

**Changing the Conversation: A Culturally Responsive Perspective on Executive Functions,
Minoritized Children and Their Families**

Dana Miller-Cotto¹, Leann V. Smith², Andrew D. Ribner³, & Aubrey H. Wang⁴

University of Delaware¹, Texas A&M University², University of Pittsburgh³, Saint Joseph's
University⁴

¹Corresponding author (damcotto@udel.edu)

To appear in *Infant and Child Development*

REFERENCE:

Miller-Cotto, D., Smith, L.V., Ribner, A. D., & Wang, A.H. (accepted). Changing the Conversation: A Culturally Responsive Perspective on Executive Functions, Minoritized Children and Their Families. *Infant and Child Development*. Manuscript accepted for publication.

Abstract

Executive functions remain one of the most investigated variables in both cognitive science and in education given its high correlation with numerous academic outcomes. Differences in executive function skills between children from higher socioeconomic and lower socioeconomic homes, as well as children from different racial/ethnic backgrounds, are often attributed to the quality of their environment and family resources. The goal of this essay is to highlight commonly held beliefs about executive functions in the field and provide alternative explanations for existing research findings for minoritized children and their families. We provide a summary of the literature on executive functions, how it's often measured, how it develops, and how we might view research findings differently with greater knowledge of the groups we are studying.

Keywords: executive functions, culturally responsive, minoritized children

Changing the Conversation: A Culturally Responsive Perspective on Executive Functions,
Minoritized Children and Their Families

Research suggests that children from lower socioeconomic homes and environments demonstrate poorer executive functions than their peers in higher socioeconomic status homes (e.g., Raver et al., 2013). Executive functions, or the interrelated cognitive processes of holding information in memory and manipulating it for later use, ignoring distractions, inhibiting inappropriate responses, and shifting between tasks (e.g., Best et al., 2011) is associated with a host of outcomes, including academic performance (e.g., Nguyen et al., 2019), native and foreign language acquisition (e.g., Baddeley et al., 1998), learning-related disabilities (e.g., Peng et al., 2018), and attention deficit/hyperactivity disorder (e.g., Willoughby et al., 2019a). While professional associations recognize the need to better understand children within their context, much of the research on executive function to date has discussed this need using a deficit narrative, or discusses children in a way that presents them as lacking skills or talent, when explaining the executive functions of children living in poverty (e.g., Ellwood-Lowe et al., 2020), as well as comparing the executive functions of Black and Latino children (referred to as minoritized children henceforth) to White children. Indeed, there is a long-standing history of decontextualizing minoritized children's experiences by using a deficit-based lens. This often concludes with assumptions that minoritized children are lacking because they and their environments are unlike their White upper middle-class counterparts culturally (García Coll et al., 1996; Perez-Brena et al., 2018). It is notable that executive function research has often focused on perceived needs or problems with student executive functions and has often made assumptions including that executive functions develop consistently across all populations and that all populations respond to assessments of executive functions in similar ways. Thus, it is

assumed that any noticeable difference in performance must be because of an inherent deficit in a subpopulation like minoritized children.

We argue that reframing how we discuss cognitive processes for minoritized children, especially as they relate to academic outcomes, can provide a better starting point to understanding the development of executive function and self-regulatory skills in minoritized children and then make meaningful recommendations on how to assess and interpret performance on related cognitive measures. In this essay, we provide a series of common beliefs, often using deficit-based framing, regarding executive functions, and offer an asset-based and contextually responsive perspective on each of these beliefs to advance the research in this field when studying minoritized populations in cognitive development. First, we provide a brief review of the literature on executive functions as it relates to development, poverty, and culture. We also provide a summary of the ways that executive functions are often measured. Then, we provide a series of commonly cited beliefs about executive functions and minoritized children and offer alternative perspectives for each using a culturally sensitive lens. We conclude with recommendations for future research.

Executive Functions

Executive functions, broadly defined, are a subset of skills under the umbrella term of self-regulation that relate specifically to goal-directed and regulatory processes housed within the prefrontal cortex (e.g., Olson & Luciana, 2008). Executive functions involve three main sub-components: working memory (holding and manipulating information in short-term memory), inhibitory control (controlling attention to override impulses), and cognitive flexibility (being flexible to changed demands or strategies) (e.g., Diamond, 2013; Dowsett & Livesey, 2000; Miyake et al., 2000). These subcomponents of executive function are inextricably linked and

together make up a set of higher-order skills including planning, problem solving, and perspective taking (e.g., Diamond, 2013). Executive functions have been associated with a wide range of academic, (e.g., Blair & Razza, 2007; Nguyen et al., 2019; Schmitt et al., 2017), social (e.g., Caporaso et al., 2019) and educational attainment (e.g., McClelland et al., 2013).

Executive Function Development. Executive functions improve due to several factors, including the normal course of development (Best & Miller, 2010; Bull & Lee, 2014), formal education (Brod et al., 2017), and more. Executive functions in early childhood (defined here as ages three to eight years) may be best explained by a single underlying factor (e.g., Hughes, 2011; Wiebe et al., 2011). This factor is believed to grow and differentiate over childhood, maturing into at least three factors that can be observed as early as middle childhood (around the ages of eight-13 years old) (Hartung et al., 2020; Lehto et al., 2003). For students in middle childhood and above, neuroimaging evidence supports that the three components of executive functions engage overlapping, but separable neural networks, similar to the networks engaged by adults (Engelhardt et al., 2019). This may suggest that executive functions may be one construct in early childhood and then become three as children age (Wiebe et al., 2011).

