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Influences on Children's Executive Function Skills Development

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Abstract

The development of executive function (EF) skills in young children is influenced by multiple factors; therefore, this paper focused on the association between home and school environmental influences. EF skills include working memory, inhibitory control, and attention or set-shifting cognitive abilities (Garon et al., 2008, as cited in Bernier, Carlson, Deschênes, & Matte-Gagné, 2012). It is important for parents and teachers to understand what EF skills are so these skills can be modeled for children. Parents and teachers also need to provide opportunities for children to practice these skills. With support from parents and other caregivers, children can learn to regulate emotions, behaviors, and cognitive states within the first three years, which leads to developmental changes from infancy and childhood to voluntary regulation of emotions and actions by the child (Williams & Berthelsen, 2017). Research was analyzed and synthesized for this paper providing an overview of literature on EF skills of young children, focusing on home and school environmental influences. Previous EF studies offered insight on home and school environments, positive and negative effects on EF development (academics and behavior), and suggested interventions. Understanding the relationship between developing EF skills, factors influencing them, and the three main EF components allows parents and teachers the opportunity to assist children in the development of EF skills. Research connecting regulatory competencies with academic achievement, social-emotional competence, and behavioral adjustment pointed out the importance of familial factors that can influence the development of self-regulation in young children. This knowledge can assist with prevention and intervention strategies for helping children with self-regulation (Zeytinoglu, Calkins, Swingler, & Leerkes, 2017).

Keywords: executive function, self-regulation, parental influence, developmentally appropriate practices (DAP), home environment, school environment

Chapter One: Introduction

Executive function (EF) abilities appear in early infancy (Blair, 2002; Zelazo & Carlson, 2012), develop throughout childhood and adolescence, and continue into adulthood (as cited in Ahmed, Tang, Waters, & Davis-Kean, 2018). Researching EF skills and possible interventions for assisting children who lack these skills makes educators better equipped for identifying these characteristics; thereby, allowing educators opportunities to assist children with developing EF skills. The connection between home and school environments plays a crucial role in how children learn and develop EF skills. When EF skills are not practiced at home, the school needs to provide modeling of these skills and opportunities for children to practice. A supportive, social environment is essential for children's psychological development (Ryan, Deci, & Vansteenkiste, 2016); therefore, encouragement must be provided to help children attain a true sense of self, regarding emotions and behaviors (as cited in van der Kaap-Deeder, Vansteenkiste, Soenens, & Mabbe, 2017). Understanding EFs and how they work provides parents and educators a better understanding of children's cognitive abilities.

A literature review regarding the development of children's EF skills is analyzed in Chapter Two. The first section in Chapter Two will discuss home environmental influences that affect the development of children's EF skills, such as maternal, paternal, siblings, and socioeconomic status (SES). Previous works (Anderson, 2002; Carlson, 2005; Garon, Bryson, & Smith, 2008) mentioned that EF skills (working memory, inhibitory control, and attention flexibility) are important for developing early academic skills, which help children adapt to classroom environments (as cited in Fuhs, Nesbitt, Farran, & Dong, 2014). The second section in Chapter Two will provide insight on influences in the school environment, such as teachers and peers. Effects of EF skills on behavior and academics are also discussed. Children entering

school with poor EF skills tend to have negative experiences with peers due to difficulties regulating emotions and behaviors. This can create internalizing problems stemming from frustration (Wang & Zhou, 2019).

Following the discussion of home and school environments, the focus will switch to the discussion, application, and future studies involved in the development of EF in children. Due to multiple influences on an individual's EF skills, the opportunities for future studies seem endless. Many different variables can be modified within a study, such as age, gender, socioeconomic status, etc. After methodology and data results from previous studies were compared, it was apparent that adults need to take the initiative to assist in the development of EF skills when working with children. Children observe choices and behaviors made by adults; therefore, as role models, adults should model effective EF skills.

The future of programming and practice in early education regarding current research and best practices (Concordia University, 2021) is to gain a better understanding of what is developmentally appropriate for children and ways for educators to assist in the development of early learning skills. Understanding factors that influence the development of EF skills in young children is beneficial because EF skills affect academic achievement and behavior. The research question guiding this paper is, "In what ways can home and school environments influence the development of children's executive function skills in early childhood?"

