



## Put the PRO in Cognitive Proficiency

Expanding  
understanding and  
teaching practices  
by exploring the  
relationship  
between  
processing speed,  
working memory,  
and ADHD

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## Key Points

### What is Cognitive Proficiency?

- The efficiency with which a child processes cognitive information; effective, efficient, and skilled use of cognitive abilities; enables creative thinking and learning by "freeing up" cognitive resources to go towards other, higher order tasks
- Combined score of a working memory and processing speed performance that provides an additional layer of insight into a child's individual pattern of cognitive strengths and weaknesses
- Students with ADHD tend to have significant weaknesses in working memory and processing speed
- Research into impairments in both processing speed and working memory indicate that they may share the same basic mechanisms in the brain
- Impairments in the ability to process new information as it comes in and continue to process it over a sustained period of time is particularly difficult for children with ADHD - abilities that are required in a typical classroom
- Functional impairment: real-life challenges that cause distress or impaired functioning at home, school and/or work, and socially. Each of these are sources of functional impairment in individuals with ADHD
- Rates of academic underachievement and learning difficulties are estimated to occur in 33% to 63% of children with ADHD across all academic areas
- An estimated 50% to 80% of children with ADHD exhibit peer relational (social) problems
- Executive functions of individuals with ADHD are significantly underdeveloped or inconsistent relative to their same-aged peers
- "Executive Functioning" (EF) is a series of cognitive processes that work together to guide our thoughts, behaviours, and feelings to accomplish the goal-directed action. Difficulties arise when students struggle to regulate one or more aspects of EF. Significant and chronic EF impairment may lead to a diagnosis of ADHD
- Working memory and processing speeds are pieces of the larger EF puzzle

### Notes

- The ability to hold information in mind, manipulate it, and sequence it for problem-solving. It is used for reasoning and the guidance of decision making and behaviour
- Up to 80% of children with ADHD may exhibit working memory deficits
- Functional impairments: strong links between children's working memory abilities and their academic functioning across all areas; underdeveloped working memory may make it extraordinarily difficult to engage in the give-and-take, listen-and-wait behaviors required for adept social interactions; working memory problems of ADHD are associated with chronic problems in managing emotion-based motivations and priorities for activities
- Academically, students with Working Memory impairments may have difficulty recalling and remembering: new content, information long enough to work through it to understanding information they already know about a topic, previously learned, following a step-by-step process, instructions and directions, due dates, and they may have few strategies when trying to remember content or concepts
- Instruction supports:
  - Give notes ahead of time (whole notes or with "cloze"/fill in the blank)
  - Encourage use of lists, advance organizers, personal planners as aids to memory
  - Allow use of a calculator for math when computation skill is not the focus of evaluation
  - Break tasks into chunks/segments to ensure student remembers what to do for each segment of a large project
  - Link new concepts and information to information and ideas that student already knows
  - Limit number of new facts, words, and concepts presented in one lesson
  - Build repetition and review into each lesson, particularly for key concepts
  - Use visuals, mapping strategies, anchor charts (i.e., key concepts), and prompts to cue recall
  - Teach the use of memory aids, such as verbal mediation or rehearsal or mnemonic strategies (e.g. Susie and Sam kiss at the church house every Wednesday at noon)
  - Reduce demands on working memory by providing a structure and outline for responding
  - Have students track their learning in a memory log or learning journal
  - Timetables, rules, and instructions must be clear, brief, and often delivered through more visible and external modes and repeated as necessary
  - Provide exemplars, rubrics, and checklists for students to use to guide their work
  - Explicitly teach students ways to create study guides and take notes with scaffolded support to enhance recall and memory
  - Communicate frequently with parents through communication book or email
- Assessment supports:
  - Pre-tests can be a very effective, low stakes, low-stress activity that increases student learning and performance
  - Have student include their brainstorming work, essay outlines, and all steps to their solutions of math questions.
  - Give partial marks, where possible

- Have students do brainstorming activities prior to tests.
- Assessment strategies provide context for recall or credit the student for the process they would use in finding answers or information.
- Use open-ended questions with more than one correct answer to allow for marks for anything the student remembers
- Don't rely only on their rote recall of facts and
- figures
- Provide extra time to complete a test to
- retrieve information from memory
- Assistive Technology:
  - Text to Speech / Optical Drag and drop information from text to word document to create study notes
  - Character Recognition: Use Kurzweil virtual printer to convert activity sheet into readable document
- Effectiveness of brain training programs is inconsistent, particularly in individuals with ADHD, and not the first line of intervention