Though the above is a popular view of executive functions, some insights have more recently been offered to better understand executive function development. Several prior studies have suggested that executive function may be impacted by characteristics of children's environments, positing that exposure to such forces as poverty, neglect, poor parenting, or low-quality food might diminish children's executive functions (e.g., Blair et al., 2014; Ellwood-Lowe et al., 2018; Raver et al., 2013). Doebel (2020) argued that this conceptualization of executive functions wherein environmental characteristics can explain deficits in executive functions has had ramifications on approaches to measurement and theoretical approaches to

improving executive function through exercising different components (i.e., task switching, manipulating numbers in a math task, practicing inhibitory control). The problem with this view, Doebel argues, is that 1) it is unlikely that executive functions can simply be reduced to a few components as evidenced by the lack of transfer on cognitive training tasks; 2) poor correlations between executive function measures and self-regulation questionnaires; and 3) correlations between executive function measures and particular outcomes alone do not provide support that executive functions are recruited in these tasks. Instead, Doebel argues that the development of executive functions is likely the development of processes to address specific tasks in one's environment. That is, executive functions develop in service of one's specific task environmental goals. This perspective renders executive functions as a contextually-contingent process in which individual and group differences in executive functions may actually reflect the development of skills that are adaptive for one person but not another. Thus, a child's executive functions emerge from task-environment demands and their exertion of control in reaching contextually-responsive goals through the use of knowledge, beliefs and norms, all of which are also contextually-bound.

Executive Functions and Poverty. It has been frequently asserted that children exposed to poverty often demonstrate poorer executive functions than their peers in higher income homes (e.g., Ellwood-Lowe et al., 2018), though some work indicates that enrollment in school helps to reduce inequities in opportunities related to growth in some aspects of executive functions, such as working memory (e.g., Finch, 2019).

However, it is important to note that much of the current research on executive functions has over-represented students from higher-income, White households (Henrich et al., 2010). Even studies which consider the development of executive function in the context of poverty (e.g., The Family Life Project, Raver et al., 2013; Early Childhood Longitudinal Study-

Kindergarten cohort (ECLS-K), Conway et al., 2019; National Institute of Child Health and Human Development (NICHD), Hackman et al., 2015) tend to do so in comparison to a higher-income counterfactual. Thus, more research is needed to better understand the role of culture, socioeconomic contexts, and other factors in the development of executive functions (e.g., Howard et al., 2020; Lewis et al., 2009).

Executive Functions and Culture. Though the literature frequently cites the role of poverty and executive functions, some literature, though limited, offers insights on the role of culture and cognition more generally. Gomez-Lavin (2021) argued that working memory, a component of executive function, was a cultural invention because there is no evidence that it exists in any specific brain region. Relatedly, Heyes (2018) argued that many psychological mechanisms that are studied in cognitive psychology are merely what she terms “cognitive gadgets”, or human neurocognitive processes that have been shaped by culture rather than genetic evolution. Examples of cognitive gadgets include imitation, reading, and mindreading which are formed through social interactions. Indeed, these interactions signal to others what is deemed important to extract from the environment and what can be ignored or devalued. Despite executive function’s existence across various species, the extent to which it has developed in human beings is largely due to nurture and culture (e.g., Diamond, 2013).

Other work in cognitive and developmental psychology suggests that humans are born with similar human cognitive architecture, and how that architecture develops depends on the environments in which they are exposed. That is, environments with high poverty, adversity, chronic stress may alter children’s development (e.g., Hair et al., 2015), which would include working memory (e.g., Fitzpatrick et al., 2014). It is reasonable then, to assume that working memory, like imitation, reading, and other cognitive mechanisms would develop depending on

culture. Poor performance in an environment that is distinctly different from the one the participant has been reared in might indicate that working memory is culturally dependent, much like it has been observed with intelligence. As an analogy, Sternberg (2004) argued that intelligence should be contextualized within an individual's culture. Sternberg cites Brazilian children who can do the mathematics needed to run their street businesses are often little able or unable to do school mathematics. In fact, the more removed from real-world contexts the problems are in their form of presentation, the worse the children performed on these problems. Otherwise, we run the risk of imposing a Westernized view of intelligence on a given group. This often results in the assumption that individuals who share characteristics with the researcher are more competent than individuals who do not share the same cultural background. Given the regular imposition of such a Westernized view, we often find ourselves "surprised" at the so-called "hidden talents" of children who grow up in non-Westernized households when in fact researchers may have been testing the wrong set of skills—or the right set of skills but in the wrong ways—all along (Ellis et al., 2020). Differences in context can have a powerful effect on performance on tasks, and the same is likely the case for executive functions.

Measurement. The inherent relations among sub-components of executive functions mean that few tasks are able to measure a single dimension of executive function—a problem known as task impurity. Instead, most tasks measure two or more dimensions of executive function; some tasks measure multiple dimensions of executive functions, whereas another might measure working memory alone. One common way to measure working memory, for instance, is the reverse digit span. In this task, the individual is required to first attempt to remember the number string, manipulate the number order mentally, and repeat the numbers aloud in the reverse order.

Inhibitory control and cognitive flexibility are often measured together. One common way that inhibitory control and cognitive flexibility have been measured is a Stroop Test where an individual is asked to read a series of names of colors that are printed in font colors that do not match their name (e.g., the word purple would be in blue, the word yellow would be in pink). The individual must ignore the color of the word and simply read the word. Some individuals with poor inhibitory control cannot complete this task successfully (see Swanson & Alloway, 2012 for a review). Another example of inhibitory control is a Flanker Task, where the individual must use the arrows on a computer keyboard to determine what direction the middle arrow in a linear series of other arrows is pointing. During this task, it is not uncommon for the middle arrow to be pointing in one direction and all the other arrows are pointing in the opposite direction. Again, the individual must override their natural response to choose the arrow that is consistent with most of the arrows and choose the one in the middle.