History of Executive Functioning

Executive function (EF) is a broad term used to describe a variety of cognitive processes. Some of these processes, which occur through the frontal lobes, include self-regulation (self-monitoring), working memory, inhibitory control, and planning (Goldstein, Naglieri, Princiotta, & Otero, 2014). A case study from the 1840's involving a railroad construction foreman named

Phineas Gage prompted brain researchers to investigate further into frontal lobes and the connection to EF (Goldstein et al., 2014). Phineas Gage was impaled through his frontal lobe by a large iron rod (Ratiu & Talos, 2004), which devastated most of his left frontal lobe (as cited in Goldstein et al., 2014). Phineas survived this accident, yet after a period of recovery friends and family began noticing a change in Phineas' personality and behavior. Phineas' behavior was described as hyperactive or disinhibited (Pribram, 1973), which is often the case in people with prefrontal cortex damage (as cited in Goldstein et al., 2014). Research regarding the prefrontal cortex continues to be studied to this day. The term cognitive control was first coined in 1975 by psychologist Michael Posner. Posner believed there was a separate executive branch responsible for the ability to focus attention on specific aspects of the environment (Goldstein et al., 2014). Reynolds and Horton (2006) explained how EFs were distinct from basic knowledge, due to EFs providing the capacity for people to plan and do things. Basic knowledge was connected more to the retention and organization of information (as cited in Goldstein et al., 2014).

Components of Executive Functioning

EF and self-regulation are terms used throughout this paper. Self-regulation according to Blair and Diamond (2008) is the overarching term referring to an individual's ability to adapt emotionally, cognitively, and motivationally (as cited in Mills et al., 2019). Self-regulation encompasses temperamental characteristics (Liew, 2012) and cognitive skills, which are often cited as EFs (as cited in Mills et al., 2019). EFs consist of three fundamental cognitive processes (Blair & Ursache, 2011; Garon, Bryson, & Smith, 2008), which include working memory, inhibitory control, and cognitive flexibility also referred to as attention flexibility (as cited in Mills et al., 2019). The following section will discuss the three main components of EF.

Working Memory

According to Baddeley (1986) working memory allows information to be temporarily stored during activities consisting of more cognitive demands (as cited in Peng & Fuchs, 2017). Working memory is essential to children's academic activities consisting of multiple steps (Shah & Miyake, 1996) in which students need to remember each step to complete the activities (as cited in Peng & Fuchs, 2017). Diamond (2013) defined working memory as the ability to mentally retain information and use the information later (as cited in Dias, Trevisan, León, Prust, & Seabra, 2017). Activities that engage working memory assist with the development of EF skills. Working memory, according to Baddeley (1992), can be associated with language comprehension, learning, and reasoning tasks (as cited in Chung, Weyandt, & Swentosky, 2014).

Inhibitory Control

Barkley (2012) explained inhibitory control as the ability to subdue an immediate action to accomplish a specific goal (as cited in Beattie, Schutte, & Cortesa, 2018). Diamond (2013) explained inhibitory control as the ability to inhibit attention when it comes to distractions (as cited in Dias et al., 2017). Inhibitory control is hard to implement in a classroom setting when students need to focus on a specific task without being side-tracked with what is seen or heard in the background. Inhibitory control can also be difficult when it comes to taking turns.

Cognitive Flexibility

Cognitive flexibility is defined as being able to see things from different perspectives (Diamond, 2013) and the ability to shift attention to other stimuli (as cited in Dias et al., 2017). Miyake et al. (2000) described another term used to describe the ability to flexibly switch between tasks called set-shifting (as cited in Chung et al., 2014). Ionescu (2012) mentioned that

cognitive flexibility assists individuals to pursue complex tasks and find adaptable solutions to changing situations.

Conclusion

EF development begins in infancy and continues into early childhood, adolescence, and young adulthood (Center on the Developing Child, 2012). A primary influence for infants and preschool children's EF development includes interactions with caregivers and the environment (Otero & Barker, 2014). During infancy, the EF skills connected with inhibitory control, set-shifting, and cognitive flexibility can be seen (Otero & Barker, 2014). Preschoolers begin to show improvements in EF skills, such as inhibition, working memory, and planning abilities, which assists in the preparation of preschoolers taking a more active role in learning and academic tasks (Otero & Barker, 2014). Research findings demonstrated that EF skills begin to develop in infancy; therefore, parents play a vital role in the development of EF skills during this stage (Center on the Developing Child, 2012). As children enter the school environment teachers begin to play a vital role in children's EF development as well. With a better understanding of EF components and how they work, parents and teachers can assist children with the core EF skills needed throughout the children's lives. Positive and negative associations of home and school environments, such as parents, siblings, socioeconomic status, teachers, and peers, will be explained in Chapter Two.

