Journal of Educational and Developmental Psychology; Vol. 4, No. 2; 2014
ISSN 1927-0526 E-ISSN 1927-0534
Published by Canadian Center of Science and Education

Development of Executive Functions in 5- to 12- Years old Iranian Children with and without ADHD

Ahmad Abedi[1], Sara Aghababaei[1], Adeleh Sharbaf Zadeh[2] & Nasrin Zamani[3]

[1]Department of children with special needs, University of Isfahan, Isfahan, Iran

[2] Departmentof psychology, Islamic Azad University, Oloom Tahghighat Branch, Isfahan, Iran

[3] Department of clinical psychology, University of Tehran, Tehran, Iran

Correspondence: Sara Aghababaei, Department of children with special needs, University of Isfahan, Isfahan, Iran. E-mail: Sara.aghababaei@ymail.com

Received: August 4, 2014 Accepted: August 27, 2014 Online Published: October 15, 2014

doi:10.5539/jedp.v4n2p134 URL: http://dx.doi.org/10.5539/jedp.v4n2p134

Abstract

The aim of this research was to investigate the development of executive functions in children with and without ADHD of preschools and primary schools. The population included the male and female children with and without ADHD that were 5 to 12 years old in Iran. Therefore among each age group, 60 subjects (15 girls without ADHD, 15 boys without ADHD, 15 girls with ADHD and 15 boys with ADHD) were selected. Children without ADHD were selected by multistage cluster random sampling and ADHD children were selected by clinicians and Conner's parental questionnaire. The instruments that have been used are Conner's parental questionnaire and NEPSY tower test. The results showed a significant differences in executive functions scores between children with and without ADHD at different age groups, But gender differences was not significant. The results reveal that the development of executive functions in children with and without ADHD is rising, but this development has a significant difference in children with and without ADHD which is the noticeable lower performance of ADHD children. Nevertheless, there is no significant difference between male and female groups with and without ADHD.

Keywords: development, executive functions, children with ADHD, children without ADHD

1. Introduction

Across development, children become increasingly more able to control their thoughts and actions (for a review see: Diamond, 2002). This change has been associated with the development of executive functions, which refers to a broad set of cognitive control processes that enable individuals to manage and direct their attention, thinking and actions to meet adaptive goals (Best & Miller, 2010; Blair & Raver, 2012; Diamond & Lee, 2011).

Today executive functions are described as multidimensional construct consisting of several sub-functions. Executive functions, as studied in the cognitive development literature, has come to refer to specific interrelated information processing abilities that enable the resolution of conflicting information; namely, working memory which is defined as the holding in mind and updating of information while performing some operation on it; inhibitory control, defined as the inhibition of prepotent or automatized responding when engaged in task completion; and mental flexibility, the ability to shift attentional or cognitive set among distinct but related dimensions or aspects ofa given task (Davidson, Arnso, Anderson, & Diamond, 2006; Diamond, Kirkham, & Arnso, 2002; Garon , Bryson, & Smith, 2008; Zelazo & Muller, 2002). Neuropsychologically, executive functions have been linked to the prefrontal cortex of the brain and supporting subcortical loops (Stuss & Alexander, 2000).

Regarding development, it was historically thought that executive functions only emerged in late adolescence to adulthood, and therefore played no significant role in development during infancy and early childhood brain development (Anderson, 2002; welsh, Pennington & Groisser, 1991). Specifically, executive functions appears to emerge in three distinct growth periods, birth to 2 years, 6 to 9 years, and adolescence to early 20s (Anderson, 1998, Anderson, Levin & Jacobs, 2002, romine & Reynolds, 2005). During these growth periods executive

functions develop rapidly and are particularly vulnerable to disruption (Ewing-Cobbss, Prasad, landry, Kramer, & Deleon, 2004).

