

Behind the Numbers:

Kindergarten Readiness and Executive Functioning

For a look at more data and discussion, go to pages 15 and 40.

Behind 1,2,3? the Numbers

After steadily climbing for four straight years, the percentage of Montgomery County's kindergartners who scored in Band 3 on the Kindergarten Readiness Assessment – Literacy (KRA-L) test recently fell. (See page 15.) Nevertheless, the 2012 value (the most recent one available) of 37.6% is over 13% greater than it was in 2007, the low point for this indicator. Perhaps it is no coincidence that 2007 is also the year that the FCFC launched the Early Care and Education initiative, soon thereafter renamed ReadySetSoar, with the specific goal of improving kindergarten readiness across the county.

Improving the school readiness of the county's children who are growing up in poverty is especially important – and urgent. In the *FCFC 2010 Progress Report*, for example, we highlighted the relationship between economic status and performance on the KRA-L and showed that there are significant differences in the results depending on whether a student is identified by the school district as economically disadvantaged or not. An economically disadvantaged student is almost 3 times as likely to be assessed in Band 1 (needing broad intense instruction) and less than half as likely to be assessed in Band 3 (needing enriched instruction). Figure 1 reinforces that point, demonstrating a strong correlation between a school district's median household income and the performance of its students on the KRA-L.

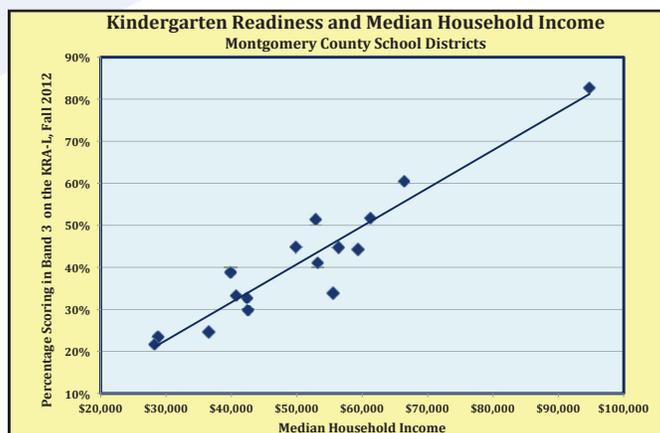


Figure 1. Each data point represents one of Montgomery County's 16 school districts. When displayed this way, the strong correlation between performance on the KRA-L and median household income is readily apparent. Sources: Ohio Department of Education; American Community Survey 2012 5-Year Estimates, Table S1903.

The KRA-L test measures a significant component of a child's development and school readiness, but it is by no means the only – or even the most important – component. Others of equal or greater importance are skills that help someone to get along with others, to set goals, to control impulses, and to focus on complicated problems – skills that have come to be known as “executive functions.”¹

In many ways, executive function skills could be called the “biological foundation” for school readiness. It has been shown that children with strong working memory, inhibitory control, and cognitive/mental flexibility skills make greater gains in academic areas than peers with weaker executive function skills. Coming to school with these foundational skills well-developed is just as important, **if not more important** (emphasis added), than fluency with letters and numbers.²

Executive function skills are clearly essential throughout life and, as Figure 2 shows, reach a peak in early adulthood. Of interest for this discussion is the dramatic growth of executive function skills during early childhood. If such skills are the “biological foundation” for school readiness, then the challenge of increasing school readiness in high poverty neighborhoods goes hand-in-hand with promoting the acquisition of executive function skills in young children in these neighborhoods.

But first, what do we know about the relationship between socioeconomic status (SES) and executive functioning, especially in children? There is a rich and growing body of research on this topic. For example, the educational level of the parents (a key component of SES) has been shown to be significantly correlated with a number of different tests of their children's executive functioning.³ Using a measure of SES that included parents' occupations and incomes as well as educational levels, socially advantaged children (from five to seven years old) demonstrated greater proficiency on a similar set of tests.⁴

Executive Function Skills Build Throughout Childhood and Adolescence

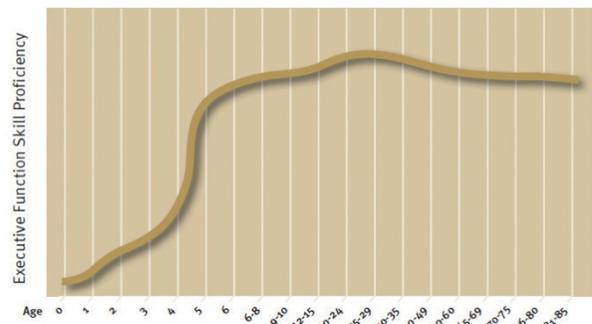


Figure 2. A range of tests measuring different forms of executive function skills indicates that they begin to develop shortly after birth, with ages 3 to 5 providing a window of opportunity for dramatic growth in these skills. Growth continues throughout adolescence and early adulthood; proficiency begins to decline in later life. Source: Center on the Developing Child at Harvard University (2011). Building the Brain's “Air Traffic Control” System: How Early Experiences Shape Development of Executive Function: Working Paper No. 11. <http://www.developingchild.harvard.edu>

Researchers have even been able to extend this type of investigation to infants by using some simple, standard tests. It is sobering to realize that differences in executive function based on socioeconomic status can be observed at that early age.⁵ To put an exclamation point on the relationship between SES and executive functioning, a study that followed children and their families for several years suggested that “children exposed to a greater number of years in poverty and to a higher number of spells of financial strain performed significantly worse on the battery of EF [executive functioning] tasks relative to children who had experienced fewer years in poverty and fewer years of financial strain.”⁶

In light of the above, the challenge of promoting the acquisition of executive function skills in children from low-income families seems especially daunting – and even more urgent. Here we can find some guidance in a recent report⁷ which included a survey of “What Neuroscience and Developmental Research Tell Us.” Briefly, the quantity and quality of social interactions that young children have can provide “features that protect and foster the development of [executive functioning] skills.”

