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Executive Function and Self-Regulation in Early Childhood

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A Literature Review Presented

in Partial Fulfillment of the Requirements

For the Degree of Master of Education

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Abstract

There has been a shift in the kindergarten classroom from one filled with play and exploration to one filled with academic rigor. In response to this, the focus of many preschool classrooms have also shifted to focus more on academic development rather than social emotional development. Executive function skills, which include inhibitory control, working memory and cognitive flexibility have been found to predict academic success and school readiness more than IQ. Self-regulation which refers to controlling behavior in response to a stimulus is interrelated with executive function and also is a predictor of success. Caregivers and early childhood classrooms must support executive function and self-regulation skills. This literature review of scholarly journal articles will provide evidence of how executive function and self-regulation are intertwined, how they play a role in social-emotional and academic development in early childhood and the science behind their development, along with factors that may influence this development. Finally, included are techniques that can help support this development at home and in the classroom.

Keywords: Kindergarten, preschool, early childhood, school readiness, executive function, self-regulation

Executive Function and Self-Regulation in Early Childhood

Over the past two decades kindergarten has shifted from being centered around play, exploration, and social skills to focusing on academic skills (Bassok et al., 2016). In turn, preschools are focusing more on academic skills in order to prepare young children for kindergarten. Today, very few teachers support a strictly academic model of school readiness (Blair & Raver, 2015). When children enter kindergarten, they are expected to focus attention, sit for extended periods of time, work independently, follow complex rules and instructions, and transition easily from one activity to the next (Moffett & Morrison, 2019). Unfortunately, nearly half of the kindergarten teachers feel that children are entering kindergarten without the skills needed to be successful in a formal education setting (Montroy et al., 2016).

Executive function skills play an important role in school readiness (Nesbitt et al., 2015). Evidence suggests that these skills predict many developmental outcomes, including social-emotional and academic achievement (Razza et al., 2015; Schmitt et al., 2018). As a result of this, a growing amount of research has been done on executive function skills in young children (Moreno et al., 2017). Executive function skills are cognitive processes which include flexible control of attention, inhibitory control, and working memory. These skills are critical for classroom learning and academic success (Gooch et al., 2015).

Self-regulation, the ability to control emotions, behavior and attention, includes the components of executive function and are highly interrelated with executive function (Williams, 2018). A child's ability to focus attention, regulate emotions, and engage in positive social relationships are essential to success in school (Blair & Raver, 2015). Self-regulation allows children to engage in learning activities, focus and maintain attention, suppress emotional and behavioral impulse responses, and engage in positive social interactions (Blair & Raver, 2015;

Bolton & Hattie, 2017), which enhance academic and social-emotional outcomes (Bolton & Hattie, 2017). Similar to executive function, self-regulation is related to school success (Bolton & Hattie, 2017; Viglas, 2017; Williams, 2018). Also, like executive function, children with low self-regulation have increased behavioral problems (Lonigan et al., 2017; Sawyer et al., 2015), social difficulties, and poor academic motivation (Fitzpatrick, 2012).

Increased evidence that executive function and self-regulation are instrumental in a child's academic and behavioral development has led to increased interest in the family's influence on the development of these skills (Hughes & Devine, 2019). There are negative and positive parenting practices. Practices that support executive function and self-regulation development include modeling, scaffolding, autonomy, routines, and teaching children self-control. Negative practices include neglect, inconsistent discipline, being overly protective and being too controlling. Children look to their parents as role models, therefore they play an important role in the development of these skills (Hughes & Devine, 2019).

Teachers also contribute significantly to the development of executive function and self-regulation skills ((Fitzpatrick, 2012; Hughes & Devine, 2019; Moreno et al., 2017, Nesbitt et al., 2015; Raver & Blair, 2016). Understanding the importance of executive function development does not automatically translate into supportive practices in the classroom (Moreno et al., 2017). In fact, connections to executive function in the preschool classroom are lacking (Moreno et al., 2017). These skills are rarely taught in school (Flook et al., 2014). Evidence shows that early childhood is the opportune time to teach these skills (Flook et al., 2014).

Review of the Literature

Changes in Kindergarten

Kindergarten education has dramatically changed in the past three decades (Bassok et al., 2016). It was once thought of as a transitional year that focused on all aspects of child development, but it is now viewed as the beginning of formal education (Russell, 2011). Bassok et al. (2016) and Cavanaugh et al. (2017) claim that the No Child Left Behind Act led to changes in the kindergarten classroom. What was once filled with free play, exploration and imagination is now filled with scripted curriculum, assessments, benchmarks and academic rigor (Cavanaugh et al., 2016). No Child Left Behind did not require testing for children before third grade, but Bassok et al. (2016) believed that the pressures felt by principals and teachers of upper elementary grades forced an accountability pushdown that resulted in changes to the kindergarten classroom.

According to Bassok et al. (2016), the number of children enrolled in preschool increased from 1.2 million to 2.9 million between 1990 and 2011. This expansion in having access to public preschool means that more children entering kindergarten already have had exposure to classroom environments (Bassok et al., 2016). Two opposing camps have emerged regarding the purpose of kindergarten. One focuses on academic content and the belief that exposure to advanced content can be beneficial for school learning. The other side claims that the focus should be on the social, emotional, and cognitive development of the child. Those that oppose the academic camp fear that the focus on academics may not leave room for other types of learning that promote social and regulation skills, which in turn will be too stressful for young children and impact their self-confidence and attitude towards school (Bassok et al., 2016; Russell, 2011). Russell (2011) referred to these two sides as the academic logic and the

developmental logic. Russell (2011) states that growing evidence indicates kindergarten teachers focus most of the day on academic skills and less time on more traditional kindergarten development areas, such as social skills and play.