The impairment of executive function is evidenced by poor attention, distractibility, reduced impulse control, difficulties with planning or organization, a reduction in goal oriented behaviors, reduced insight, a tendency to blame others, or perseveration on thoughts or actions (Anderson, 2002; Bradshow, 2001; Busch, McBride, Curtiss & Vanderploeg, 2005). Furthermore, problems with executive functioning development may impact several childhood disorders, such as attention deficit hyperactivity disorder (ADHD), learning disabilities, autism spectrum disorders (Semrud-Clikeman, Goldenring Fine, & Bledsoe, 2014).

Attention Deficit Hyperactivity Disorder (ADHD) is defined as a developmental disorder characterized by difficulties with sustained attention, distractibility, hyperactivity, and impulse control (Barkley, 1998). A review of eighteen studies by Pennington and Ozonoff (1996) concluded that executive functions deficits were consistently associated with ADHD, in both community and referred samples of children and adolescents with this disorder. A meta-analysis of 83 studies of executive functions in ADHD (Willcutt et al., 2005) found that children and adolescents with ADHD exhibited significant deficits compared to those without ADHD in neuropsychological measures of executive functions (inhibitory control, vigilance, planning, verbal and spatial working memory, and cognitive flexibility), with effect sizes ranging from 0.46 to 0.69 (Soriano-Ferrer, Félix-Mateo, & Begeny, 2014).

Neuropsychological deficits, particularly those related to executive function, are common in individuals with ADHD (Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005). Seidman (2001) and Doyle and colleagues (2001) used neuropsychological measures of executive functions to assess impairments of executive function in children and adolescents with ADHD. They found that about 30% of children and adolescents in their ADHD sample were significantly impaired on traditional neuropsychological tests of executive functions. They concluded that psychometrically defined impairments of executive functions should be considered a comorbid problem that is present in about one third of individuals with ADHD, a comorbidity that compounds the already compromised school functioning of children and adolescents with ADHD (Brown, Reichel, & Quinlan, 2011).

Considering the fact that ADHD costs millions a year in treatment and has lasting effects into adulthood, it is imperative that it should be studied more thoroughly (Sarkis, Sarkis, Marshall, & Archer, 2005). Although ADHD is one of the most commonly diagnosed mental disorders (Conners & Jett, 1999). If a relationship can be determined between ADHD and the executive functions, new interventions may be developed, and more effective medication can be prescribed (Sarkis et al, 2005).

With regard to the results of these studies, the aim of the present study was to obtain more insight into the developmental timetable of executive functions in preschool and school-age without ADHD and ADHD children and to compare development of these functions in Iranian children as well.

2. Method

2.1 Participants

The samples consisted of 420 Iranian children (210 children without ADHD, 210 children with ADHD, 50% boys and 50% girls) aged 5 years to 12 years. Participants were divided into seven groups (5-6 years, 6-7 years, 7-8years, 8-9 years, 9-10 years, 10-11 years, and 11-12 years) and each age group included30 children without ADHD and 30 ADHD children, also multistage random cluster sampling method was used for selecting children. In order to select subjects, from 6 educational areas, 3 areas were randomly selected. Subsequently from these 3 areas 20 preschools and primary schools were randomly selected. Finally from these 20 preschools and schools, 210 children with ADHD and 210 children without ADHD were randomly selected.

Also, the following criteria were considered for samples in order to enter the research:

1) No intellectual disability exist

2) Having no specific and clear disorder except ADHD (for ADHD samples).

3) Parents' written consent for their children's participation

2.2 Instruments

2.2.1 NEPSY Neuropsychology Test (Tower subtest)

This subtest is designed to assess the executive functions of planning, monitoring,self-regulation, and problem solving. This multidimensional problem-solving subtest is an adaptation of Shallice's (1982, 1988) Tower of

London test (TOL). The child moves three colored balls to target positions on three pegs in a prescribed number of moves. There is a time limit (30-60 sec) and also rules to which the child must adhere: (a) Only one ball can be moved at a time; (b) a ball cannot be placed on the table or in the lap or held in the hand while moving another ball, and (c) only a certain number of balls can be put on each of the different pegs. The difficulty of the 20 tasks varies according to the complexity and the number of moves (from 1 to 7). The score is the number of correctly achieved target positions (maximum 20 points) (Klenberg, Korkman & Lahti-Nuuttila, 2001).

