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

<table>
<thead>
<tr>
<th>Age</th>
<th>Working memory is crucial for:</th>
<th>Indicators that working memory needs to be improved:</th>
</tr>
</thead>
</table>
| Preschool      | • Learning the alphabet  
• Focusing on short instructions such as “Come brush your teeth”  
• Remaining seated to complete independent activities | • Seems unwilling or unable to learn alphabet, numbers  
• Can’t focus long enough to grasp and follow instructions  
• Flits from one thing to another |
| Elementary School | • Reading and understanding content material (reading comprehension)  
• Mental arithmetic  
• Interacting and responding appropriately in peer activities | • Reads (decodes) but does not understand or remember material read  
• Difficulty memorizing math facts  
• Difficulty participating in group activities (e.g. awaiting turn); makes friends but cannot keep them |
# About working memory

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<td>Middle School</td>
<td>• Doing homework independently&lt;br&gt;• Planning and packing for an activity&lt;br&gt;• Solving multi-step math problems, especially word problems&lt;br&gt;• Participating in team sports</td>
<td>• Does not begin or persist with homework without supervision&lt;br&gt;• Packs but forgets essential items&lt;br&gt;• Reads the problem but can’t break it into understandable parts&lt;br&gt;• Problems grasping rules of a game, functioning as a “team player”</td>
</tr>
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<td>High School</td>
<td>• Getting a driver’s license – and driving safely&lt;br&gt;• Understanding social cues &amp; responding to the demands of a social situation&lt;br&gt;• Writing essays &amp; reports</td>
<td>• Problems with spatial awareness, reading and following traffic cues&lt;br&gt;• Interrupts, talks excessively, doesn’t listen to others&lt;br&gt;• Essays and reports are short, sloppy and disorganized</td>
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| **College** | • Focusing on and following a conversation  
• Making and adhering to work plans, such as studying for an exam successfully  
• Participating in group activities in school and socially  
• Sustaining focus and interest throughout lectures | • Changes topics suddenly, makes irrelevant comments  
• Procrastinates, then tries to “cram” the night before an exam  
• Doesn’t listen or participate during group activities  
• Falls asleep or “zones out” during lectures |
| **Adults** | • Getting to work on time  
• Meeting deadlines at work  
• Prioritizing multiple activities  
• Handling conflicts within the family | • Frequently late to work  
• Often underestimates time required for a task  
• Has problems breaking a project into manageable steps  
• Often loses temper with children and spouse |
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<td>Seniors</td>
<td>• Actively participate in group discussions</td>
<td>• Forgetfulness</td>
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<td></td>
<td>• Being able to perform what you are planning to do</td>
<td>• Distractibility</td>
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<td></td>
<td>• Organizing your materials and activities</td>
<td>• Losing track of the topic in a conversation</td>
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<td></td>
<td>• Managing important financial transactions</td>
<td>• Misplacing things like glasses, mobile phone, keys etc</td>
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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% (Kingberg 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 prefrontal 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

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