Chapter Two: Review of Literature

This literature review analyzed empirical research studies, which focused on the development of young children's executive function (EF) skills. Researchers included in this literature review have added to the growing body of literature on EF and circumstances that affect the development of EF skills. Additionally, researchers included effects that emerge from a lack of EF skills, such as speaking out of turn, not following directions, and the inability to manage emotions (Bassett, Denham, Wyatt, & Warren-Khot,, 2012, as cited in Mills et al., 2019); therefore, assisting with answering the question, "In what ways can home and school environments influence the development of children's executive function skills in early childhood?" This chapter will describe home environmental influences (maternal, paternal, sibling, and socioeconomic status) and how stimuli in the home can assist or hinder the development of EF skills from infancy through early childhood. Influences in the school environment (teachers and peers) will be described along with the effects of EF skills on behavior and academic achievement. By studying the influences of home and school environments, connections will be made to determine how children's EF skills are developed in early childhood.

Influences on Executive Function Skills

Stachel (2015) discussed internal factors that may impact the development of EF skills, such as intellectual disabilities, physical or mental health problems, or learning differences. A learning difference mentioned by Stachel (2012) included children with attention deficit hyperactivity disorder (ADHD), since children with ADHD often have problems with planning and prioritizing. Stachel (2015) also discussed external factors that may impact EF skill development. These factors include socioeconomic status (economic hardship),

abusive/neglectful caregivers, violence within the home or community, unstable surroundings, and insufficient access to healthy food. Although all the factors listed above provide ample research opportunities, external factors dealing with home and school environments are the focus of this paper.

Home Environment

EF skills begin in infancy; therefore, parent-child relationships are arguably the most important for setting positive examples for young children (Bernier et al., 2012). Since home environments differ in many ways this section will discuss the effects of positive and negative home environments and how EF development is affected. Sameroff (2010) proposed early self-regulation as a neurobiological process supported by caring and responsive caregivers (as cited in Williams & Berthelsen, 2017). Shonkoff and Bales (2011) noted how a foundation, whether sturdy or fragile, was based on children's relationships and interactional processes with caregivers, which are essential to children's future capabilities (as cited in Williams & Berthelsen, 2017). Carlson (2009) and Bernier et al. (2012) also declared the importance of social interactions regarding EF development and the association between children and primary caregiver relationships and opportunities to support children's developing EF skills (as cited in Towe-Goodman et al., 2014). Williams and Berthelsen (2017) declared a child's predisposition regarding greater or less concern for others was based on early experiences within the home environment. Dunsmore and Halberstadt (1997) and Thompson and Meyer (2007) explained how daily exposure to emotions (negative and positive) within family interactions can pose problems regarding the development of effective schemas; therefore, making children unsure of how to regulate emotions (as cited in Speidel, Wang, Cummings, & Valentino, 2020). Bernier, Carlson, Deschênes, and Matte-Gagné (2012), Calkins (2011) and Sameroff (2010) understood

that caregiver support can serve as an external regulator regarding children's attention, emotions, and behaviors; thereby, providing children opportunities to develop the capabilities needed to regulate themselves (as cited in Zeytinoglu et al., 2017). Positive and negative associations between parental and sibling influences on children's EF development are discussed in the following section.

Parental Influence

Sixty-two families from a Canadian metropolitan area participated in a qualitative study conducted by Bernier et al. (2012). Bernier et al. (2012) investigated a possible connection between the quality of early caregiving environments (at one and two-years-old) and EF performance (at three-years-old). Families participated in five home and lab visits (12, 15, 18 months old, 2 and 3 years of age). Most mothers (87%) and fathers (79%) in the study were Caucasian; mostly middle-class, and over half of the parents had a college degree. Child-centered tasks were videotaped showing mother-infant interactions and father-child free-play. Assessments were used to gather data on maternal sensitivity, child attachment security, child EF at ages two and three, and child verbal ability with receptive vocabulary. Primary caregivers and children were assessed on the quality of parent-infant interactions and how secure the mother-child attachment relationship was.

Using a longitudinal analysis, Blair, Raver, Berry, and the Family Life Project Investigators (2014) contrasted two analytical approaches to find how parents influence children's EF development. A sample of 1,571 low-income families with children between 36 and 60 months old were assessed using annual in-home visits. During the in-home visits primary caregivers completed an income and demographic survey. A battery of six EF tasks was administered to children to assess working memory, inhibitory control, and attention shifting.

Parent responsiveness and cognitive stimulation were measured using the Home Observation for Measurement of the Environment scale (HOME; Caldwell & Bradley, 1984) and parenting sensitivity and stimulation were measured using observation ratings during structured parent-child interaction activities (Blair et al., 2014).