2.2.2 Conner's Rating Scale

In this research, Conner's rating scale was filled by parents in order to rate their children's ADHD symptoms. This scale was designed by Keith Conner (2001) and consists of 27 items. The scale is designed to measure the intensity of ADHD symptoms. Conner's scale is one of the most well-known instruments for assessing of ADHD which is used in various researches.

2.3 Research Method

For selecting ADHD children, parents of children were asked to fill Conner's parental questionnaire (2001). Then, 210childrenwho had been identified as children with ADHD by parents and professional and 210children without ADHD were selected. All children were examined individually in a quiet room at their respective school.

Squirrel item was used for children aged 5 to 6 years old and bullet item was used for children aged 7 to 12 years old.

3. Results

Table 1. Mean and standard deviation scores of executive functions in girls and boys aged 5-12 years with and without ADHD

Age group	*5-6*		*6-7*		*7-8*		*8-9*		*9-10*		*10-11*		*11-12*	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Sex														
Girls without ADHD	4.9	2.28	5.4	2.13	11.5	2.46	10.9	2.28	14.4	2.47	13.6	2.79	16.5	2.44
Boys without ADHD	5.2	2.39	5.7	1.66	9.93	4.19	12.6	3.57	14.7	2.12	13.9	3.01	15.8	3.52
ADHD girls	3	1.3	2.6	1.54	4.13	0.91	3.80	0.77	6	1.81	6.29	1.63	9.2	2.17
ADHD boys	2.6	0.89	2.2	1.32	4.6	1.17	4.93	1.48	7.66	2.12	12.6	20.6	10.2	2.43
Children without ADHD (general)	5	2.11	5.5	2.31	10.7	3.97	11.7	4.45	14.5	4.46	13.7	10.6	16.1	4.21
ADHD children (general)	2.8	1.11	2.4	1.42	4.4	1.06	4.36	1.29	6.83	2.11	9.76	14.6	9.73	2.33

The means and standard deviations of executive functions for the four groups are presented in Table 1.As itis shown, development of executive functions is ascending.

To assess the impact of age and gender on executive function, a two-way analysis of variance was performed.

Table 2. Summary of Analysis of Variance in children with and without ADHD

Age	*sources*	*Sum of Squares*	*df*	*Mean Square*	*F*	*p*
	A	74.817	1	74.817	22.207	0.001
	B	0.017	1	0.017	0.005	0.9
5-6	A×B	1.350	1	1.350	0.104	0.5
	Error	188.667	56	3.369		
	General	1201	60			
	A	153.600	1	153.600	53.537	0.001
	B	0.067	1	0.067	0.023	0.8
6-7	A×B	1.667	1	1.667	0.581	0.4
	Error	160.667	56	2.869		
	General	1275	60			
	A	558.150	1	558.150	86.122	0.001
	B	1.350	1	1.350	0.208	0.6
7-8	A×B	10.417	1	10.417	1.607	0.2
	Error	362.933	56	6.481		
	General	4243	60			
	A	828.817	1	828.817	149.915	0.001
	B	30.817	1	30.817	5.574	0.2
8-9	A×B	1.350	1	1.350	0.244	0.6
	Error	309.600	56	5.529		
	General	5091	60			
	A	897.067	1	897.067	194.813	0.001
	B	15	1	15	3.257	0.07
9-10	A×B	6.667	1	6.667	1.448	0.2
	Error	257.867	56	4.605		
	General	8046	60			
	A	240	1	240	2.149	0.1
	B	135	1	135	1.209	0.2
10-11	A×B	106.667	1	106.667	0.955	0.3
	Error	6255.067	56	111.698		
	General	15044	60			
	A	628.267	1	628.267	86.349	0.001
	B	0.600	1	0.600	0.083	0.7

