

# cerobrate

## Research Summaries

### Executive Function System

## Executive Functions, Learning, and Academic Achievement

- 1** Social-emotional development has become a significant focus, and this article concludes that emotional, self-regulatory, and cognitive skills should be focused on in a balanced way for the most effective learning environment. The authors recommend the use of targeted instruction for developing behavioral and emotional executive function skills in the classroom, and they point to academic achievement as a foundational benefit.

#### Citation:

Blair, Clancy & Diamond, Adele. (2008). Biological processes in prevention and intervention: The promotion of self-regulation as a means of preventing school failure. *Development and psychopathology*. 20. 899-911. 10.1017/S0954579408000436.

Click this [link](#) to access the research

- 2** This study found that students improved significantly on a Common Core achievement exam after 9 weeks of focused executive function skill training, with little impact to the class's other learning schedule. The training included planning, task initiation, organization, and self-monitoring strategies. The authors cite that these findings are consistent with significant similar research.

#### Citation:

Akers, Donna, "How Does Executive Function Skills Instruction Impact Student Executive Function Levels And Academic Achievement On Common Core State Standards Assessments?" (2015). *Electronic Theses and Dissertations*. 488.

Click this [link](#) to access the research

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This white paper emphasizes the benefit of teaching executive functions skills to improve emotional regulation and to assist with student's emotional development. The authors specifically state: "Evidence from cognitive development and developmental cognitive neuroscience has shown that the development of emotion regulation is strongly supported by several core executive functions." Multiple research studies are cited for the conclusion that educational programs should include direct executive function training "to promote children's social and emotional competence."

**Citation:**

Rueda, Maria & Paz-Alonso, Pedro. (2013). Executive Function and Emotional Development.

Click this [link](#) to access the research

4

Two field trials targeted executive function skills, and the results demonstrated noteworthy and impressive increases in speaking, listening, reading, writing, and math performance. 84% of one trial's students, many of whom were low-achieving students prior to training, reached nationally expected levels of attainment in English and Math after receiving executive function training.

**Citation:**

Joni Holmes & Susan Elizabeth Gathercole (2014) Taking working memory training from the laboratory into schools, *Educational Psychology*, 34:4, 440-450, DOI: 10.1080/01443410.2013.797338

Click this [link](#) to access the research

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In this review, the authors summarize research connections between executive functions and academic success in reading and math. Students with the skill of self-regulation (aka self-monitor) can see when they are not following directions or understand when they need help. They are also able to check their work for mistakes, correct mistakes, and try to keep their work neat.

**Citation:**

Blair, Clancy and Raver, C. Cybele, School Readiness and Self-Regulation: A Developmental Psychobiological Approach (January 2015). *Annual Review of Psychology*, Vol. 66, pp. 711-731, 2015.

Click this [link](#) to access the research

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The authors illustrate how students who are trained in cognitive flexibility have an increase in attention and fluid intelligence, and how there is also a benefit to working memory and inhibitory skills, both of which have proven impact on student's success in learning. Multiple studies are also used to show that the training of executive function skills have a direct and positive association to improvements on standardized tests.

**Citation:**

Karbach, Julia & Unger, Kerstin. (2014). Executive control training from middle childhood to adolescence. *Frontiers in psychology*. 5. 390. 10.3389/fpsyg.2014.00390.

Click this [link](#) to access the research

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Researchers made a crucial conclusion that working memory, a key cognitive executive function skill, is not simply a contributor to IQ or overall learning success, but it is also so vital a skill that its influences stand alone in relation to a child's learning. These researchers also emphasize that working memory should be cultivated as students develop and that direct training can be a significant technique for positive learning outcomes.

**Citation:**

Alloway, Tracy & Alloway, Ross. (2010). Investigating the predictive roles of working memory and IQ in academic attainment. *Journal of Experimental Child Psychology*. 106. 20-29. 10.1016/j.jecp.2009.11.003.

Click this [link](#) to access the research

# Executive Functions and Reading, Writing, and Math

- 1** This study shows that reading comprehension is directly influenced by the executive function skills of flexibility and self-control. Specifically, for self-control, students need to be able to synthesize information as they read, but also disregard extraneous pieces concurrently. For flexibility, there are direct and indirect associations between attention shifting and successful reading comprehension that includes moving between actual reading and re-reading of a text and locating significant pieces of data.

## Citation:

Kieffer, Michael & Vukovic, Rose & Berry, Daniel. (2013). Roles of Attention Shifting and Inhibitory Control in Fourth-Grade Reading Comprehension. *Reading Research Quarterly*. 48. n/a-n/a. 10.1002/rrq.54.

Click this [link](#) to access the research

- 2** Researchers conclude that the direct training of executive function skills contribute to students learning new math concepts and completing math operations. Three core executive function competencies of working memory, inhibition (self-control), and shifting (flexibility) are referenced throughout, and the authors show the specific connections between executive function skills and mathematics achievement.

## Citation:

Cragg L, Gilmore C. Skills underlying mathematics: The role of executive function in the development of mathematics proficiency. *Trends in Neuroscience and Education* (2014).

Click this [link](#) to access the research

- 3** This study, with reviews of key research, confirms if students are taught how to use self-regulation skills, like planning and self-monitoring in their writing assignments, their writing competency can directly improve.

## Citation:

Steve Graham & Karen R. Harris (2000) The Role of Self-Regulation and Transcription Skills in Writing and Writing Development, *Educational Psychologist*, 35:1, 3-12, DOI: 10.1207/S15326985EP3501\_2

Click this [link](#) to access the research

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The authors summarize the impact anxiety can have on working memory and mathematical computations, and they also clarify the link between all three. The research in this article is abundant and clear that achievement in mathematics is directly correlated to executive function skills.

**Citation:**

Ashcraft, Mark & Krause, Jeremy. (2007). Working memory, math performance, and math anxiety. *Psychonomic bulletin & review*. 14. 243-8. 10.3758/BF03194059.

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This research study informs that not only are self-regulatory strategies important for developing writing, but that the executive functions of working memory, attention, and inhibitory control also impact concrete pieces of the composition process such as text length, text generation, written content, and language skills.

**Citation:**

Drijbooms, E., Groen, M.A. & Verhoeven, L. The contribution of executive functions to narrative writing in fourth grade children. *Read Writ* 28, 989-1011 (2015).

Click this [link](#) to access the research

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Additionally, this report highlights specific strategies recommended for writing success in middle and high school students. Planning, self-assessment and evaluation, goal setting, organization, and flexibility are highlighted as fundamental in the teaching of writing. The authors make a clear connection that executive function skills are vital in “writing to learn.”

**Citation:**

Graham, S., & Perin, D. (2007). *Writing next: Effective strategies to improve writing of adolescents in middle and high schools - A report to Carnegie Corporation of New York*. Washington, DC:Alliance for Excellent Education.

Click this [link](#) to access the research