

# **Improving Attention and Learning in Children & Adolescents: The Role of Working Memory**

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# **Cogmed Working Memory Training: A Program for Improved Attention**



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# What is Working Memory?

**Working memory** is the ability to keep information in your mind for a short period of time (seconds)

*and*

be able to use that information in your thinking

*and*

process what you are doing in the present moment.

Example: Solving a math problem in your head.

# About Working Memory

## Working memory is the search engine of the mind

- Working memory is responsible for keeping information online, manipulating it, and using it in our thinking.
- It enables us to delegate the things we encounter to the parts of our brains that can take action.

# About Working Memory

- It is necessary for staying focused on a task, blocking out distractions, and staying updated and aware about what's going on around us.
- We use our working memory constantly in daily life to perform efficiently and effectively in academic, professional, and social settings.

# About Working Memory

Age	Working memory is crucial for:	Indicators that working memory needs to be improved:
<b>Preschool</b>	<ul style="list-style-type: none"><li>• Learning the alphabet</li><li>• Focusing on short instructions such as “<i>Come brush your teeth</i>”</li><li>• Remaining seated to complete independent activities</li></ul>	<ul style="list-style-type: none"><li>• Seems unwilling or unable to learn alphabet, numbers</li><li>• Can’t focus long enough to grasp and follow instructions</li><li>• Flits from one thing to another</li></ul>
<b>Elementary School</b>	<ul style="list-style-type: none"><li>• Reading and understanding content material (reading comprehension)</li><li>• Mental arithmetic</li><li>• Interacting and responding appropriately in peer activities</li></ul>	<ul style="list-style-type: none"><li>• Reads (decodes) but does not understand or remember material read</li><li>• Difficulty memorizing math facts</li><li>• Difficulty participating in group activities (e.g. <i>awaiting turn</i>); makes friends but cannot keep them</li></ul>

# About working memory

Age	Working memory is crucial for:	Indicators that working memory needs exercise:
<b>Middle School</b>	<ul style="list-style-type: none"><li>• Doing homework independently</li><li>• Planning and packing for an activity</li><li>• Solving multi-step math problems, especially word problems</li><li>• Participating in team sports</li></ul>	<ul style="list-style-type: none"><li>• Does not begin or persist with homework without supervision</li><li>• Packs but forgets essential items</li><li>• Reads the problem but can't break it into understandable parts</li><li>• Problems grasping rules of a game, functioning as a "team player"</li></ul>
<b>High School</b>	<ul style="list-style-type: none"><li>• Getting a driver's license – and driving safely</li><li>• Understanding social cues &amp; responding to the demands of a social situation</li><li>• Writing essays &amp; reports</li></ul>	<ul style="list-style-type: none"><li>• Problems with spatial awareness, reading and following traffic cues</li><li>• Interrupts, talks excessively, doesn't listen to others</li><li>• Essays and reports are short, sloppy and disorganized</li></ul>

# About working memory

Age	Working memory is crucial for:	Indicators that working memory needs exercise:
<b>College</b>	<ul style="list-style-type: none"><li>• Focusing on and following a conversation</li><li>• Making and adhering to work plans, such as studying for an exam successfully</li><li>• Participating in group activities in school and socially</li><li>• Sustaining focus and interest throughout lectures</li></ul>	<ul style="list-style-type: none"><li>• Changes topics suddenly, makes irrelevant comments</li><li>• Procrastinates, then tries to “<i>cram</i>” the night before an exam</li><li>• Doesn’t listen or participate during group activities</li><li>• Falls asleep or “<i>zones out</i>” during lectures</li></ul>
<b>Adults</b>	<ul style="list-style-type: none"><li>• Getting to work on time</li><li>• Meeting deadlines at work</li><li>• Prioritizing multiple activities</li><li>• Handling conflicts within the family</li></ul>	<ul style="list-style-type: none"><li>• Frequently late to work</li><li>• Often underestimates time required for a task</li><li>• Has problems breaking a project into manageable steps</li><li>• Often loses temper with children and spouse</li></ul>



# About working memory

Age	Working memory is crucial for:	Indicators that working memory needs exercise:
<b>Seniors</b>	<ul style="list-style-type: none"><li>• Actively participate in group discussions</li><li>• Being able to perform what you are planning to do</li><li>• Organizing your materials and activities</li><li>• Managing important financial transactions</li></ul>	<ul style="list-style-type: none"><li>• Forgetfulness</li><li>• Distractibility</li><li>• Losing track of the topic in a conversation</li><li>• Misplacing things like glasses, mobile phone, keys etc</li></ul>

# Working Memory and Attention

- Working memory is closely related to the ability to concentrate.
- You can remember information for a short while by concentrating on it, but it disappears from your memory if you are distracted.