11-12	A×B	11.267	1	11.267	1.551	0.2
	Error	406.800	56	7.264		
	General	11134	60			

A=group B=sex A×B=group×sex

As it is presented in Table2, with the exception of10-11years old group; there is a significant difference between the means cores of groups with and without ADHD among other age groups. There is no gender effect between two groups with and without ADHD, also there is not significant interaction between group and gender.

Table 3. The results of scheffe post hoc test in executive functions of children without ADHD

Group (I)	*Group (J)*	*Mean difference (I–J)*	*Sig.*
	6-7	-0.53	0.9
	7-8	-5.43	0.000
5-6	8-9	-6.73	0.000
	9-10	-9.5	0.000
	10-11	-8.7	0.000
	11-12	-11.13	0.000
	5-6	0.53	0.9
	7-8	-4.9	0.000
6-7	8-9	-6.2	0.000
	9-10	-8.96	0.000
	10-11	-8.16	0.000
	11-12	-10.6	0.000
	5-6	5.43	0.000
	6-7	4.9	0.000
7-8	8-9	-1.3	0.8
	9-10	-4.06	0.000
	10-11	-3.26	0.003
	11-12	-5.7	0.000
	5-6	6.73	0.000
	6-7	6.2	0.000
8-9	7-8	1.3	0.7
	9-10	-2.76	0.02
	10-11	-1.96	0.2
	11-12	-4.4	0.000
	5-6	9.5	0.000
	6-7	8.96	0.000

9-10	7-8	4.06	0.000
	8-9	2.76	0.02
	10-11	0.8	0.9
	11-12	-1.63	0.5
	5-6	8.7	0.000
	6-7	8.16	0.000
10-11	7-8	3.26	0.003
	8-9	1.96	0.2
	9-10	-0.8	0.9
	11-12	-2.43	0.07
	5-6	11.13	0.000
	6-7	10.6	0.000
11-12	7-8	5.7	0.000
	8-9	4.4	0.000
	9-10	1.63	0.5
	10-11	2.4	0.07

Table 4. The results of scheffe post hoc test in executive functions of ADHD children

Group (I)	*Group (J)*	*Mean difference (I–J)*	*Sig.*
	6-7	0.43	1
	7-8	-1.5	0.9
5-6	8-9	-1.53	0.9
	9-10	-4	0.2
	10-11	-6.93	0.002
	11-12	-6.9	0.002
	5-6	-0.43	1
	7-8	-2	0.9
6-7	8-9	-1.96	0.9
	9-10	-4.43	0.1
	10-11	-7.36	0.001
	11-12	-7.3	0.001
	5-6	1.56	0.9
	6-7	2	0.9
7-8	8-9	0.03	1
	9-10	-2.43	0.8
	10-11	-5.36	0.04

	11-12	-5.3	0.04
	5-6	1.53	0.9
	6-7	1.96	0.9
8-9	7-8	-0.03	1
	9-10	-2.46	0.8
	10-11	-5.4	0.04
	11-12	-5.3	0.04
	5-6	4	0.2
	6-7	4.43	0.1
9-10	7-8	2.43	0.8
	8-9	2.46	0.8
	10-11	-2.93	0.6
	11-12	-2.9	0.6
	5-6	6.93	0.002
	6-7	7.36	0.001
10-11	7-8	5.36	0.04
	8-9	5.4	0.04
	9-10	2.93	0.6
	11-12	0.03	1
	5-6	6.9	0.002
	6-7	7.3	0.001
11-12	7-8	5.3	0.04
	8-9	5.36	0.4
	9-10	2.9	0.6
	10-11	-0.03	1

Tables 3 and 4 shows results of the Scheffe test between the means of executive functions of groups with and without ADHD.