Executive Function

In the past 10 – 15 years there has been a growing amount of research done on executive function skills in young children (Moreno et al., 2017). What was once thought not to apply to children at all, is now viewed as a critical foundation to school readiness and performance in school (Moreno et al., 2017). A large body of evidence that suggests executive function is as important, if not more so, than general intelligence for early success in school and contributes to overall academic achievement (Blair & Raver, 2015; Booth et al., 2018).

Executive function consists of higher order thinking processes which are crucial for cognitive, social, and psychological functioning (Matte-Gagné et al., 2014). They include inhibitory control, working memory, and cognitive flexibility or shifting. Inhibitory control is the ability to inhibit the automatic, dominant responses to stimulation when necessary (Blair et al., 2015; Booth et al., 2018). Working memory is the ability to retain information in an easily retrievable state while blocking distractors that might otherwise hinder the retrieval process (Bolton & Hattie, 2017; Diamond, 2016). In other words, the ability to hold and manipulate information in the mind (Schmitt et al., 2018). Cognitive flexibility, also known as shifting, is the ability to shift attention between information or tasks (Booth et al., 2018; Hughes & Devine, 2019; Williams, 2018). These executive function skills are often viewed as the air traffic control of the brain (Raver & Blair, 2016). They serve as a basis for the child to act appropriately and be able to adapt in a classroom setting (Montroy et al., 2016). They are critical for kindergarten

readiness and classroom learning (Gooch et al., 2016). In fact, executive function skills are more important for school readiness than IQ or basic reading and math skills (Diamond, 2016).

Executive function skills begin to develop during infancy, but are not fully mature until young adulthood (Diamond, 2016). According to Booth (2018), inhibitory control begins to develop a little earlier than working memory and cognitive flexibility. A vast majority of studies assert that between the ages of 2 and 5 is when the largest period of growth occurs, with children being able to inhibit for greater periods of time (Booth et al., 2018). Fitzpatrick (2012) believes that working memory and cognitive flexibility begin to develop before inhibitory control. He believes improvements in these two areas serve as a predictor of inhibitory control which emerges during the preschool years. Developmental research shows that these skills develop rapidly during early childhood and have a large age-related change from 3 to 5 years (Booth et al., 2018).

Development of executive function is linked with anatomical and physiological changes to the prefrontal cortex of the brain (Booth et al., 2018; Diamond, 2016; Flook et al., 2014; Lonigan et al., 2017; Raver & Blair, 2016). The prefrontal cortex is located in the topmost forward portion of the brain (Raver & Blair, 2016). It has numerous connections with most of the regions of the cortex and some parts of the lower brain (Booth et al., 2018). The prefrontal cortex is one of the last areas of the brain to mature. It is not fully mature until early adulthood, sometime between mid-twenties to thirty years of age, (Booth et al., 2018, Diamond, 2016; Raver & Blair, 2016) and it is one of the first to show signs of ageing (Booth et al., 2018). Between birth and 2 years old, the brain is forming its largest number of new neuron connections and is increasing in size. Between the ages of 7 and 12 months synaptogenesis occurs which is consistent with observable improvements in shifting and inhibition (Booth et al., 2018). Between

the ages of 2 and 6 dramatic physical changes are occurring to the structure of the prefrontal cortex that are associated with improvements in the control of behavior (Booth et al., 2018).

Executive function development is susceptible to environmental factors and experiences. Research has shown that adverse early experiences (Raver & Blair, 2016), poverty (Nesbitt et al., 2015), stress (Diamond, 2016), and negative parenting (Diamond, 2016; Hughes & Devine, 2019; Raver & Blair, 2016) can have adverse effects on executive function development. Early executive function skills may be a predictor of later executive function, but it is important to remember that executive function can be improved (Diamond, 2016). However, children who begin school with less developed executive function skills are at risk of struggling socially and academically, along with developing negative self-perceptions which are difficult to change (Diamond, 2016).

Evidence suggests that executive function predicts many developmental outcomes, including social-emotional and academic achievement (Razza et al., 2015; Schmitt et al., 2018). Schmitt, (2018) goes on to claim that preschool executive function is foundational for long-term success. Preschool students with developed executive function skills have better social interactions, higher academic ability and fewer behavioral problems (Hughes et al., 2019; Nesbitt et al., 2015). Lower executive function may lead to disruptive behaviors, being disengaged in learning activities (Nesbitt et al., 2015) and off-task behaviors (Moffett & Morrison, 2019; Nesbitt et al., 2015). Early childhood classrooms include many shared learning experiences, where a child must engage with both teachers and peers (Nesbitt et al., 2015). Executive function skills allow children to adapt to learning environments, engage in behaviors that facilitate academic achievement, and successfully participate in social interactions (Nesbitt et al., 2015).

Self-regulation

Self-regulation, as a broad definition, refers to the process of controlling behavior, emotion, and cognition in response to a situation, stimulus, or demand (Razza et al., 2015; Lonigan et al., 2017). Bater & Jordan (2017) defined self-regulation based on two different perspectives: the cognitive perspective, which focuses on the executive functioning aspect and the behavioral perspective, which focuses on the effortful control aspect. A definition which combines both perspectives is that children learn to regulate their attention and behavioral responses to complete a goal or activity (Bater & Jordan, 2017). Bolton & Hattie (2017) defined self-regulation based on three perspectives: cognitive, behavioral, and emotional. Their definition of cognitive and behavioral self-regulation were similar to Bater & Jordan. They believed cognitive regulation controlled cognitive capacities such as attention and memory, and behavioral regulation involved the capacity to suppress or initiate a behavioral response. They also included emotional regulation which is the ability to modulate emotional responses using tools such as distraction or reevaluating a situation in order to reduce anxiety (Bolton & Hattie, 2017). Executive function falls under the umbrella of self-regulation (Williams, 2018).