However, measuring executive functions has posed many challenges. Many of the above tasks don't resemble any activity in the real world; that is, children rarely need to remember a string of numbers in the reverse order, nor do they need to delineate between the direction of arrows. Executive function measures have come into questions because they do not resemble a real-world task and thus begs the question of what researchers are really measuring and why it has any bearing on so many outcomes (e.g., Willoughby et al., 2012; Willoughby et al., 2019b). Furthermore, these "acontextual" measures may systematically downwardly bias approximation of skills among minoritized children who may be less familiar with performing novel tasks with researchers and in spaces who do not look like themselves or their regular settings. Instead, Doebel (2020) argued that executive function measures should resemble ecologically valid tasks and do away with typical laboratory measures. In this way, we might get away from having tasks

that demonstrate different correlations with various outcomes depending on the executive function task.

It is also worth noting that some traditional executive function tasks may be valued in different communities over others. For instance, remembering items and costs before being rung up at the grocery store may be a task someone is exposed to regularly, whereas playing double-dutch which certainly requires executive functions may be valued and practiced more frequently in another. Thus, even when we decide what executive function tasks might be ecologically valid, we may find that some individuals have more experience, and thus likely perform better, on some tasks more than others depending on the context in which they were reared in. Comparisons on these tasks, tasks for which one is not familiar, would tend to make anyone seem deficient, and thus, is worth considering. Thus, another example of the cultural embeddedness of executive functions and example of how the temptation to remove culture from assessments of executive functions may, intentionally or unintentionally, perpetuate a deficit-based approach.

Offering an Asset-Based, Contextual Lens

The objective of this essay is to offer a culturally responsive perspective on executive functions for minoritized children and their families, while also identifying common beliefs about these children in the literature and offering counternarratives. In the next section, we offer a number of these beliefs and provide a new lens to better understand executive function development for minoritized children.

Belief #1: Ethnic/Racial minority children frequently demonstrate poor executive function skills relative to their white peers. It appears to be well documented that children living in high-poverty neighborhoods, including minoritized children, demonstrate poorer

executive functions than their peers in higher socioeconomic status homes (e.g., Nesbitt et al., 2013; Raver et al., 2013). Nesbitt et al. (2013) asserts that this can be explained by exposure to early life trauma, such as chronic stress, and supported by observed elevation in stress hormones for these children (Blair et al., 2005, 2011). A normative interpretation of the above statement would suggest that minoritized children have poor executive functions, and that there is something inherent about them, their environment, or their development that is qualitatively different from their White peers.

Counternarrative #1: Ethnic/racial minority children perform worse on executive function tasks that were originally normed on White children. The conclusion of differences alone is not dangerous, but rather, the assumption of inferiority and qualitative meaning of those differences is what creates deficit-based conclusions. An analogous example involves intelligence, which has also been used, like executive functions, to test children of color in ways to rank them in terms of relative ability. Sternberg (2004) argued that while children in remote areas did not perform well on American created intelligence tests, they did demonstrate sophisticated calculation ability which was not captured on any intelligence test, likely because they needed to perform quick calculations to sell goods in their towns. Thus, measures and constructs previously created and operationalized for all children may not have much predictive utility when making claims about minoritized children. Indeed, the literature reviewed at this point suggests that cultural embeddedness of executive functions offers an opportunity for Westernized ideologies to further marginalize and skew our understanding of executive functions (likely via “culture-free”, deficit-oriented, and/or bias-laden approaches). By repositioning executive functions as skills developed through task-environment exchanges, we can more accurately assess the opportunities, demands, and beliefs surrounding the development and

deployment of executive functions. This will ultimately shift how we operationalize these terms for subpopulations, which has a cascade effect on the way we assess, interpret and intervene to support the executive functions of students who are not White and upper-middle class.

Belief #2: The association between executive functions and other factors exacerbated by positive and negative parenting and household risk characteristics. Susic-Vasic and colleagues (2017) investigated the relationships of various aspects of parenting and children's executive function skills. These aspects included positive involvement, supervision, monitoring, positive discipline, consistency with discipline, use of corporal punishment, and authoritarian parenting. For children ages nine to 14 in the study, results suggested that high parent involvement was associated with better executive function skills, regardless of socioeconomic status. Additionally, household chaos, defined by confusion, ambient noise, clutter around the home, and neighborhood characteristics (Matheny et al., 1995; St. John & Tarullo, 2020) has been associated with executive function, through parenting behaviors (e.g., Vernon-Feagans et al., 2016). That is, a chaotic home—one in which there is more happening at a given time, less adherence to a consistent daily schedule, and a lack of routines—often predicted parenting practices that negatively impacted behavior regulation and executive functions. Of course, these factors are highly tied to high-poverty homes, not specific to being a minoritized child, and are difficult to disentangle from hardships associated with a lack of resources. Further, studies which have examined mediators of intergenerational transmission of executive functions (e.g., Distefano et al., 2018) demonstrating that commonly found mediators of intergenerational transmission (e.g., autonomy support, sensitivity) center children in middle-income White families, further suggesting that what we call executive function is promoted by things valued by groups in power. A normative but incomplete interpretation would be that poor parenting

practices are associated with poor executive function development. This interpretation would lead to a potentially faulty conclusion and would reinforce the deficit-based approach of synthesizing research results.