4. Discussion

This study investigated the development of executive functions among preschool and primary schools children with and without ADHD aged 5 to 12 years in Iran.

The findings of research show that development of executive functions is rising in children with and without ADHD. There are also significant differences between executive functions means in two groups (with and without ADHD). Thus, executive functions scores in ADHD children are significantly lower than children without ADHD. Interaction of gender and group is not significant and there are no significant differences between executive functions means in girls and boys in both groups.

Findings of researches Penington & Ozonof (1996), Barkley (1997), and Tehranidoostet al (2003) and … indicate that preschool and school children with ADHD have lower performance in executive functions in comparison with children without ADHD.

Levin et al (1991) found significant increases in sensitivity to feedback, problem solving, concept formation, and impulse control between children without ADHD 7-8 years old and 9-12 years old.

The concept of executive functions usually refers to cognitive abilities responsible for controlling and coordinating performance in complex cognitive tasks. The subfunctions or components of goal selection, working memory, planning, inhibition of irrelevant impulses and responses, monitoring and regulation of activity and evaluation ofthe results of activity are most often included in executive functions (Baddeley, 1990, 1996; Lezak, 1993; Stuss & Benson, 1986; Vilkki, 1995).

The empirical evidence available to evaluate Barkley's theoretical model, suggesting inhibition as being the fundamental core in effective executive functioning. Children with ADHD are assumed to be developmentally delayed with regard to inhibitory function (Barkley, 1997). The model of Barkley (1997) would predict that, at each age level studied children with ADHD would perform like younger children without ADHD. In congruence with Barkley's model, Pennington and Ozonoff (1996) concluded that children with ADHD demonstrate deficits in motor inhibition. This conclusion was based on a literature review of five executive function domains (inhibition, planning, set-shifting, working memory, and fluency) in different developmental disorders. Also, according to Douglas (2008) deficient self-regulation is responsible for impaired performance of children with ADHD on cognitive, information-processing and neuropsychological tasks. Regulatory deficit models offer an alternative conceptual framework, integrating cognitive and motivational processes across levels of information processing to understand behavioral regulation. Since self-monitoring and adaptive control processes work together to produce goal-directed behavior, deficits in either or both of these regulatory processes may result in maladaptive or suboptimal behavior. Given heterogeneity of ADHD and the lack of a common core neuropsychological deficit among children with this disorder, regulatory models provide a plausible alternative to core-cognitive/motivational-deficit models of ADHD (Douglas, 2008).

Douglas' model (2008) suggests that complex effortful control processes (or adaptive) contribute to efficient attention and inhibition. Effortful control is conceptually related to self-regulation and executive functions (Martel & Nigg, 2006; Rothbart, Ellis, Rueda, & Posner, 2003) and is thought to modulate other cognitive processes implicated in ADHD, including working memory, self-monitoring, and planning (Douglas, 2008).

Executive functions were hypothesized to predict achievement, consistent with evidence linking executive functions to school achievement and readiness (Blair & Raver, 2012; Raver et al., 2011; Willoughby et al., 2011). There is also a considerable evidence linking executive functions to peer acceptance and rejection (Hughes & Ensor, 2011; Riggs, Jahromi, Razza, Dillworth-Bart, & Mueller, 2006; Willoughby et al., 2010). There is less evidence linking executive functions directly to prosocial behavior; however, the thoughtful and empathic behaviors that are central to ratings of prosocial behavior in school-age children have theoretical ties to theory-of-mind abilities in children(understanding the perspectives of other people), which have strong empirical, as well as conceptual, links to executive functions (e.g., Riggset al., 2006). In contrast, executive functions task performance has been directly linked by theory and empirical findings to symptoms of in attention and impulsivity (Hughes & Ensor, 2011; Willoughby et al., 2010). Thus, we hypothesized that executive functions would be inversely predictive of these symptoms reported by teachers. Children who had better executive functions, did better in kindergarten or first grade with respect to school adjustment criteria, with better academic achievement, peer acceptance and prosocial behavior and fewer problems of impulsivity, inattention, aggression, or noncompliance (Matson et al, 2012).