Similar to executive function, self-regulation development begins in infancy (Montroy et al., 2016; Sawyer et al., 2015). Also, like executive function, a period of rapid development occurs during the preschool years (Blair & Raver, 2015; Montroy et al., 2016; Razza et al., 2015; Sawyer et al., 2015; Williams, 2018) which coincides with children's first experiences in an educational setting. During these years children are faced with demanding situations outside of the home and are required to meet the requirements of the classroom (Lincoln et al., 2016; Viglas & Perlman, 2017). Self-regulation is not only shaped by environmental factors, but by genetics as well (Bolton & Hattie, 2017). Because of this, the rate of development varies for each

individual child (Montroy et al., 2016; Sawyer et al., 2015). Each facet (behavioral, emotional, and cognitive) and individual skills within the facets develop at different rates and times (Montroy et al., 2016).

Self-regulation allows children to engage in learning activities, focus and maintain attention, suppress emotional and behavioral impulse responses, and engage in positive social interactions (Blair & Raver, 2015; Bolton & Hattie, 2017). All of which enhance academic and socioemotional outcomes, including school readiness, fewer behavior problems, and lower levels of anxiety and depression (Bolton & Hattie, 2017). Children who do not have the skills to regulate their emotion or behavior and the ability to sustain attention during tedious, undesirable tasks are more likely to display noncompliant behavior (Lincoln et al., 2016). Bolton & Hattie (2017) state that studies have shown an association between self-regulation and positive life outcomes that are interdependent of IQ. According to Montroy et al. (2016) self-regulation is an important developmental milestone and children who are considered “later developers” show considerably less developmental progress than their peers and require support as early as possible. It has been found that delays in developing self-regulation in early childhood may lead to later behavioral problems (Sawyer, 2015).

As with executive function, environmental factors affect a child’s self-regulation development (Bolton & Hattie, 2017; Montroy et al., 2016; Sawyer et al., 2015). Positive shared interactions with parents help children understand and express emotional responses and aid in the development of cognitive processes, such as attention (Bolton & Hattie, 2017). It is important that parents and caregivers provide clear and consistent rules and expectations. This helps young children develop self-regulatory skills (Bolton & Hattie, 2017). A few environmental factors that have been known to hinder self-regulatory development are chaotic conditions (Bolton &

Hattie, 2017), maternal depression (Sawyer et al., 2015), and less advantaged backgrounds (Williams, 2018).

Montroy et al. (2016) found that early language skills may affect the timing of development of early self-regulation. They believe that higher levels of language development may give young children the ability to better understand incoming information, such as rules or directions, which helps them use self-regulation skills such as remembering information and inhibiting responses. Vygotsky's theory of inner speech may play a role in self-regulation (Fitzpatrick, 2012). Self-control skills are required for a child to move from out loud, non-specific speech to private, internalized speech which allows children to give themselves instructions while completing complex tasks (Fitzpatrick, 2012).

Like executive function, self-regulation is related to school success (Bolton & Hattie, 2017; Viglas, 2017; Williams, 2018). Also, like executive function, children with low self-regulation have increased behavioral problems (Lonigan et al., 2017; Sawyer et al., 2015), social difficulties, and poor academic motivation (Fitzpatrick, 2012). Therefore, the development of self-regulation is critical during early childhood since this is the time that these skills are rapidly developing (Bolton & Hattie, 2017; Flook et al., 2015). Self-regulation during this period, according to Bolton and Hattie (2017), has a lasting impact on children's development because it is during this time that children begin to form relationships with peers and teachers, as well as engage in learning. Self-regulation makes it easier for children to resist distractions, regulate emotional responses, and inhibit inappropriate behavior in the classroom (Fitzpatrick, 2012). Children with higher self-regulation may be better able to calm themselves during frustrating tasks and to follow school rules (Sawyer, et al., 2015). Therefore, it is essential that early

childhood teachers help young children learn how to regulate their emotions, thinking, and behavior (Williams, 2018).

School Readiness

Due to the academic shift of the kindergarten classroom, there has been growing research on the meaning of school readiness. Bassok et al. (2016) studied responses from kindergarten teachers on their beliefs about school readiness in 1998 and 2010. Not surprisingly, there was a significant increase in the percentage of teachers who viewed academic skills, such as knowing letters and shapes, as necessary, (Bassok et al., 2016) which supports the academic shift. But it is essential to note that even though the importance of academic skills significantly increased, self-regulation skills such as following directions, sitting still, focusing attention, not being disruptive, and completing tasks are still the most important for school readiness (Bassok et al., 2016). Very few teachers support a strictly academic conception of school readiness, but they believe students with well-developed self-regulation skills are ready to successfully participate in learning activities in the classroom (Blair & Raver, 2015).

Therefore, the term school readiness encompasses many areas of development. A child is ready to enter formal schooling when a child has the maturity and ability to navigate classroom demands (Fitzpatrick, 2012). In order to learn, they need to be able to regulate their behavior, including attention, emotion and cognition (Nesbitt et al., 2015). In other words, school readiness is when a child is ready to learn and is able to participate in the academic and social aspects of the kindergarten classroom (Fitzpatrick, 2012). When children enter kindergarten, they are expected to focus attention, sit for extended periods of time, work independently, follow more complex rules and instructions, and transition from one activity to the next (Moffett & Morrison, 2019). In research conducted by Blair & Raver (2015), they concluded that kindergarten teachers

believe that children are ready for school when they are able to be enthusiastic and curious about learning, pay attention, follow directions, not be disruptive and be sensitive to other children's feelings. The integration of these skills is considered to be behavioral self-regulation (Moffett & Morrison, 2019).