Counternarrative #2: Distinguishing proximal and distal factors clarifies the development of executive function skills and acknowledges the role of stress in these environments. Given that it has been established through this paper that executive functions are developed through interactions between a child's cultural environment and task-goal structures that must be met developmentally, it follows that an understanding of the cultural environment should give insight into marginalized children's executive function development. Indeed, much of the research that has led to deficit-based thinking has focused on distal factors as opposed to proximal factors. Cokley and Awad's (2013) recommendations on how to more appropriately infuse social justice in quantitative research on marginalized populations helps frame our counternarrative to claims of parenting and home environment factors as being deterministic, or predestined, in the development of executive functions for children. In fact, we agree that quantitative research methods will continue to be a priority for public policy, and uphold their importance in our field. However, similar to their claims for psychology overall, we suggest that the way in which quantitative research designs have been utilized for exploring executive functions for minoritized children is currently leading to perpetually deficit-oriented conclusions. In particular, when we attempt to understand parenting and home environment outside the context of the larger ecosystem and sociopolitical histories, we blame distal factors for poor executive functions instead of more proximal, and appropriate, areas of influence.

Furthermore, by over relying on variables of household chaos, familial stress and other normative responses to structural and institutional oppression, we not only further privilege the

picture of a middle-class white family, but also begin to pathologize and scrutinize marginalized populations for meeting their survival needs and developing their resilience. Consistent with an ecological systems model (Bronfenbrenner, 1992; García Coll et al., 1996; Spencer et al., 1997) that considers position variables, universal human vulnerability and the availability of protective factors and supports, many families at the intersection of various levels of sociopolitical oppression adapt in ways not often considered in traditional research in executive functions. What remains left from the conversation of household chaos and parenting that occurs within that context is the availability of individual, familial and community resources and stressors. It's worth noting the realities of household chaos when it is operationalized as lack of parental warmth and the presence of abuse and neglect; however, a slippery slope occurs when transient household structures, clutter, and confusion are centered without the context of the utility these factors have within the home. To elucidate this example, consider a marginalized child who is within a traditionally termed "overcrowded" home context. Overcrowding is seen as a marker of household chaos in our Westernized view of normative family structures; however, many families of color and/or those in closer proximity to poverty tend to have multigenerational living arrangements to preserve family resources and cultural assets (e.g., Chase-Lansdale et al., 1994; Jahromi et al., 2014; Pearson et al., 1990; Updegraff et al., 2018). This often means that parenting is not merely reduced to the interactions between a child and their mother and/or father, but rather, older kinship networks within and outside of the home (e.g., grandparents, uncles, etc.). This is even more vital when considering child outcomes given that research shows that much of the childhood socialization that occurs for younger children also occurs outside of the nuclear family unit (e.g., Updegraff et al., 2018). A research design that only acknowledges the challenges of "overcrowding" and not the culturally-specific assets of multigenerational

home contexts and extended kinship networks will inevitably perpetuate a deficit-oriented approach.

As potential criticisms to our claims are considered, we want to emphasize that we are not suggesting that existing research on family/parenting variables that have deleterious impact on child executive functions (and other developmental outcomes) be ignored. In fact, these findings are important information that has helped us get to this point of awareness. Research cannot stop there. Instead, we are imploring the field to be more thoughtful and comprehensive in weaving resilience (at individual, family, and community levels) into a picture that has become too narrow. This is a noteworthy point because by minimizing parenting to traditional, Eurocentric childrearing, the assessment of the social interactions that lead to executive function development misses potential key socializing agents. To this end, it is important that both the assessment, interpretation and intervention for any executive functions takes a more phenomenological approach; in that, the subjective experiences of the specific populations should be weighted equally, if not more, than the objectivity that research has traditionally emphasized. Furthermore, research designs that infuse bidirectional socializing processes will be paramount due to the awareness that environment shapes behavior and environment adjusts to previous behavior (e.g., Kuczynski & Parkin, 2007; Rodas et al., 2017).

Belief #3: Interventions should target children living in poverty, particularly minoritized children, to promote positive emotional supports to bolster their executive function skills. As previously noted, it is believed that minoritized children living in poverty frequently demonstrate lower performance on current measures of executive functions relative to their White peers (e.g., Nesbitt et al., 2013; Raver et al., 2013). This is notable because executive functions predict a plethora of outcomes, including mathematics and reading skills

(e.g., Byrnes et al., 2019; Nguyen et al., 2019), two topics that are paramount to thriving academically. Although some research suggests that executive function training infrequently demonstrates transfer to executive function tasks (e.g., Blair, 2016), there is some hope that training may be fruitful (e.g., Diamond & Lee, 2011; Traverso et al., 2015). Interventions to promote executive functions in appropriate contexts may help children who struggle with executive functions demonstrate improved skills in these domains and subsequent long-term success on academic achievement measures.