References

Anderson, P. (2002). Assessment and development of executive function (EF) during childhood. *Child Neuropsychology*, *8*, 71-82. http://dx.doi.org/10.1076/chin.8.2.71.8724

Anderson, V. (2002). Executive functions in children: Introduction. *Child Neuropsychology*, *8*(2), 69-70. http://dx.doi.org/10.1076/chin.8.2.69.8725

Anderson, V. (1998). Assessing executive functions in children: Biological, psychological, and developmental considerations. *Neuropsychological rehabilitation*, *8*, 319-349. http://dx.doi.org/10.1080/713755568

Anderson, V., Levin, H. S., & Jacobs. (2002). Executive functioning after frontal lobe injury: A developmental perspective. In D. T. Stuss, & R. T. Knight (Eds.), *Principles of Frontal Lobe Function* (pp. 504-527). New York: Oxford University Press.

Baddeley, A. (1990). *Human memory: Theory and practice*. Hove, England: Lawrence Erlbaum Associates, Inc.

Baddeley, A. (1996). Exploring the central executive.*The Quarterly Journal of Experimental Psychology*, *49*(1), 5-28. http://dx.doi.org/10.1080/713755608

Barkley, R. A. (1998). *Attention-deficit hyperactivity disorder: Ahandbook for diagnosis and treatment* (2nd ed.). New York: Guilford.

Barkley, R. A. (1997). *ADHD and the nature of self-control*. New York: Guilford.

Best, J. R., & Miller, P. H. (2010).A developmental perspective onexecutive function. *Child Development*, *81*(6), 1641-1660. http://dx.doi.org/10.1111/j.1467-8624.2010.01499.x

Blair, C., & Raver, C. C. (2012). Individual development and evolution: Experiential canalization of self-regulation. *Developmental Psychology*, *48*, 647-657. http://dx.doi.org/10.1037/a0026472

Bradshow, J. L. (2001). *Developmental disorders of the frontostriatal system: Neuropsychological, Neuropsychiatric, and evolutionary perspectives*. East Sussex: Psychology Press, LTD.

Brown, T. E., Reichel, P. C., & Quinlan, D. M. (2011). Executive function impairments in high IQ children and adolescents with ADHD. *Open Journal of Psychiatry*, *1*, 56-65. http://dx.doi.org/10.4236/ojpsych.2011.12009

Busch, R. M., McBride, A., Curtiss, G., Vanderploeg, D. (2005). The components of executive functioning in traumatic brain injury.*Journal of clinical and experimental neuropsychology*, *27*, 1022-1032. http://dx.doi.org/10.1080/13803390490919263

Conner, C. K. (2001).*Conner's rating scale revised technical manual*. New York: Multi health systems Incorporated.

Conners, C. K., & Jett, J. L. (1999). *Attention deficit hyperactivity disorder (in adults and children): The latest assessment and treatmentstrategies*. Kansas City, MO: Compact Clinical.

Davidson, M. C., Amso, D., Anderson, L. C., & Diamond, A. (2006). Developmentof cognitive control and executive functions from 4–13 years: Evidencefrom manipulations of memory, inhibition, and task switching. *Neuropsychologia*, *44*, 2037-2078. http://dx.doi.org/10.1016/j.neuropsychologia.2006.02.006

Diamond, A. (2002). Normal development of prefrontal cortex from birth to young adulthood: Cognitive functions, anatomy, and biochemistry. In D. T. Stuss, & R. T. Knight (Eds.), *Principles of frontal lobe function*. London: Oxford University Press. http://dx.doi.org/10.1093/acprof:oso/9780195134971.003.0029

