

Focusing on executive functions in kindergarten leads to lasting academic improvements

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An educational approach focused on the development of children's executive functions - the ability to avoid distractions, focus attention, hold relevant information in working memory, and regulate impulsive behavior - improved academic learning in and beyond kindergarten, according to a new study by researchers at NYU's Steinhardt School of Culture, Education, and Human Development.

Because some effects were especially pronounced in high-poverty schools, the findings hold promise for closing the poverty-related achievement gap and suggest that an emphasis on executive functions in kindergarten may reduce poverty-linked deficits in school readiness. The findings are published online in the journal *PLOS ONE*.

"Working memory and the ability to control attention, both important components of executive functions, enable [children](#) to focus and process information more efficiently. Our results suggest that a combined focus on executive functions and early academic learning provides the strongest foundation for early success in school," says Clancy Blair, professor of applied psychology at NYU Steinhardt and the study's principal investigator.

Effective early education is critical for [academic achievement](#), especially for children in poverty, whose socioeconomic status leaves them vulnerable to gaps in achievement. Recent advances in

neuroscience suggest that focusing on self-regulation - which includes executive functions and regulating one's emotions - can enhance children's engagement in learning and put them on an upward academic trajectory.

Tools of the Mind is a research-based educational program that blends a curriculum of literacy, math, and science with child-directed activities and structured make-believe play. Using Tools of the Mind, teachers organize and manage instruction so that children build self-regulation skills through interactions with classmates, supporting the development of executive functions.

While Tools of the Mind was previously tested in preschools, with mixed results reported, this study is the first to evaluate the program's use in kindergarten. In a two-year [randomized controlled trial](#), the researchers studied 759 children in 29 Massachusetts schools, comparing the Tools of the Mind program with typical kindergarten curricula. In addition to measuring academic achievement and changes in executive functions, the researchers also took saliva samples to measure cortisol and alpha amylase, two indicators of stress response.

When compared with their peers in control classrooms, the researchers found that Tools of the Mind improved participants' academic achievement, including math, reading, and vocabulary. Remarkably, the gains seen in [kindergarten](#) were sustained and increased into the first grade in reading and vocabulary, suggesting that programs that improve self-regulation in children can have long-term benefits.

Kindergartners in the Tools of the Minds classrooms were also better at paying attention in the face of distractions, had better [working memory](#) and executive functions, and processed information more efficiently. In [saliva samples](#), the researchers found evidence of increases in stress response physiology, indicating that children in the Tools of the Mind

classrooms were more engaged physiologically as well as cognitively.

"To date, decisions about the most effective ways to foster learning in early childhood have not fully capitalized on advances in the neuroscience of executive functions, particularly for children in poverty," says C. Cybele Raver, professor of applied psychology at NYU Steinhardt and the study's co-principal investigator.

"The ability to control impulses and regulate behaviors and emotions is a critical function to build into early childhood education, ensuring children's success in both gaining knowledge and learning life skills."

The researchers noted that Tools of the Mind can be implemented using typical professional development activities, and without a high level of additional resources and support, an important consideration for high-poverty schools.

More information: Blair C, Raver CC (2014) Closing the Achievement Gap through Modification of Neurocognitive and Neuroendocrine Function: Results from a Cluster Randomized Controlled Trial of an Innovative Approach to the Education of Children in Kindergarten. PLoS ONE 9(11): e112393.
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