and colleagues tested more than 3,000 grade school and junior high children in the U.K. They found that one in 10 had very poor working memory.

This turned out to be a reliable indicator of who would struggle in the classroom, she says. In fact, when following up six years later, they found working memory to be a more powerful predictor than IQ when it comes to learning.<sup>5</sup> “Ninety-eight percent with poor working memory had very low scores in standardized tests of reading comprehension and math.”

These weaknesses may show up later, when executive skills of comprehension and analysis come into play, says Swanson. “Schools do a pretty good job of drill and repetition and teaching kids phonics, but when you get into things like comprehension, it can begin to fall apart.”

And, if a child has a learning disability, weak working memory can add insult to injury. For example, a fifth grader who is still sounding out words while reading is relying heavily on working memory to help compensate. This puts a huge tax on the working memory system, says Cruger. At this stage, you want reading to be more automatic. You want to be able to look at a word and recognize it, he says, and not have to recruit attentional or working memory resources to the task. But for a child who needs to compensate but can’t rely on working memory, the process can become all the more painful.

This weakness may compound things, especially for those with LD, says Alloway. “I’ve worked at schools where the average 10-year-old can remember and process four pieces of information, but one with poor working memory can look like an average five-year-old,” she says. “For this child, the teacher talks too fast, making it hard to keep up. So the child may eventually start disengaging altogether.”

Combine these challenges with high anxiety, which also puts demands on working memory, and it becomes more than a double whammy. “Your emotional state can play a role in working memory performance, which can in turn influence performance on tests,” says Alloway.

## How Can You Diagnose Working Memory Problems?

So how can you know whether or not your child has a problem with working memory? First, watch for signs. Then, consider testing to confirm the weakness, assessing both types of working memory.

**Know the signs.** Alloway has helped develop a 22-item checklist, standardized for grade school and junior high students and published by Pearson Assessment in the U.K. (A U.S. version will soon be available.) Called the Working Memory Rating Scale (WMRS), it helps teachers identify this problem by listing behaviors that are typical of someone with poor working memory such as:

Abandons activities before completing them

Looks like he's daydreaming

Fails to complete assignments

Puts up a hand to answer questions but forgets what she wanted to say (This is typical for a five-year-old, but not for an 11-year-old, for example.)

Mixes up material inappropriately, for example, combining two sentences

Forgets how to continue an activity that he's started, even though the teacher has explained the steps

Alloway emphasizes that students always be compared with peers to know what is typical for a given age group. That's because working memory develops over time. The average five-year-old, she says, can hold and process one or two pieces of information. But a 10-year-old can do this with three and a 14-year-old with four.<sup>6</sup> A kindergarten teacher recently told Alloway, "Now it makes sense why they don't listen to me because I always give them about four instructions at a time!"

**Consider formal testing.** A school psychologist can test for working memory with tests such as the Working Memory Index in the WISC. Unfortunately many with poor working memory go undiagnosed. That's because they learn to compensate, says Swanson. "Their knowledge base or basic skills acquired in specific academic domains, such as reading or math, helps them deal with any working memory demands related to a particular task."

Although diagnosis can help you understand what underlies any difficulties, Swanson cautions to find assessments that actually test working memory and not just short-term memory. "The test has to involve interpreting information as it is coming in." He recommends two:

The Automated Working Memory Assessment (AWMA), a PC-based assessment published by Pearson

The Wide Range Assessment of Memory and Learning (WRAML-2), published by PRO-ED

**Assess both types of working memory.** From an educational perspective, it is important to know the difference between them because children with different learning needs may have very different working memory profiles, says Alloway.

"A student with a reading disorder can have a weakness in auditory working memory but relative strengths in visual spatial working memory," says Alloway. "But another student with [dyspraxia](#) may have deficits across the board but particularly with visual spatial working memory."

Also be aware that auditory working memory usually affects learning more so than visual-spatial working memory, says Alloway. That's because, with so much information relayed verbally in school, it's harder for a student to easily find ways to compensate.

Now that you understand the role of working memory, perhaps it's time to seek help for your child. Without intervention that specifically addresses this weakness, students with poor working memory won't catch up over time, says Alloway. Fortunately, there are more ways than ever to help.

## Free online games that practice memory-building skills

Memory Games by Lumosity

The Original Memory Gym

Easysurf Memory Games

## Additional Resources

A workout for working memory (American Psychological Association)

Don't Forget: Memory Tips for ADHD Students [and those with LD]

Working Memory Capacity and the Wandering Mind

Improving Working Memory: Supporting Students' Learning by Tracy Packiam Alloway

The Learning Brain: Memory and Brain Development in Children

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1 UCL Institute of Cognitive Neuroscience: "[Executive Functions.](http://www.icn.ucl.ac.uk/executive_functions/)" [http://www.icn.ucl.ac.uk/executive\\_functions/](http://www.icn.ucl.ac.uk/executive_functions/)

2 Alloway, T. [Improving Working Memory: Supporting Students' Learning](#), Sage Publications, 2010.

[http://www.amazon.com/Improving-Working-Memory-Supporting-Students/dp/1849207488/ref=sr\\_1\\_1?ie=UTF8&qid=1334873180&sr=8-1](http://www.amazon.com/Improving-Working-Memory-Supporting-Students/dp/1849207488/ref=sr_1_1?ie=UTF8&qid=1334873180&sr=8-1)

3 Ibid

4 Ibid.

5 Alloway, T. et al. *Child Development*, 2009; 80: 606-621.

6 Alloway, T. *Improving Working Memory: Supporting Students' Learning*, Sage Publications, 2010.

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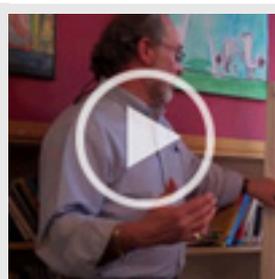
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