Diamond, A., Kirkham, N., & Amso, D. (2002). Conditions under whichyoung children can hold two rules in mind and inhibit a prepotent response. *Developmental Psychology*, *38*(3), 352-362. http://dx.doi.org/10.1037/0012-1649.38.3.352

Diamond, A., & Lee, K. (2011). Interventions shown to aid executivefunction development in children 4 to 12 years old. *Science*, *333*, 959-964. http://dx.doi.org/10.1126/science.1204529

Douglas V. I. (2008).*"Core Deficits" and Contingency Management in Attention Deficit Hyperactivity Disorder*. Buffalo, NY: University at Buffalo Center for Children and Families Speaker Series.

Ewing-Cobbs, L., Prasad, M. R., Landry, S. H., Kramer, L., & Deleon, R. (2004). Executive functions following traumatic brain injury in children: A preliminary analysis. *Developmental Neuropsychology*, *26*(1), 487-512. http://dx.doi.org/10.1207/s15326942dn2601_7

Garon, N., Bryson, S. E., & Smith, I. M. (2008). Executive function inpreschoolers: A review using an integrative framework. *PsychologicalBulletin*, *134*, 31-60. http://dx.doi.org/10.1037/0033-2909.134.1.31

Hughes, C., & Ensor, R. (2011). Individual differences in growth in executive function across the transition to school predict externalizing and internalizing behaviors and self-perceived academic success at 6 years of age. *Journal of Experimental Child Psychology*, *108*(3), 663-676. http://dx.doi.org/10.1016/j.jecp.2010.06.005

Klenberg, L., Korkman, M., & Lahti-Nuuttila, P. (2001). Differential development of attention and executive functions in 3- to 12-year-old Finnish children. *Developmental Neuropsychology*, *20*(1), 407-428. http://dx.doi.org/10.1207/S15326942DN2001_6

Levin, H. S., Culhane, K. A., Hartman, J., Evankovich, K., Mattson, A. J., Harward, H., Ringholz, G.,Ewing-Cobbs, L., & Fletcher, J. M. (1991). Developmental changes in performance on tests of purportedfrontal lobe functioning. *Developmental Neuropsychology*, *7*, 377-395. http://dx.doi.org/10.1080/87565649109540499

Lezak, M. D. (1993). Newer contributions to the neuropsychological assessment of executive functions. *Journal of Head Trauma Rehabilitation*, *8*, 24-31. http://dx.doi.org/10.1097/00001199-199303000-00004

Martel, M. M., & Nigg, J. T. (2006). Child ADHD and personality/temperament traits of reactive and effortful control, resiliency, and emotionality. *Journal of Child Psychology and Psychiatry*, *47*(11), 1175-1183. http://dx.doi.org/10.1111/j.1469-7610.2006.01629.x

Masten, A. S., Herbers, J. E., Desjardins, C. D., Cutuli, J. J., McCormick, C. M., Sapienza, J. K., Long, J., & Zelazo, P. D. (2012). Executive function skills and school success in young children experiencing homelessness. *Educational Researcher*, *41*(9), 375-384. http://dx.doi.org/10.3102/0013189X12459883

Pennington, B. F., & Ozonoff, S. (1996). Executive Functions and developmental psychopathology. *Journal of Child Psychology and Psychiatry*, *37*, 51-87. http://dx.doi.org/10.1111/j.1469-7610.1996.tb01380.x

Raver, C. C., Li-Grining, C., Bub, K., Jones, S. M., Zhai, F., & Pressler, E. (2011). CSRP's impact on low-income preschoolers' preacademic skills: Self-regulation as a mediating mechanism. *Child Development*, *82*(1), 362-378. http://dx.doi.org/10.1111/j.1467-8624.2010.01561.x