Preschool and Kindergarten has evolved over the last few decades and continues to evolve from a focus on social-emotional skills to a focus on academic skills (Montroy et al., 2016). When children transition to kindergarten, they are required to have a high level of self-regulation (Sawyer et al., 2015). Unfortunately, nearly half of the kindergarten teachers feel that children are entering kindergarten without the self-regulation skills needed to be successful in a formal education setting (Montroy et al., 2016). Montroy et al. (2016) go on to say that it is important to remember that social-emotional development, including self-regulation development can have a long-lasting impact on a child's academic success. Lower levels of self-regulation make it difficult for children to adjust, engage, and learn in a formal school environment (Sawyer et al., 2015). This focus on self-regulation is necessary in order to prevent widening gaps in learning when children begin school (Williams, 2018) and to facilitate social success (Nesbitt et al., 2015).

Executive function skills also play an important role in school readiness because of their positive association with academic success (Nesbitt et al., 2015). They are necessary to prepare young children for the increase in complexity of learning tasks that will occur in elementary school (Moreno et al., 2017). Working memory allows young children to remember instructions, inhibition helps them to hold their thoughts and wait their turn, and cognitive flexibility allows them to transition effectively (Moreno et al., 2017). Children with poor inhibitory control often blurt out the answer, struggle with staying in their seat, take things from other children, and have

difficulty paying attention and completing their tasks (Diamond, 2016). Greater executive function skills are associated with higher involvement in learning opportunities, participation in social-learning interactions, and fewer disruptive and unoccupied behaviors (Nesbitt et al., 2015), which are all necessary in order to be successful in school.

Bater & Jordan (2017) want to stress that a focus on self-regulation and executive function on school readiness does not take precedence over cognitive development. As children make progress with self-regulation, they set the stage for cognitive growth, and vice versa (Blair & Raver, 2015). In fact, early learning that focuses on development of self-regulation and academic content most effectively promotes school readiness (Blair & Raver, 2015).

Academic Development

Evidence shows that children's executive function when entering school predicts early language and mathematical skills (Nesbitt et al., 2015; Raver & Blair, 2016). Raver & Blair (2016) found that executive function in children as young as 4 and 5 predicts their math and literacy ability through elementary school. In order to be successful in literacy and math, children must be able to focus and shift attention, hold information in their mind and follow multi-step instructions (Raver & Blair, 2016). Executive function increases behavioral and cognitive control, regulates attention and motivation (Raver & Blair, 2016), which in turn allows children to solve more complex academic problems (Nesbitt et al., 2015; Raver & Blair, 2016). Whereas low impulse control and poorer working memory prevents children from actively participating in learning activities which negatively affects their academic development (Nesbitt et al., 2015).

Literacy and Language. Kindergarten is a crucial year for developing the foundational skills for reading (Moffett & Morrison, 2019). Children with poor working memory and lower inhibition control have difficulty staying on task. The more time spent off-task and disengaged

predicts fewer gains in letter-word identification and reading comprehension (Moffett & Morrison, 2019). Engagement in learning is positively associated with reading achievement at the beginning and end of kindergarten (Nesbitt et al., 2015). Reading not only requires engagement, it also requires the ability to shift attention between phonemes and whole words (Hughes & Devine, 2019). Phoneme awareness requires a child to recognize smaller units of meaning and sound (Blair & Raver, 2015). Similarly, spelling requires a child to hold multiple representations of letter sounds in mind while inhibiting one over the other (Blair & Raver, 2015). Through their work, Nesbitt et al., (2015) supported previous research that executive function skills aid in reading and literacy development.

Research supports a correlation between language, executive function, (Blair & Raver, 2015; Gooch et al., 2016) and self-regulation (Lonigan et al., 2017; Montroy et al., 2016). Language provides the tools necessary to organize thoughts (Montroy et al., 2016) and utilize higher order reasoning (Schmitt et al., 2018) to control behavior. Vygotsky believes that language skills help children regulate behaviors through verbalizations known as private speech or self-talk, which support children's ability to plan and monitor thoughts and actions (Fitzpatrick, 2012; Schmitt et al., 2018). Once children are able to internalize speech, they are able to give themselves instructions to perform tasks (Fitzpatrick, 2012). During early childhood, expressive language is particularly important because it allows children to communicate their current state and manipulate that state in relation to the context (Montroy et al., 2016). Studies have shown that vocabulary is a predictor of executive function (Schmitt et al., 2018). This may be due to the fact that instructions and behavior expectations are often given in verbal format. If children are unable to comprehend what is being asked of them, they may struggle with remembering instructions, adapting to changing stimuli, or engaging their

inhibitory control (Schmitt et al., 2018). Children use both expressive and receptive language when completing a task (Montroy et al., 2016) and therefore, these language skills are necessary for the acquisition of both executive function and self-regulation skills (Schmitt et al., 2018).

Math

Mathematical skills and executive function are also strongly related (Blair & Raver, 2015; Nesbitt et al., 2015; Schmidt et al., 2018). Most research supports that executive function is a predictor of math, but new evidence shows that math is also an indicator of executive function in preschool (Schmidt et al., 2018). According to Schmidt et al. (2018), mathematical language is a child's understanding of mathematical terms and concepts. It can be viewed as a form of complex language that is often representational and may involve higher order reasoning. Children with more advanced executive function skills may be able to pay attention better, allowing them to remember mathematical terms during activities (Schmidt et al., 2018). Math often requires a child to follow a set of multiple step instructions and in order to do this, a child must understand the language the teacher is using in the directions (Schmidt et al., 2018). Multiple step directions can be cognitively demanding and executive function skills aids in completion of these types of tasks (Nesbitt et al., 2015). Early math activities, such as ordinality, cardinality, and pattern completion, can be cognitively demanding (Blair & Raver, 2015). They require children to flexibly shift attention and to inhibit one response in favor of another response (Blair & Raver, 2015). The majority of research focuses on executive function as a predictor of mathematics, but according to Schmidt et al. (2018), the relationship between executive function and mathematics may be bidirectional. Mathematical language may help develop executive function (Schmidt et al., 2018).