Counternarrative #3: Interventions that seek to improve executive functions for minoritized children should first aim to understand what poor performance on these tasks means in the context of the White/Eurocentric society. Given the importance of executive functions as it relates to academic outcomes, it seems plausible that improving executive functions might lead to improved academic outcomes as well, though the causal role of executive functions in academic outcomes has yet to be determined (e.g., Miller-Cotto & Byrnes, 2019). However, before attempting to design interventions to improve executive functions, it is worth considering whether measures used to assess executive functions can account for the cultural nuances discussed throughout this essay. Consider first that, for minoritized children, most executive functions are assessed within the school context. A culturally responsive perspective would question ways in which these two contexts (i.e., home and traditional educational spaces), or values within these contexts, do not align. Assessment of learning in a context that is fundamentally distinct from one's home would inevitably produce different outcomes. For instance, an incorporation of a cultural asset of Black populations, Afrocentrism, may provide insights. It has been well established that learning is socially situated, and that culture influences our approach to the learning process (Vygotsky, 1978). For Black children, Afrocultural styles of

verve (receptiveness for heightened levels of physical stimulation), communalism (a commitment to social connectedness, including an awareness that social bonds transcend the individual), affect (an emphasis on emotion and the ability to be emotionally expressive), movement (an emphasis on the interconnectedness of movement, dance, rhythm, and percussiveness), and orality (emphasizing oral and aural modes of communication) have been shown to be inconsistent with traditional classroom structures (e.g., bureaucracy, individualism, and competition) and that a value of these Afro-cultural styles sometimes leads to better academic engagement and outcomes (e.g., Boykin & Bailey, 2000; Okagaki, 2001; Rouland et al., 2014). In fact, Carter and colleagues (2008) found that in a sample of Black and White middle school children, the Black students displayed higher level of verve in the classroom and that higher levels of verve were negatively associated with academic performance. By not incorporating minoritized children's funds of knowledge into a typical classroom, (i.e., Black children's cultural socialization to the Afrocentric value of verve or learning through physical encounters and connection with others), this might have an impact on how Black children are performing in schools and even on cognitive measures like executive functions. This begs the question for current executive function trainings and assessment: are we training and assessing minoritized children's skills in service of their own goals, or how to be more like White children?

Conclusion

Executive functions and their development have rightfully received extensive attention in recent years, as it is becoming increasingly clear that executive functions and related self-regulatory skills support the development of academic and social skills. However, much of the research has positioned minoritized children as an outgroup in an attempt to explain gaps in performance on standardized tests between white children and children of color at the expense of

the latter. We argue in agreement with Doebel (2020) that executive functions must be reconceptualized from the current deficit lens to a more assets-based approach that centers the context of the developing child rather than the average child.

To this end, we offer three considerations for the field. We first suggest that measurement of executive function be reexamined, both in terms of the tasks themselves and contexts in which executive function is being measured. Widely used tasks of executive functions have been normed with data from predominantly white children in predominantly white spaces in sessions run by predominantly white researchers. A culturally relevant reconceptualization of executive functions will take into consideration the unique strengths of minoritized children and will celebrate children's ability to persist through real-world distractions and perform complex, planful actions in rapidly changing environments. Second, we suggest reexamining the role of parenting and environmental characteristics in the development of executive functions. Current ideas of executive function development posit that busy, crowded households in which biological parents may play a different role than in a prototypical middle-class white family are deleterious to executive function development. A culturally relevant reconceptualization of executive functions will take into account the benefits of multi-generational family structures which might include non-parental and sibling care, and will extend beyond considerations of the nuclear family to include considerations of systemic inequities facing minoritized children which—at least in the U.S.—have dictated payment structures and work schedules (i.e., economic policy), close-quartered living (i.e., housing policy), and insufficient access to health care (i.e., health policy) and educational opportunity for all children. Finally, we suggest a reconsideration of the many interventions which target the executive function skills of minoritized children. Beyond the fact that most intervention efforts assume a deficit orientation from the start (as articulated by the

presumed need to improve children's skills), they also proscribe an outcome which makes a child perform more like a prototypical white, middle-class student. A culturally responsive reconceptualization of executive functions will develop interventions that allow children to leverage their assets to build executive functions in ways that are meaningful to them rather than a Eurocentric norm.

This critique and these suggestions are not to disparage the important research on executive functions and their development, nor do we mean to undercut the assumption that executive functions play a role in the development of characteristics critical to success in modern society. On the contrary, we recognize the importance of past research for laying the groundwork to allow for a more nuanced consideration of what successful executive functions looks like in different populations rather than assume some unattainable universal. Successful executive functions might look different from one group to the next, and that is why it is time to reconceptualize the role of context in executive functions.

References

- Baddeley, A., Gathercole, S., & Papagno, C. (1998). The phonological loop as a language learning device. *Psychological Review*, *105*(1), 158. <https://doi.org/10.1037/0033-295X.105.1.158>
- Best, J. R., & Miller, P. H. (2010). A developmental perspective on executive function. *Child Development*, *81*(6), 1641–1660. <https://doi.org/10.1111/j.1467-8624.2010.01499.x>
- Best, J. R., Miller, P. H., & Naglieri, J. A. (2011). Relations between executive function and academic achievement from ages 5 to 17 in a large, representative national sample. *Learning and Individual Differences*, *21*(4), 327–336. <https://doi.org/10.1016/j.lindif.2011.01.007>
- Blair, C. (2016). Developmental science and executive function. *Current Directions in Psychological Science*, *25*(1), 3–7. <https://doi.org/10.1177/0963721415622634>
- Blair, C., Granger, D. A., & Razza, R. P. (2005). Cortisol reactivity is positively related to executive function in preschool children attending head start. *Child Development*, *76*(3), 554–567. <https://doi.org/10.1111/j.1467-8624.2005.00863.x>
- Blair, C., Granger, D. A., Willoughby, M., Mills-Koonce, R., Cox, M., Greenberg, M. T., Kivlighan, K. T., & Fortunato, C. K. (2011). Salivary cortisol mediates effects of poverty and parenting on executive functions in early childhood. *Child Development*, *82*(6), 1970–1984. <https://doi.org/10.1111/j.1467-8624.2011.01643.x>
- Blair, C., Raver, C. C., & Berry, D. J. (2014). Two approaches to estimating the effect of parenting on the development of executive function in early childhood. *Developmental Psychology*, *50*(2), 554–565. <https://doi.org/10.1037/a0033647>

- Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development, 78*(2), 647–663. <https://doi.org/10.1111/j.1467-8624.2007.01019.x>
- Boykin, A. W., & Bailey, C. T. (2000). *The role of cultural factors in school relevant cognitive functioning: description of home environmental factors, cultural orientations, and learning preferences*. (No. 43). Center for Research on the Education of Students Placed At Risk. <http://www.csos.jhu.edu>.
- Brod, G., Bunge, S. A., & Shing, Y. L. (2017). Does one year of schooling improve children's cognitive control and alter associated brain activation? *Psychological Science, 28*(7), 967–978. <https://doi.org/10.1177/0956797617699838>
- Bronfenbrenner, U. (1992). Ecological systems theory. In *Six theories of child development: Revised formulations and current issues* (pp. 187–249). Jessica Kingsley Publishers.
- Bull, R., & Lee, K. (2014). Executive functioning and mathematics achievement. *Child Development Perspectives, 8*(1), 36–41. <https://doi.org/10.1111/cdep.12059>
- Byrnes, J. P., Wang, A., & Miller-Cotto, D. (2019). Children as mediators of their own cognitive development in kindergarten. *Cognitive Development, 50*, 80–97. <https://doi.org/10.1016/j.cogdev.2019.03.003>
- Caporaso, J. S., Boseovski, J. J., & Marcovitch, S. (2019). The individual contributions of three executive function components to preschool social competence. *Infant and Child Development, 28*(4), e2132. <https://doi.org/10.1002/icd.2132>
- Carter, N. P., Hawkins, T. N., & Natesan, P. (2008). The relationship between verve and the academic achievement of African American students in reading and mathematics in an urban middle school. *Educational Foundations, 22*, 18.

- Chase-Lansdale, P. L., Brooks-Gunn, J., & Zamsky, E. S. (1994). Young African-American multigenerational families in poverty: Quality of mothering and grandmothering. *Child Development, 65*(2), 373–393. <https://doi.org/10.2307/1131390>
- Cokley, K., & Awad, G. H. (2013). In defense of quantitative methods: Using the “master’s tools” to promote social justice. *Journal for Social Action in Counseling & Psychology, 5*(2), 26–41. <https://doi.org/10.33043/JSACP.5.2.26-41>
- Conway, A., Waldfogel, J., & Wang, Y. (2019). Disparities in kindergarteners’ executive functions at kindergarten entry: Relations with parenting and child care. *Early Childhood Research Quarterly, 48*, 267–283. <https://doi.org/10.1016/j.ecresq.2019.03.009>
- Diamond, A. (2013). Executive functions. *Annual Review of Psychology, 64*(1), 135–168. <https://doi.org/10.1146/annurev-psych-113011-143750>
- Diamond, A., & Lee, K. (2011). Interventions shown to aid executive function development in children 4–12 years old. *Science (New York, N.Y.), 333*(6045), 959–964. <https://doi.org/10.1126/science.1204529>
- Distefano, R., Galinsky, E., McClelland, M. M., Zelazo, P. D., & Carlson, S. M. (2018). Autonomy-supportive parenting and associations with child and parent executive function. *Journal of Applied Developmental Psychology, 58*, 77–85. <https://doi.org/10.1016/j.appdev.2018.04.007>
- Doebel, S. (2020). Rethinking executive function and its development. *Perspectives on Psychological Science, 15*(4), 942–956. <https://doi.org/10.1177/1745691620904771>
- Dowsett, S. M., & Livesey, D. J. (2000). The development of inhibitory control in preschool children: Effects of “executive skills” training. *Developmental Psychobiology, 36*(2), 161–174. <https://doi.org/10.1002/>

- Ellis, B. J., Abrams, L. S., Masten, A. S., Sternberg, R. J., Tottenham, N., & Frankenhuis, W. E. (2020). Hidden talents in harsh environments. *Development and Psychopathology*, 1–19. <https://doi.org/10.1017/S0954579420000887>
- Ellwood-Lowe, M. E., Humphreys, K. L., Ordaz, S. J., Camacho, M. C., Sacchet, M. D., & Gotlib, I. H. (2018). Time-varying effects of income on hippocampal volume trajectories in adolescent girls. *Developmental Cognitive Neuroscience*, 30, 41–50. <https://doi.org/10.1016/j.dcn.2017.12.005>
- Ellwood-Lowe, M. E., Whitfield-Gabrieli, S., & Bunge, S. A. (2020). What is an adaptive pattern of brain network coupling for a child? It depends on their environment. *BioRxiv*. <https://doi.org/10.1101/2020.05.29.124297>
- Engelhardt, L. E., Harden, K. P., Tucker-Drob, E. M., & Church, J. A. (2019). The neural architecture of executive functions is established by middle childhood. *NeuroImage*, 185, 479–489. <https://doi.org/10.1016/j.neuroimage.2018.10.024>
- Finch, J. E. (2019). Do schools promote executive functions? Differential working memory growth across school-year and summer months. *AERA Open*, 5(2), 2332858419848443. <https://doi.org/10.1177/2332858419848443>
- Fitzpatrick, C., McKinnon, R. D., Blair, C. B., & Willoughby, M. T. (2014). Do preschool executive function skills explain the school readiness gap between advantaged and disadvantaged children? *Learning and Instruction*, 30, 25–31. <https://doi.org/10.1016/j.learninstruc.2013.11.003>
- García Coll, C., Crnic, K., Lamberty, G., Wasik, B. H., Jenkins, R., García, H. V., & McAdoo, H. P. (1996). An integrative model for the study of developmental competencies in