Riggs, N. R., Jahromi, L. B., Razza, R. P., Dillworth-Bart, J. E., & Mueller, U. (2006). Executive function and the promotion of socialemotionalcompetence.*Journal of Applied Developmental Psychology*, *27*, 300-309. http://dx.doi.org/10.1016/j.appdev.2006.04.002

Romine, C. B., & Reynolds, C. R. (2005). A model of the development of frontal lobe functioning: Findings from a meta-analysis. *Applied Neuropsychology*, *12*, 190-201. http://dx.doi.org/10.1207/s15324826an1204_2

Rothbart, M. K., Ellis, L. K., Rueda, M. R., & Posner, M. I. (2003). Developing mechanisms of temperamental effortful control. *Journal of Personality*, *71*(6),1113-1143. http://dx.doi.org/10.1111/1467-6494.7106009

Sarkis, S. M., Sarkis, E. H., Marshall, D., & Archer, J. (2005). Self-Regulation and Inhibition inComorbid ADHD Children: An Evaluation of Executive Functions. *Journal of Attention Disorders*, *8*(3), 96-108. http://dx.doi.org/10.1177/1087054705277265

Semrud-Clikeman, M., Goldenring Fine, J., & Bledsoe, J. (2014). Comparison Children with Autism Spectrum Disorder, Nonverbal Learning Disorder and Typically Developing Children on Measures of Executive Functioning. *Journal of Autism and Developmental Disorders*, *44*(2), 331-342. http://dx.doi.org/10.1007/s10803-013-1871-2

Soriano-Ferrer, M., Félix-Mateo, V., & Begeny, J. C. (2014). Executive function domains among children with ADHD: Do they differ between parents and teachers ratings? *Social and Behavioral Sciences*, *132*, 80-86.

Stuss, D. T., & Alexander, M. P. (2000). Executive functions and the frontal lobes: A conceptual view.*Psychological Research*, *63*, 289-298. http://dx.doi.org/10.1007/s004269900007

Stuss, D. T., & Benson, D. F. (1986). *The frontal lobe*. New York: Raven.

Tehranidoost, M., Rad, R., Sepasi, M., & Alagheband, J. (2003). Executive functions deficits in children with ADHD. *Cognitive Sciences Advances*, *5*, 1-9.

Vilkki, J. (1995). Neuropsychology of mental programming: An approach for the evaluation of frontallobe dysfunction. *Applied Neuropsychology*, *2*, 93-106. http://dx.doi.org/10.1080/09084282.1995.9645346

Welsh, M. C., Pennington, B. F., & Groisser, D. B. (1991). A normative study of executive function: Awindow on prefrontal function in children. *Developmental Neuropsychology*, *7*, 131-149. http://dx.doi.org/10.1080/87565649109540483

Willcutt, E. G., Doyle, A. E., Nigg, J. T., Faraone, S. V., & Pennington, B. F. (2005). Validity of the executive function theory of attentiondeficit/hyperactivity disorder: A meta-analytic review. *Biological Psychiatry*, *57*, 1336-1346. http://dx.doi.org/10.1016/j.biopsych.2005.02.006

Willoughby, M. T., Blair, C. B., Wirth, R. J., & Greenberg, M. (2010). The measurement of executive function at age 3 years: Psychometricproperties and criterion validity of a new battery of tasks. *Psychological Assessment*, *22*, 306-317. http://dx.doi.org/10.1037/a0018708

Willoughby, M. T., Kupersmidt, J., Voegler-Lee, M., & Bryant, D. (2011). Contributions of hot and cool self-regulation to preschooldisruptive behavior and academic achievement. *Developmental Neuropsychology*, *36*(2), 162-180. http://dx.doi.org/10.1080/87565641.2010.549980

Zelazo, P. D., & Muller, U. (2002). Executive function in typical andatypical development. In U. Goswami (Ed.), *Handbook of childhoodcognitive development* (pp. 445-469). Oxford, England: Blackwell.