An example of such a social interaction is a set of behaviors that a parent or teacher might employ called “scaffolding.” Scaffolding refers to the interactions, mostly verbal, that someone would have while supporting the child’s attempts to solve a problem or learn a new task. In one study, scaffolding was found to have a direct effect on executive function as well as additional effects that involved the child’s verbal ability.⁸ Another study of preschoolers in a Head Start program found that their verbal ability as assessed in the fall was a significant predictor of individual variations in executive function that developed over the next few months.⁹ As Figure 3 demonstrates, however, children from a lower SES face additional challenges.

Remembering that the quantity and quality of social interactions can play a crucial role in the development of executive functioning in young children, it is imperative that we explore every opportunity to promote such interactions, ranging from parent education programs to high quality preschool. Supporting and expanding ongoing research to identify the most effective approaches for improving executive function in children, especially those who are socially disadvantaged, and then implementing the most successful approaches as widely as possible may be some of the most important public policy decisions we face in our efforts to prevent future academic and behavioral problems for these children.

¹ Child Care Aware of America. (2012). Executive Function and School Readiness. http://www.naccrra.org/sites/default/files/default_site_pages/2012/executive_function_11-27-12.pdf

² Carrie Gajowski. (2012) 5 Reasons Why Every Parent Should Be Familiar with Executive Function, <http://www.scilearn.com/blog/5-reasons-why-every-parent-should-be-familiar-with-executive-function-skills.php>

³ Ardila, A., Rosselli, M., Matute, E., & Guajardo, S. (2005). The influence of the parents’ educational level on the development of executive functions. *Developmental Neuropsychology*, 28 (1), 539–560.

⁴ Mezzacappa, E. (2004). Alerting, orienting, and executive attention: Developmental properties and sociodemographic correlates in an epidemiological sample of young, urban children. *Child Development*, 75 (5), 1373–1386.

⁵ Lipina, S.J., Martelli, M.I., Vuelta, B., & Colombo, J.A. (2005). Performance on the A-not-B task of Argentinian infants from unsatisfied and satisfied basic needs homes. *International Journal of Psychology*, 39, 49–60. Cited by Lawson, G.M., Duda, J.T., Avants, B.B., Wu J., & Farah, M.J. (2013). Associations between children’s socioeconomic status and prefrontal cortical thickness. *Developmental Science*, 16 (5), 641-652.

⁶ Raver, C. C., Blair, C., & Willoughby, M. (2013). Poverty as a predictor of 4-year-old’s executive function: New perspectives on models of differential susceptibility. *Developmental Psychology*, 49 (2), 292-304.

⁷ Center on the Developing Child at Harvard University (2011). Building the Brain’s “Air Traffic Control” System: How Early Experiences Shape the Development of Executive Function: Working Paper No. 11. <http://www.developingchild.harvard.edu>

⁸ Hammond, S., Muller, U., Carpendale, J., Bibok, M. B., & Liebermann – Finestone, D. P. (2011). The effects of parental scaffolding on preschooler’s executive function. *Developmental Psychology*, 48 (1):271-81. doi: 10.1037/a0025519

⁹ Fuhs, M.W., & Day, J.J. (2011). Verbal ability and executive functioning development in preschoolers at Head Start. *Developmental Psychology*, 47 (2) 404-416.

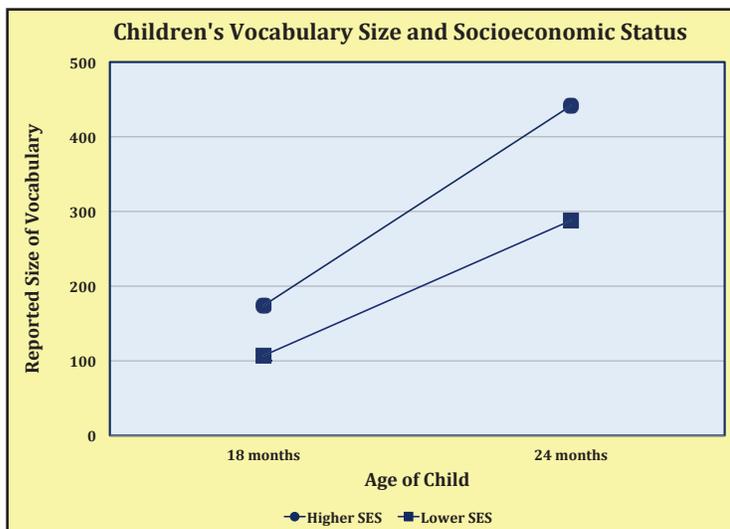


Figure 3. Not only do children from a higher SES have larger vocabularies, their rate of word acquisition is also faster. Source: Fernald, A. Marchman, V.A., & Weisleder, A. (2013) SES differences in language processing skill and vocabulary are evident at 18 months. *Developmental Science*, 16 (2) 234-248.

What are “Executive Functions?”

Executive functions consist of the following core competencies:

- (1) **working memory**, the ability to hold and manipulate complex information in the mind;
- (2) **inhibition (or inhibitory control)**, the ability to delay a well-learned prepotent response for the purposes of a more appropriate response; and
- (3) **cognitive flexibility**, the capacity to adapt behavior quickly and flexibly to changing situations.

Sarsour, K., Sheridan, M., Jutte, D., Nuru-Jeter, A., Hinshaw, S., & Boyce, W.T. (2011). Family socioeconomic status and child executive functions: the roles of language, home environment, and single parenthood. *Journal of the International Neuropsychological Society*, 17 (1), 120–132.