- minority children. *Child Development*, 67(5), 1891–1914. <https://doi.org/10.1111/j.1467-8624.1996.tb01834.x>
- Gomez-Lavin, J. (2021). Working memory is not a natural kind and cannot explain central cognition. *Review of Philosophy and Psychology*, 12, 199–225. <https://doi.org/10.1007/s13164-020-00507-4>
- Hackman, D. A., Gallop, R., Evans, G. W., & Farah, M. J. (2015). Socioeconomic status and executive function: Developmental trajectories and mediation. *Developmental Science*, 18(5), 686–702. <https://doi.org/10.1111/desc.12246>
- Hair, N. L., Hanson, J. L., Wolfe, B. L., & Pollak, S. D. (2015). Association of child poverty, brain development, and academic achievement. *JAMA Pediatrics*, 169(9), 822–829. <https://doi.org/10.1001/jamapediatrics.2015.1475>
- Hartung, J., Engelhardt, L. E., Thibodeaux, M. L., Harden, K. P., & Tucker-Drob, E. M. (2020). Developmental transformations in the structure of executive functions. *Journal of Experimental Child Psychology*, 189, 104681. <https://doi.org/10.1016/j.jecp.2019.104681>
- Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences*, 33(2–3), 61–83. <https://doi.org/10.1017/S0140525X0999152X>
- Heyes, C. (2018). Cognitive gadgets: The cultural evolution of thinking. In *Cognitive Gadgets*. Harvard University Press. <https://doi.org/10.4159/9780674985155>
- Howard, S. J., Cook, C. J., Everts, L., Melhuish, E., Scerif, G., Norris, S., Twine, R., Kahn, K., & Draper, C. E. (2020). Challenging socioeconomic status: A cross-cultural comparison of early executive function. *Developmental Science*, 23(1), e12854. <https://doi.org/10.1111/desc.12854>

- Hughes, C. (2011). Changes and challenges in 20 years of research into the development of executive functions. *Infant and Child Development, 20*(3), 251–271.
<https://doi.org/10.1002/icd.736>
- Jahromi, L. B., Guimond, A. B., Umaña-Taylor, A. J., Updegraff, K. A., & Toomey, R. B. (2014). Family context, Mexican-origin adolescent mothers' parenting knowledge, and children's subsequent developmental outcomes. *Child Development, 85*(2), 593–609.
<https://doi.org/10.1111/cdev.12160>
- Kuczynski, L., & Parkin, C. M. (2007). Agency and bidirectionality in socialization: Interactions, transactions, and relational dialectics. In J. E. Grusec & P. D. Hastings (Eds.), *Handbook of socialization: Theory and research* (pp. 259–283). The Guilford Press.
- Lehto, J. E., Juujärvi, P., Kooistra, L., & Pulkkinen, L. (2003). Dimensions of executive functioning: Evidence from children. *British Journal of Developmental Psychology, 21*(1), 59–80. <https://doi.org/10.1348/026151003321164627>
- Lewis, C., Koyasu, M., Oh, S., Ogawa, A., Short, B., & Huang, Z. (2009). Culture, executive function, and social understanding. *New Directions for Child and Adolescent Development, 2009*(123), 69–85. <https://doi.org/10.1002/cd.236>
- Matheny, A. P., Wachs, T. D., Ludwig, J. L., & Phillips, K. (1995). Bringing order out of chaos: Psychometric characteristics of the confusion, hubbub, and order scale. *Journal of Applied Developmental Psychology, 16*(3), 429–444. [https://doi.org/10.1016/0193-3973\(95\)90028-4](https://doi.org/10.1016/0193-3973(95)90028-4)
- McClelland, M. M., Acock, A. C., Piccinin, A., Rhea, S. A., & Stallings, M. C. (2013). Relations between preschool attention span-persistence and age 25 educational outcomes. *Early*

Childhood Research Quarterly, 28(2), 314–324.

<https://doi.org/10.1016/j.ecresq.2012.07.008>

Miller-Cotto, D., & Byrnes, J. P. (2019). What's the best way to characterize the relationship between working memory and achievement?: An initial examination of competing theories. *Journal of Educational Psychology*, 112(5), 1074.

<https://doi.org/10.1037/edu0000395>

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex “frontal lobe” tasks: A latent variable analysis. *Cognitive Psychology*, 41(1), 49–100.

<https://doi.org/10.1006/cogp.1999.0734>

Nesbitt, K. T., Baker-Ward, L., & Willoughby, M. T. (2013). Executive function mediates socio-economic and racial differences in early academic achievement. *Early Childhood Research Quarterly*, 28(4), 774–783. <https://doi.org/10.1016/j.ecresq.2013.07.005>

Nguyen, T., Duncan, R. J., & Bailey, D. H. (2019). Theoretical and methodological implications of associations between executive function and mathematics in early childhood.

Contemporary Educational Psychology, 58, 276–287.

<https://doi.org/10.1016/j.cedpsych.2019.04.002>

Okagaki, L. (2001). Triarchic model of minority children's school achievement. *Educational Psychologist*, 36(1), 9–20. https://doi.org/10.1207/S15326985EP3601_2

Olson, E., & Luciana, M. M. (2008). The development of prefrontal cortex functions in adolescence: Theoretical models and a possible dissociation of dorsal versus ventral subregions. In C. A. Nelson & M. M. Luciana (Eds.), *The Handbook of Developmental Cognitive Neuroscience*. MIT Press.