## Spotlight on Processing Speed

## Notes

- Automatically and fluently performing relatively easy or over-learned cognitive tasks, particularly when high mental efficiency is required
- Relates to the ability to process information automatically and therefore speedily, without intentionally thinking things through
- Processing information is crucial for performing effectively in everyday life, in particular in terms of predicting, anticipating, and responding efficiently in a variety of situations
- Functional impairments: lower achievement in reading, math, and written expression; children with social impairments demonstrated slowed processing speed indicating that successful interactions with same-aged peers may rely to a greater extent on the rapid processing of social information
- Academically, students with Processing Speed impairments may have difficulty: performing basic skills when they are not automatic, performing reasoning tasks under time pressure, keeping up with fast-paced lessons, making connections between isolated pieces of information across media, take extra time and effort to cover material, resulting in less academic material being covered, take longer to think of responses, and responses may be disconnected or disjointed, appear disengaged or that they don't know the answer, but may be still processing the question, have many ideas, but has difficulty thinking through them all and committing to just one main idea, appear extremely drowsy when the task is not personally engaging or relevant
- Instruction supports
  - Allow longer response time for the student to respond orally to questions in class
  - Allow more time to complete assignments in class and to make decisions when offered choices
  - Reduce the quantity of work the student is required to do, focusing instead on quality.
  - Focus on quality VS quantity (depending on the task)
  - Give questions ahead of time to allow for "think time"
  - Review questions and expectations ahead of time to ensure the student understands what is required and may be

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- encouraged to work more confidently and efficiently
  - Provide copies of notes rather than requiring the student to copy information quickly
  - Provide exemplars, rubrics, and checklists for students to use to guide their work
  - Teach the student to monitor the time spent on each activity and allocate amounts of time for each task
  - Provide timed activities to build speed and automaticity with basic skills, such as:
    - reading a list of high-frequency letter sequences and words as fast as possible
    - calculating simple math facts as fast as possible
    - learning simple math calculations through flash cards and educational software exercises
    - chart daily speed and accuracy performance to demonstrate growth over time
  - Assessment supports:
    - Pre-tests can be a very effective, low stakes, low-stress activity that increases student learning and performance
    - Use speech-to-text or text-to-speech software as needed
    - Emphasize accuracy rather than speed in evaluating the student in all subjects
    - Use test formats with reduced written output formats (e.g. multiple choice, True / False, fill in the blank) to accommodate for slow writing fluency
    - Replace timed tests with alternative assessment procedures
    - Focus on and mark what has been completed
    - Provide extra time to complete a test to retrieve information from memory
  - Assistive technology:
    - Word Prediction: Support cognitive load, increase comprehension by removing need to decode information
    - Speech to Text: Record students answers for writing fluency
    - Text to Speech: Read assignments or test questions to support reading fluency

# Resources

- American Psychiatric Association (2013). Diagnostic and statistical manual of mental disorders, fifth edition. Washington, DC: Author.
- Barkley, R.A. (Ed.). (2014). *Attention-deficit hyperactivity disorder: a handbook for diagnosis and treatment (5<sup>th</sup> ed.)*. New York: Guilford Publications
- Brown, T. (2017). *Outside the Box: Rethinking ADD/ADHD in Children and Adults A Practical Guide*. Arlington, VA: American Psychiatric Association Publishing.
- Cornoldi, C., Giofre, D., Orsini, A., Pezzuit, L. (2014). Differences in the intellectual profile of children with intellectual vs. learning disability. *Research in Developmental Disabilities, 35*, 2224-2230.
- de Boo, G. M., & Prins, P. J. (2007). Social incompetence in children with ADHD: Possible moderators and mediators in social-skills training. *Clinical Psychology Review, 27*, 78–97. doi:10.1016/j.cpr.2006.03.006
- Giofre, D. & Cornoldi, C (2015). The structure of intelligence in children with specific learning disabilities is different as compared to typically developing children. *Intelligence, 52*, 36-43.
- Huang-Pollock, C. L., Mikami, A. Y., Pfiffner, L., & McBurnett, K. (2009). Can executive functions explain relation between ADHD and social adjustment? *Journal of Abnormal Child Psychology, 37*, 679–691
- Jacobson, N. S., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology, 59*, 12–19.
- Jacobson, L. A., Ryan, M., Martin, R. B., Ewen, J., Mostofsky, S. H., Denckla, M. B., & Mahone, E.
- M. (2011). Working memory influences processing speed and reading fluency in ADHD. *Child Neuropsychology, 17*, 209–224.
- Kasper, L. J., Alderson, R. M., & Hudec, K. L. (2012). Moderators of working memory deficits in children with ADHD: A meta-analytic review. *Clinical Psychology Review, 32*, 605–617.
- Kofler, M. J., Rapport, M. D., Sarver, D. E., Raiker, J. S., Orban, S. A., Friedman, L. M., & Kolomeyer, E. G. (2013). Reaction time variability in ADHD: A meta-analytic review of 319 studies. *Clinical Psychology Review, 33*, 795–811.
- Kofler, M.J., Sarver, D.E., Spiegel, J.A., Day, T.N., Harmon, S.L., & Wells, E.L. (2017) Heterogeneity in ADHD: Neurocognitive predictors of peer, family, and academic functioning, *Child Neuropsychology, 23:6*, 733-759, DOI: 10.1080/09297049.2016.1205010
- Logue, E., Scarisbrick, D., Thaler, N., Mahoney, J., Block, C., Adams, R., Scott, J (2015). Criterion validity of the wais-iv cognitive proficiency index (cpi). *The Clinical Neuropsychologist, 29* (6), 777-787.
- Maybery, M. T., & Do, N. (2003). Relationships between facets of working memory and performance on a curriculum-based mathematics test in children. *Educational and Child Psychology, 20*, 77–92.
- Mayes, S. D. & Calhoun, S. L. (2007). Learning, attention, writing, and processing speed in typical children and children with ADHD, autism, anxiety, depression, and oppositional defiant disorder. *Child Neuropsychology, 13*, 469–493.
- Melby-Lervåg, M., & Hulme, C. (2016). There is no convincing evidence that working memory training is effective: A reply to Au et al. (2014) and karbach and verhaeghen (2014). *Psychonomic Bulletin & Review, 23*, 324–330.
- Orban, S.A, Rapport, M.D., Friedman, L.M., Eckrich, S.J., Kofler, M. J. (2017). Inattentive behavior in boys with adhd during classroom instruction: the mediating role of working memory processes. *Journal of Abnormal Child Psychology*. DOI:10.1007/s10802-017-0338-x
- Phillips, L. H., Tunstall, M., & Channon, S. (2007). Exploring the role of working memory in dynamic social cue decoding using dual task methodology. *Journal of Nonverbal Behavior, 31*, 137–152.