Parenting Practices

Bater & Jordan (2017) define parenting practices as behaviors used to perform parental duties. Both negative and positive parenting practices exist. Characteristics of positive practices are praise, involvement, routine (Bater & Jordan, 2017), warmth (Bater & Jordan, 2017; Hughes & Devine, 2019; Lincoln et al., 2016), sensitivity (Lincoln et al., 2016), encouragement (Hughes & Devine, 2019), attention (Hughes & Devine, 2019; Raver & Blair, 2016), and scaffolding (Bater & Jordan, 2017; Diamond, 2016; Hughes & Devine, 2019; Lincoln et al., 2016; Raver & Blair, 2016). Negative behaviors include neglect (Bater & Jordan, 2017; Raver & Blair, 2016), inconsistent discipline (Bater & Jordan, 2017), being overly protective, and being too controlling (Diamond, 2016; Hughes & Devine, 2019). The development of self-regulatory skills are especially affected by parenting practices (Bater & Jordan, 2017). Children look to their parents as role models. (Bater & Jordan, 2017). Parents can help or hinder a preschool child's development of executive function skills (Hughes & Devine, 2019). Increased evidence that executive function and self-regulation play an important role in a child's academic and behavioral development has led to increased interest in the family's influence on the development of these skills (Hughes & Devine, 2019).

Modeling

According to Lincoln et al. (2016), mothers in particular play an important role in helping young children develop self-regulation. Young children frequently turn to their mothers when experiencing strong emotions and how their mother handles those strong emotions influences the development of their own self-regulation (Lincoln et al., 2016). Lincoln et al. (2016) goes on to say that mothers with well-developed self-regulation will respond to these emotions in a way that models effective regulation. Whereas, mothers who struggle with their own self-regulation and

are experiencing stressors in their own life will model ineffective strategies to their children.

According to Bandura's Social Learning Theory, children learn by observing other's behaviors and imitating their behavior (Lincoln et al., 2016).

Scaffolding

In addition to modeling, scaffolding is an effective way parents can foster their child's development of executive function (Bater & Jordan, 2017; Diamond, 2016; Hughes & Devine, 2019; Lincoln et al., 2016; Raver & Blair, 2016). Scaffolding is a process that reduces the level of parental support given until the child is able to show mastery of a skill on their own (Hugh & Devine, 2016). Scaffolding occurs when a child observes a caregiver's modeled behavior and then with responsive interactions, the child has opportunities to practice, develop, and refine their behavior (Lincoln, et al., 2016). There is evidence that effective scaffolding which includes positive feedback, directing without controlling, and respecting autonomy for their children leads to fewer behavior problems, stronger interpersonal relationships, and the ability to delay gratification (Lincoln et al., 2016). In addition, studies report a link between parental scaffolding and a child's academic success and adjustment (Hughes & Devine, 2016; Lincoln et al., 2016).

Autonomy

Along with modeling and scaffolding, parents who nurture autonomy have children with stronger executive function and self-regulation skills who engage in socially appropriate behavior (Lincoln et al., 2016; Matte-Gagné et al., 2014). Matte-Gagné et al. (2014) defines parental autonomy as behaviors that support a child's goals and choice. Autonomy support requires scaffolding to ensure that the child plays an active role in completing the goal or task (Matte-Gagné et al., 2014) while receiving guidance so that the behavior is regulated, as well as, socially and developmentally appropriate (Lincoln et al., 2016). Children require guidance to

develop autonomy rather than be granted autonomy (Lincoln et al., 2016). Lincoln et al., (2016) states that it is with this guidance, children learn compliance. Compliance is the ability to meet expectations of parents and others and is considered to be a developmental hallmark and necessary outcome for socialization (Lincoln et al, 2016). Without guidance, children are likely to take advantage of this autonomy and choose instantly gratifying behaviors rather than socially appropriate, regulated behaviors (Lincoln et al, 2016).

Routines

Routines also help a child develop executive function (Bater & Jordan, 2017; Raver & Blair, 2016). According to Bater & Jordan (2017), routines are observable repetitive behaviors which regularly occur in a predictable manner on a daily or weekly basis. They go on to say that routines provide consistent and environmental cues for expected behavior. Studies show that giving a child the opportunity to practice expected behaviors helps a child develop appropriate behaviors (Bater & Jordan, 2017). Consistent routines are associated with less impulsivity and aggression (Bater & Jordan, 2017). Routines also aid in developing self-regulation because they provide structure, predictability and boundaries that allow children to learn what is appropriate and expected (Bater & Jordan, 2017). Therefore, routines play an important role in the development of executive function and self-regulation (Bater & Jordan, 2017).

Problem-Solving and Self-Control

Parents can also foster executive function by helping children solve their own problems and exercise self-control (Diamond, 2016). Caregivers can develop problem solving skills by asking guided questions regarding the problem, reducing the number of options for problem solving, and helping a child handle frustration and persevere (Diamond, 2016). Practice exercising self-control can be done by helping a child sustain attention, stay on task and by

delaying gratification (Diamond, 2016). In fact, Fitzpatrick (2012) states that preschool children who are able to delay gratification score higher on achievement tests in adolescence, whereas those who struggle with self-control often show internalizing and externalizing problems later in childhood.

Negative Parenting

Negative parenting practices show an inverse association with a child's executive function (Diamond, 2016; Hughes & Devine, 2019; Raver & Blair, 2016). Parents who are too controlling or harsh have children with lower executive functions (Diamond, 2016). These children have less opportunity to develop autonomy (Diamond, 2016). Negative parenting practices are viewed as a stressor and executive function development is vulnerable to stress. Research supports that stressful environments (Hughes & Devine, 2019) and neglectful caregiving (Raver & Blair, 2016) affect the development of the prefrontal cortex which is the neural center of executive function and self-regulation. Neurobiological processes underlying children's attention, executive function, and self-regulation are to a great extent shaped by the quality of parenting (Raver & Blair, 2016).