- Pearson, J. L., Hunter, A. G., Ensminger, M. E., & Kellam, S. G. (1990). Black grandmothers in multigenerational households: Diversity in family structure and parenting involvement in the Woodlawn community. *Child Development, 61*(2), 434–442.
<https://doi.org/10.2307/1131105>
- Peng, P., Wang, C., & Namkung, J. (2018). Understanding the cognition related to mathematics difficulties: A meta-analysis on the cognitive deficit profiles and the bottleneck theory. *Review of Educational Research, 88*(3), 434–476.
<https://doi.org/10.3102/0034654317753350>
- Perez-Brena, N. J., Rivas-Drake, D., Toomey, R. B., & Umaña-Taylor, A. J. (2018). Contributions of the integrative model for the study of developmental competencies in minority children: What have we learned about adaptive culture? *American Psychologist, 73*(6), 713. <https://doi.org/10.1037/amp0000292>
- Raver, C. C., Blair, C., & Willoughby, M. (2013). Poverty as a predictor of 4-year-olds' executive function: New perspectives on models of differential susceptibility. *Developmental Psychology, 49*(2), 292. <https://doi.org/10.1037/a0028343>
- Rodas, N. V., Chavira, D. A., & Baker, B. L. (2017). Emotion socialization and internalizing behavior problems in diverse youth: A bidirectional relationship across childhood. *Research in Developmental Disabilities, 62*, 15-25.
<https://doi.org/10.1016/j.ridd.2017.01.010>.
- Rouland, K., Matthews, J. S., Byrd, C. M., Meyer, R. M. L., & Rowley, S. J. (2014). Culture clash: Interactions between Afrocultural and mainstream cultural styles in classrooms serving African American students. *Interdisciplinary Journal of Teaching and Learning, 4* (3), 186-202.

- Schmitt, S. A., Geldhof, G. J., Purpura, D. J., Duncan, R., & McClelland, M. M. (2017). Examining the relations between executive function, math, and literacy during the transition to kindergarten: A multi-analytic approach. *Journal of Educational Psychology, 109*(8), 1120–1140. <https://doi.org/10.1037/edu0000193>
- Sosic-Vasic, Z., Kröner, J., Schneider, S., Vasic, N., Spitzer, M., & Streb, J. (2017). The association between parenting behavior and executive functioning in children and young adolescents. *Frontiers in Psychology, 8*, 472. <https://doi.org/10.3389/fpsyg.2017.00472>
- Spencer, M. B., Dupree, D., & Hartmann, T. (1997). A phenomenological variant of ecological systems theory (PVEST): A self-organization perspective in context. *Development and Psychopathology, 9*(4), 817–833. <https://doi.org/10.1017/S0954579497001454>
- St. John, A. M., & Tarullo, A. R. (2020). Neighbourhood chaos moderates the association of socioeconomic status and child executive functioning. *Infant and Child Development, 29*(1), e2153. <https://doi.org/10.1002/icd.2153>
- Sternberg, R. J. (2004). Culture and intelligence. *American Psychologist, 59*(5), 325. <https://doi.org/10.1037/0003-066X.59.5.325>
- Swanson, H. L., & Alloway, T. P. (2012). Working memory, learning, and academic achievement. In *Theories, Constructs, and Critical Issues* (Vol. 1, pp. 327–366). American Psychological Association.
- Traverso, L., Viterbori, P., & Usai, M. C. (2015). Improving executive function in childhood: Evaluation of a training intervention for 5-year-old children. *Frontiers in Psychology, 6*, 525. <https://doi.org/10.3389/fpsyg.2015.00525>
- Updegraff, K. A., Umaña-Taylor, A. J., Zeiders, K. H., Bravo, D. Y., & Jahromi, L. B. (2018). Familism values across the transition to adolescent motherhood: Links to family

- functioning and Mexican-origin adolescent mothers' adjustment. *Development and Psychopathology*, 30(5), 1589–1609. <https://doi.org/10.1017/S0954579418000986>
- Vernon-Feagans, L., Willoughby, M., & Garrett-Peters, P. (2016). Predictors of behavioral regulation in kindergarten: Household chaos, parenting, and early executive functions. *Developmental Psychology*, 52(3), 430. <https://doi.org/10.1037/dev0000087>
- Vygotsky, L. (1978). Interaction between learning and development. In M. Gauvain & M. Cole (Eds.), *Readings on the Development of Children* (pp. 34–40). Scientific American Books.
- Wiebe, S. A., Sheffield, T., Nelson, J. M., Clark, C. A. C., Chevalier, N., & Espy, K. A. (2011). The structure of executive function in 3-year-olds. *Journal of Experimental Child Psychology*, 108(3), 436–452. <https://doi.org/10.1016/j.jecp.2010.08.008>
- Willoughby, M. T., Kupersmidt, J. B., & Voegler-Lee, M. E. (2012). Is preschool executive function causally related to academic achievement? *Child Neuropsychology*, 18(1), 79–91. <https://doi.org/10.1080/09297049.2011.578572>
- Willoughby, M. T., Wylie, A. C., & Blair, C. B. (2019a). Using repeated-measures data to make stronger tests of the association between executive function skills and attention deficit/hyperactivity disorder symptomatology in early childhood. *Journal of Abnormal Child Psychology*, 47(11), 1759–1770. <https://doi.org/10.1007/s10802-019-00559-w>
- Willoughby, M. T., Wylie, A. C., & Little, M. H. (2019b). Testing longitudinal associations between executive function and academic achievement. *Developmental Psychology*, 55(4), 767–779. <https://doi.org/10.1037/dev0000664>