- Rapport, M. D., Orban, S. A., Kofler, M. J., & Friedman, L. M. (2013). Do programs designed to train working memory, other executive functions, and attention benefit children with ADHD? A meta-analytic review. *Clinical Psychology Review*, 33, 1237–1252.
- Rubia, K., Alegria, A. A., Cubillo, A. I., Smith, A. B., Brammer, M. J., & Radua, J. (2014). Effects of stimulants on brain function in ADHD: A systematic review and meta-analysis. *Biological Psychiatry*, 76, 616–628.
- Saklofske, D., Zhu, J., Coalson, D., Raiford, S., Weiss, G. L. (2010). Cognitive proficiency index for the canadian edition of the wechsler intelligence scale for children-fourth edition. *Canadian Journal of School Psychology*, 25, 117-123.
- Sarver, D. E., Rapport, M. D., Kofler, M. J., Scanlan, S. W., Raiker, J. S., Altro, T. A., & Bolden, J.(2012). Attention problems, phonological short-term memory, and visuospatial short-term memory: Differential effects on near-and long-term scholastic achievement. *Learning and Individual Differences*, 22, 8–19.
- Sesma, H. W., Mahone, E. M., Levine, T., Eason, S. H., & Cutting, L. E. (2009). The contribution of executive skills to reading comprehension. *Child Neuropsychology*, 15, 232–246.
- Shipstead, Z., Hicks, K. L., & Engle, R. W. (2012). Cogmed working memory training: Does the evidence support the claims? *Journal of Applied Research in Memory and Cognition*, 1, 185– 193.
- Thorell, L. B. (2007). Do delay aversion and executive function deficits make distinct contributions to the functional impact of ADHD symptoms? *Journal of Child Psychology and Psychiatry*, 48, 1061–1070.
- Walg, M., Hapfelmeier, G., El-Wahsch, D., Prior, H. (2017) The faster internal clock in adhd is related to lower processing speed: wisc-iv profile analyses and time estimation tasks facilitate the distinction between real adhd and pseudo-adhd. *Eur Child Adolesc Psychiatry*, 26, 1177-1186.
- Weiss, L.G., Saklofske, D.H., Coalson, D.L., Raiford, S.E. (2010). WAIS-IV, clinical use, and interpretation. Academic Press, Amsterdam.
- Websites:
  - [www.ChildMindInstitute.org](http://www.ChildMindInstitute.org)
  - [www.ldac-acta.ca](http://www.ldac-acta.ca)
  - [www.Understood.org](http://www.Understood.org)
  - ADHD Essential Ideas for Parents by Russell Barkley: <https://www.youtube.com/watch?v=SCAGc-rklfo&t=2s>
  - Official website for Dr. Russell A. Barkley: <http://www.russellbarkley.org/>
  - [www.ADDvance.com](http://www.ADDvance.com)
  - [www.ADDitudemag.com](http://www.ADDitudemag.com)
  - [www.insideADHD.org](http://www.insideADHD.org)
  - [www.ParentsMedGuide.org](http://www.ParentsMedGuide.org)
  - [www.ChildMind.org](http://www.ChildMind.org)