Teaching Practices

Teachers also play an important role in the development of a young child's executive function and self-regulatory skills (Fitzpatrick, 2012; Hughes & Devine, 2019; Moreno et al., 2017, Nesbitt et al., 2015; Raver & Blair, 2016). Early childhood teachers spend a substantial amount of time with children as both a nurturer and educator (Fitzpatrick, 2012). Positive relationships of warmth and structure can enhance child development, whereas negative relationships of conflict and anger can negatively affect child development (Fitzpatrick, 2012). Similar to routines at home, classroom routines and expectations will aid in the development of

self-regulation and executive function by providing structure, boundaries, and predictability (Bater & Jordan, 2017). A child's classroom environment must provide opportunities for the child to practice self-regulation (Viglas & Perlman, 2017). Viglas & Perlman (2017) emphasized that a developmentally appropriate early childhood classroom supports self-regulation with the understanding that social, emotional, and cognitive development are all interconnected.

Understanding the importance of executive function development does not automatically translate into supportive practices in the classroom (Moreno et al., 2017). In fact, connections to executive function in the preschool classroom are lacking (Moreno et al., 2017). Classrooms that show the lowest scores on development of cognitive executive function skills are those that focus on rote learning, have few opportunities for students to engage in analysis of learning, and lack scaffolding (Moreno et al., 2017). Effective classrooms are those that support regulated thinking, extend topics into conversation, pose thought provoking questions rather than just comments, and make connections between new concepts and previously learned material (Moreno et al., 2017). These practices should be an integral part of the child-teacher interactions in the preschool classroom (Moreno et al., 2107). Teachers must help children think about their thinking and the processes they use when they complete a task (Moreno et al., 2017). This supports higher-order thinking and the problem solving aspect of executive function (Moreno et al., 2017).

Executive function plays an important role in self-regulation and evidence has shown that self-regulation skills are predictors of outcomes later in life (Flook et al., 2014). This being said, these skills are rarely explicitly taught in school (Flook et al., 2014). Flook et al., (2014) believes that early childhood is the opportune time to teach these skills due to the malleability of the brain

and the rapid development that occurs during this time. Early intervention is critical in order to help those students who struggle with executive function to succeed in school (Diamond, 2016).

Mindfulness-Based Practices

Emerging scientific studies support teaching executive function and self-regulation skills through mindfulness-based practices (Flook et al., 2014). Flook et al., (2014) defines mindfulness as the ability to focus awareness on a particular object, such as one's own body, thoughts, emotions, or an external object, and to notice when the mind has wandered from that object and to be able to bring attention back to that object. Therefore, mindfulness training provides a positive impact on attention (Flook et al., 2014; Viglas & Perlman, 2017). Mindfulness is also believed to be able to reduce impulsivity and decrease emotional reactivity (Viglas & Perlman, 2017). The ability to delay gratification at age four predicts attention and self-control during adolescence (Flook et al., 2014). Training improves the ability to focus attention and regulate emotions which enhances academic and social outcomes in children (Flook et al., 2014; Viglas & Perlman, 2017).

Mindfulness-based practices such as yoga may aid in the development of self-regulation (Razza et al., 2015; Williams, 2018). They facilitate self-regulation by having children inhibit or control their impulses (Razza et al., 2015). This can be accomplished through quiet static sitting and mindful movements through yoga. (Razza et al., 2015). Both practices strengthen attention as well as impulse control (Razza et al., 2015). Through their research, Razza et al., (2015) concluded that the children in a intervention classroom exhibited advantages in self-regulation and executive function at the end of a school year compared to their peers who did not participate in mindful yoga.

Music

Music activities in early childhood classrooms are developmentally appropriate and can be easily implemented (Williams, 2018). Evidence shows that beat synchronization skills are an important neurodevelopment indicator (Williams, 2018). Practicing beat synchronization through rhythmic movement could support the development of self-regulation skills (Williams, 2018). According to Williams (2018), children who struggle with finding the beat in group music activities are often the same children who struggle with maintaining attention. Group music activities, such as clapping games, circle games, and movement activities (Zachariou & Whitebread, 2017), are also a motivating way for children to practice self-regulation skills (Williams, 2108). Studies showed that children enrolled in music classes demonstrated better self-regulation skills than their socio-demographically equivalent peers who did not participate. (Williams, 2018; Zachariou & Whitebread, 2017). Williams (2018) concludes that incorporating movement with rhythm activities will enhance motor coordination and self-regulatory functioning.

Play

The No Child Left Behind Act has dramatically changed the early childhood classroom (Cavanaugh et al., 2017). Classrooms that were once filled with imagination, discovery and play are now virtually devoid of play (Cavanaugh et al., 2017). Vygotsky's sociocultural theory combined with Bandura's social learning theory suggest that preschoolers use social interactions to learn self-regulation expectations and the skills required to meet those expectations (Lincoln et al., 2016). Self-regulation is an important outcome of social learning (Fitzpatrick, 2012) and social interactions through play aids in the development of executive function (Cavanaugh et al., 2017).

Vygotsky believes that the greatest benefits of play occur during dramatic or make-believe play (Bodrova et al., 2013). Bodrova et al. (2013) states that according to Vygotsky, real play must include an imaginary situation where children act out roles and follow a set of rules. During this type of play children must communicate and negotiate with each other (Cavanaugh et al., 2017). They must design and implement rules (Bodrova et al., 2013; Moreno et al., 2017), remember their own and their peer's roles, plan activities, and use abstract symbols (Moreno et al., 2017). They are also required to observe others (Bodrova et al., 2013) and exercise self-control (Bodrova et al., 2013; Cavanaugh et al., 2017).