**Working memory = “Working attention”**

# Working Memory and Attention

- ADHD, or attention deficit hyperactivity disorder is one of the most common neurobehavioral disorders of childhood.
- It is a behavioral condition that makes focusing on everyday requests and routines challenging.
- About 9.5 % of children age 4-17 in the United States have been diagnosed with ADHD, according to the Centers for Disease Control and Prevention (2010).
- Children with ADHD typically present pronounced deficits in working memory.

# Can working memory be improved?

- With the development of f-MRI technology, neuroscience has dramatically changed what we understand about the brain.
- F-MRI has enabled us to better observe how the brain works, how it reacts to external and internal influences.
- One critical discovery is that the brain is *“plastic.”*

# Can working memory be improved?

- **Neuroplasticity** refers to the brain's ability to reorganize itself by forming new neural connections.
- Brain reorganization takes place with repeated activity, changes in behavior, and changes in the environment.
- Brain functioning is not fixed – it is like a muscle that can be strengthened and trained.
- Brain functioning is optimized with exercise and maintained with practice.

# Can working memory be improved?

- In 1999, researchers, lead by Dr. Torkel Klingberg in Stockholm, Sweden, began exploring the possibility of improving working memory with computerized training.
- They teamed up with programmers who specialized in game development for children.
- They developed a video-game like program that was engaging to the user.

# Can working memory be improved?

- Klingberg and associates piloted a series of studies investigating the effectiveness of this computerized program (Cogmed) in retraining working memory.
- The first treatment group consisted of children with ADHD.
- Results showed substantial impact on the working memory capacity of the children who participated in the training.

# What is Cogmed Working Memory Training?

- Based on the understanding that the human brain is relatively “*plastic*,” **Cogmed Working Memory Training** evolved as a means to exercise and strengthen working memory capacity.
- F-MRI studies have demonstrated that when you train your working memory, activity in the parts of your brain associated with WM increases.



# COGMED Programs

- **Cogmed JM – Pre-school**

To help improve focus, ability to follow instructions, remain seated, and work/play independently

- **Cogmed RM – School age**

To help improve reading, math problem solving, planning, and the ability to follow instructions and participate in conversations

- **Cogmed QM – Adult**

To help with planning, focusing, resisting distractions, and meeting deadlines

# How does Cogmed work?

- **Very focused design – working memory improvement**  
The computerized, cognitive exercises are designed by neuroscientists to target this key cognitive function.
- **Finely tuned difficulty level – you are always challenged**  
The difficulty level of the training is adjusted in real time by the software based on the user's performance.
- **Highly personal support ensures you will complete the training**  
Cogmed training is always supported by a Cogmed-trained coach.
- **The improved working memory “generalizes” to behavior**  
Training a tightly defined cognitive function creates a cascading effect of improvements.

# Cogmed Results

- With WM training, about 80% of children show improvements in attention and hyperactivity. At 6 month and 1 year follow-ups, about 80% of participants maintained the WM gains (Pearson, 2010)
- Overall, research has shown that with Cogmed training, you can improve WM up to 20%  
(Klingberg et al., *Journal of the American Academy of Child & Adolescent Psychiatry*, 2005)
- Children with ADHD improve on neuropsychological tests after WM training  
(Klingberg et al., *Journal of Clinical and Experimental Neuropsychology*, 2002)
- Healthy adults show increased brain activity in pre-frontal cortex and improved working memory capacity after Cogmed  
(Westerberg & Klingberg, *Physiology & Behavior*, 2007)

# Cogmed Results

- Children with low WM improve WM, attention, and math 6 months after Cogmed training  
(Holmes et al., *Developmental Science*, 2009)
- Preschoolers improve WM, with transfer to better attention  
(Thorell et al., *Developmental Science*, 2009)
- Six month lasting effects on WM in children with ADHD, wider effect on executive functions than stimulant medication (Holmes et al., *Applied Cognitive Psychology*, 2010)
- Parents and teachers report improved WM, executive functioning, and ADHD symptoms in children on attention rating scales  
(Beck et al., *Journal of Clinical Child & Adolescent Psychology*, 2010)

# Research Summary

- WM is key to attention and learning
- WM can be improved by computerized training such as Cogmed
- WM can be improved at all age levels
- The improvement can be shown on three levels: f-MRI/PET, neuropsychological testing and by rating scales
- Improved working memory generalizes to behavioral improvement
- Behavioral improvement is sustained
- Effects of WM training are specific: WM and its derived functions are improved, but no across-the-board-improvement
- Training effects are pronounced in populations with a WM constraint

# Contact Us

For further information, please visit:

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