Mature dramatic play requires children to use object-substitutes to take the place of real objects during play (Bodrova et al., 2013). Bodrova et al. (2013) used the example of a pipe cleaner for a stethoscope. As play continues to become more mature these object-substitutes are no longer needed because the children will use gestures or language to create imaginary objects (Bodrova et al., 2013). Mature play goes beyond reciprocal actions such as feeding/eating, as they become more engaged in their role in the scenario (Bodrova et al., 2013). According to Bodrova et al. (2013), mature play involves elaborate scenarios that take on themes and may be carried out for days. During mature dramatic, pretend play, children have the opportunity to exercise inhibitory control, attention-shifting, and working memory (Bodrova et al., 2013; Moreno et al., 2017).

According to Vygotsky, children should reach mature play around the age of 5 and 6 (Bodrova et al., 2013). Sadly, evidence from around the world supports that mature play no longer prevails in the early childhood classroom (Bodrova et al., 2013). Early childhood educators are not providing the support children need to progress from immature play to mature play (Bodrova et al., 2013). In fact, 5 and 6 year-olds often engage in immature play by using

only realistic props, stereotypical scenarios, limited roles which incorporates very little variation into their roles and scenarios (Bodrova et al., 2013). This type of immature play does not foster the skill development young children need (Bodrova et al., 2013). Bodrova et al. (2013) goes on to say that preschool children today do not have the same level of self-regulation or the ability to follow directions as generations have in the past. Researchers attribute this to a decline in quantity and quality of play found in preschool and kindergarten classrooms (Bodrova et al., 2013). This is troubling since mature play fosters self-regulation and a decline in self-regulation skills puts children at risk of developing cognitive and social-emotional problems (Bodrova et al., 2013).

Free play is another type of play which include activities that are fun, voluntary, and flexible and do not have an extrinsic goal (Cavanaugh et al., 2016) . Make-believe often includes free play. Whereas, guided play requires an adult to scaffold learning objectives and guide students toward a goal (Cavanaugh et al., 2017). Studies showed that children who engage in free play achieve lower academic gains than those who receive direct instruction, but children who participate in guided play obtain greater academic gains than both free play and direct instruction (Cavanaugh et al., 2017). Guided play leads to the greatest gains and play is one of the greatest motivators for young children (Cavanaugh et al., 2017). In fact, according to Cavanaugh et al. (2017), children learn best through play. Therefore, the best way to enhance a child's self-regulation and executive function skills is through guided play (Cavanaugh et al., 2017) and through mature play (Bodrova et al., 2013).

Conclusion and Future Studies

Until recently executive function skills were not studied in young children. Now they are considered to be a critical foundation to school readiness and success not only in school, but later in life (Moreno et al., 2017). In fact, a large body of evidence that shows executive function is as important, if not more so, than IQ for success in school (Blair & Raver, 2015; Booth et al., 2018). Self-regulation, like executive function is also related to school success (Bolton & Hattie, 2017; Viglas, 2017; Williams, 2018). Therefore, it is critical that parents and schools work together to promote the development of executive function and self-regulation in young children.

In order to do this, early childhood educators need to be trained on the importance of fostering executive function and self-regulation in their students. It is important to note, that just understanding the significance of executive function development does not mean that supportive practices will automatically be implemented in the classroom (Moreno et al., 2017). Early childhood educators have extensive demands already placed on them. Therefore, it is essential that they not only be trained on the importance of executive function and self-regulation, but they are given easy-to-implement methods to foster this development in the classroom using their current activities. More research is needed to determine effective strategies and interventions for young children.

In order to be most effective, executive function and self-regulation skills must be promoted at home and at school. Therefore, educators must work to effectively communicate the importance of these skills to families. Just as educators have extensive pressures placed on them, so do families. Therefore, it is important that this communication be done in a way that is informative and easy to understand. It is crucial that suggested practices are not critical of their current parenting practices, but rather promote collaboration and communication. Families must

believe that educating their child is a team effort and that the primary goal of the school is to help their child be successful, not only academically, but also socially and emotionally.

Communication between families and schools is essential and is not always done effectively. Therefore, further research on how to enhance communication between families and schools regarding executive function and self-regulation will ultimately benefit the child.

With the focus in early childhood classrooms changing from social-emotional development to academic development, educators must find ways to develop the whole child. It is not necessary to choose between one developmental focus or the other. Researchers believe that self-regulation and executive function do not need to take precedence over cognitive development (Bater & Jordan, 2017). In fact, evidence shows that as children make progress with self-regulation, they set the stage for cognitive growth, and vice-versa (Blair & Raver, 2015). Developing these skills will give young children the tools necessary to succeed both academically and socially.

References

- Bassok, D., Latham, S., & Rorem, A. (2016). Is kindergarten the new first grade? *AERA Open*, *1*(4), 1-31. <https://journals.sagepub.com/doi/full/10.1177/2332858415616358>
- Bater, L. R., & Jordan, S. S. (2017). Child routines and self-regulation serially mediate parenting practices and externalizing problems in preschool children. *Child & Youth Care Forum*, *46*(2), 243-259. <https://doi.org/10.1007/s10566-016-9377-7>
- Blair, C., & Raver, C. C. (2015). School readiness and self-regulation: A developmental psychobiological approach. *Annual review of psychology*, *66*, 711–731.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4682347/?report=classic>
- Booth, A., Hennessy, E., & Doyle, O. (2018). Self-regulation: Learning across disciplines. *Journal of Child and Family Studies*, *27*(12), 3767-3781. <https://doi.org/10.1007/s10826-018-1202-5>
- Bolton, S. & Hattie, J. (2017). Cognitive and brain development: Executive function, Piaget, and the prefrontal cortex. *Archives of Psychology*, *1*(3), 1-36.
<https://archivesofpsychology.org/index.php/aop/article/view/30/51>
- Cavanaugh, D. M., Clemence, K. J., Teale, M. M., Rule, A. C., & Montgomery, S. E. (2017). Kindergarten scores, storytelling, executive function, and motivation improved through literacy-rich guided play. *Early Childhood Education Journal*, *45*(6), 831-843.
<https://doi.org/10.1007/s10643-016-0832-8>
- Diamond, A. (2016). Why improving and assessing executive functions early in life is critical. In J. A. Griffin, P. McCardle, & L. S. Freund (Eds.), *Executive function in preschool-age children: Integrating measurement, neurodevelopment, and translational research*, (1st

ed., pp. 11-43). American Psychological Association.

<https://www.apa.org/pubs/books/4318129>

Fitzpatrick, C. (2012). Ready or not: Kindergarten classroom engagement as an indicator of child school readiness. *South African Journal of Childhood Education*, 2(1), 1-32.

<https://files.eric.ed.gov/fulltext/EJ1187383.pdf>

Flook, L., Goldberg, S. B., Pinger, L., & Davidson, R. J. (2015). Promoting prosocial behavior and self-regulatory skills in preschool children through a mindfulness-based kindness curriculum. *Developmental Psychology*, 51(1), 44-51. <https://doi.org/10.1037/a0038256>

Gooch, D., Thompson, P., Nash, H.M., Snowling, M.J., Hulme, C. (2016). The development of executive function and language skills in the early school years. *Journal of Child Psychology and Psychiatry*, 57(2), 180-187.

<https://onlinelibrary.wiley.com/doi/full/10.1111/jcpp.12458>

Hughes, C., & Devine, R. (2019). For better or for worse? positive and negative parental influences on young children's executive function. *Child Development*, 90(2), 593-609.

<https://doi.org/10.1111/cdev.12915>

Lincoln, C. R., Russell, B. S., Donohue, E. B., & Racine, L. E. (2017). Mother-child interactions and preschoolers' emotion regulation outcomes: Nurturing autonomous emotion regulation. *Journal of Child and Family Studies*, 26(2), 559-573.

<https://doi.org/10.1007/s10826-016-0561-z>

Lonigan, C. J., Spiegel, J. A., Goodrich, J. M., Morris, B. M., Osborne, C. M., Lerner, M. D., & Phillips, B. M. (2017). Does preschool self-regulation predict later behavior problems in general or specific problem behaviors? *Journal of Abnormal Child Psychology*, 45(8),

1491-1502. <https://doi.org/10.1007/s10802-016-0260-7>

- Matte-Gagné, C., Bernier, A., & Lalonde, G. (2015). Stability in maternal autonomy support and child executive functioning. *Journal of Child and Family Studies*, 24(9), 2610-2619. <https://doi:10.1007/s10826-014-0063-9>
- Moffett, L., & Morrison, F. J. (2019). Off-task behavior in kindergarten: Relations to executive function and academic achievement. *Journal of Educational Psychology*. Advance online publication. <https://doi.org/10.1037/edu0000397>
- Montroy, J. J., Bowles, R. P., Skibbe, L. E., McClelland, M. M., & Morrison, F. J. (2016). The development of self-regulation across early childhood. *Developmental Psychology*, 52(11), 1744–1762. <https://doi.org/10.1037/dev0000159>
- Moreno, A. J., Shwayder, I., & Friedman, I. D. (2017). The function of executive function: Everyday manifestations of regulated thinking in preschool settings. *Early Childhood Education Journal*, 45(2), 143-153. <https://doi.org/10.1007/s10643-016-0777-y>
- Nesbitt, K. T., Farran, D. C., & Fuhs, M. W. (2015). Executive function skills and academic achievement gains in prekindergarten: Contributions of learning-related behaviors. *Developmental Psychology*, 51(7), 865-878. <https://doi.org/10.1037/dev0000021>
- Raver, C., & Blair, C. (2016). Neuroscientific insights: attention, working memory, and inhibitory control. *The Future of Children*, 26(2), 95-118. <https://eric.ed.gov/?id=EJ1118545>
- Razza, R. A., Bergen-Cico, D., & Raymond, K. (2015). Enhancing preschoolers' self-regulation via mindful yoga. *Journal of Child and Family Studies*, 24(2), 372-385. <https://doi.org/10.1007/s10826-013-9847-6>

- Russell, J. (2011). From child's garden to academic press: The role of shifting institutional logics in redefining kindergarten education. *American Educational Research Journal*, 48(2), 236-267. <https://doi.org/10.3102/0002831210372135>
- Sawyer, A. C. P., Miller-Lewis, L., Searle, A. K., Sawyer, M. G., & Lynch, J. W. (2015). Is greater improvement in early self-regulation associated with fewer behavioral problems later in childhood? *Developmental Psychology*, 51(12), 1740-1755. <https://doi.org/10.1037/a0039829>
- Schmitt, S., Purpura, D., & Elicker, J. (2018). Predictive links among vocabulary, mathematical language, and executive functioning in preschoolers. *Journal of Experimental Child Psychology*, 180, 55-68. <https://doi.org/10.1016/j.jecp.2018.12.005>
- Viglas, M., & Perlman, M. (2017). Effects of a mindfulness-based program on young children's self-regulation, prosocial behavior and hyperactivity. *Journal of Child and Family Studies*, 27(4), 1150-1161. <https://doi.org/10.1007/s10826-017-0971-6>
- Williams, K. E. (2018). Moving to the beat: Using music, rhythm, and movement to enhance self-regulation in early childhood classrooms. *International Journal of Early Childhood*, 50(1), 85-100. <https://doi.org/10.1007/s13158-018-0215-y>
- Zachariou, A., & Whiting, D. (2017). A new context affording for regulation: The case of musical play. *International Journal of Educational Psychology*, 6(3), 212-249. <https://eric.ed.gov/?q=music+self+regulation&pr=on&ft=on&id=EJ1159063>