A longitudinal study conducted by Lagasse et al. (2016) used a developmental psychopathology approach to gain a better understanding of how internalizing behaviors, such as learning disabilities and physical or mental health problems and externalizing behaviors, such as socioeconomic status and unstable surroundings could evolve from early and middle childhood experiences into adolescence. This study added to existing research by examining the effects of caregiver stress on children's behavior problems over time. Participants in this study included 1,388 children with prenatal drug exposure. Demographics of this study included African American (76.6%), Caucasian (15.9%), Hispanic (6.3%), children marked as other (1.2%). Mothers in this study dealt with substance abuse prenatal and postnatal and had other stressors impacting their caregiving skills such as poverty, depression, and domestic violence (Lagasse et al., 2016). The average maternal age used in this study was 28.3 years. The study consisted of single mothers (80.6%), mothers who did not complete high school (39.3%), and mothers socioeconomically low (22.3%). Lagasse et al. (2016) listed percentages regarding prenatal substance exposures: cocaine (43.7%), opiates (8.4%), tobacco (53.9%), marijuana (23.6%) and alcohol (59.4%). Behavioral and EF measures were used to collect data on children; psychosocial risk factors (such as socioeconomic status, parenting stress, and ongoing drug use) were used to collect data on caregivers (Lagasse et al., 2016). The Child Behavior Checklist (CBCL) was used to measure internalizing and externalizing behavior. Caregiving stress was assessed using measures, such as the Brief Symptom Inventory (BSI; Derogatis, 1993), Beck

Depression Inventory (BDI; Beck, Steer, & Brown, 1996), the Parenting Stress Index (PSI; Abidin, 1983), Caretaker Inventory of Substance Abuse (CISU; Shankaran et al., 1996), and the Caregiving Stress Summary Score, which was calculated at each developmental period (Lagasse et al., 2016). The purpose of this study was to understand how caregiver stress is related to the development of EF skills, which connected to internalizing and externalizing behavior.

Another longitudinal study (based on information from The Family Life Project) was conducted by Towe-Goodman et al. (2014) in rural Pennsylvania and South Carolina using a sample of 1,292 families with chronic poverty situations. This study examined the sensitivity of mothers and fathers during infancy and toddlerhood and the connection to EF skills at three years old. During the study research assistants performed in-home interviews and observations at different age intervals. Infant general cognitive ability was measured using the MDI assessment (Bayley, 1993). Child EF tasks consisted of Working Memory Span (working memory), Somethings the Same Game (attention shifting), Silly Sounds Stroop (inhibitory control), Spatial Conflict (inhibitory control), and Animal Go/No-Go (inhibitory control). Parenting quality was measured using observations of mothers and fathers playing with seven-and twenty-four-month-old children during ten-minute play activities, which occurred on different days.

A quantitative study conducted by van der Kaap-Deeder et al. (2017) focused on three important socialization figures in children's lives: mothers, teachers, and siblings and the relationship between daily autonomy support and psychological control. Participants consisted of 154 Dutch speaking families in Belgium with at least two elementary school children between eight and twelve years old. Children were asked to fill out a diary questionnaire each day (during five consecutive school days) to record daily autonomy support and psychological control, need satisfaction and frustration, and well-being and ill-being regarding mother, teacher,

and sibling relationships (van der Kaap-Deeder et al., 2017). Measures in this study included person-level measures, using a Dutch version of the Autonomy Support Scale of the Perceptions of Parents Scale (POP; Grolnick et al., 1991) and the Psychological Control Scale-Youth Self Report (PCS-YSR; Barber, 1996). To measure autonomy support and psychological control (mother, teacher, and sibling) the POPS and PCS-YSR were assessed again. Psychological need satisfaction and need frustration were measured using The Basic Psychological Need Satisfaction and Need Frustration scale (Chen et al., 2015). Well-being and ill-being were assessed using a short scale from the Positive and Negative Affect Schedule for Children (Laurent et al., 1999). Multiple sources of emotional support (mothers, teachers, siblings) were studied; therefore, providing information on the importance of parents when introducing societal norms and providing the guidance necessary for children to be responsible for their own functioning (van der Kaap-Deeder et al., 2017). The teacher's role included the development of cognitive skills and being a source of emotional support, especially during difficulty with socially adjusting to school. Scholte et al. (2001) stated that siblings are important influencers on children's development regardless of whether the influence is positive or negative (Buhrmester & Furman, 1990; as cited in van der Kaap-Deeder, 2017).

Zeytinoglu et al. (2017) designed a qualitative study using direct and indirect connections between maternal emotional support and how these connections affect children's self-regulation (executive functioning and behavioral regulation). Participants included 278 children and primary caregivers (96% mothers). Child demographics consisted of European American (59%), African American (30%), Hispanic (6.5%), and other ethnicities (11%). Maternal effortful control was measured using the Adult Temperament Questionnaire Short Form (ATQ; Evans & Rothbart, 2007). Maternal effortful support was measured using seven-minute observations of

mother-child interactions, which included semi-structured planning and problem-solving activities. Child EFs were assessed using Animal Go/No-Go (inhibitory control), Numbers Reversed test (working memory) from the Woodcock-Johnson III (Woodcock, McGrew, & Mather, 2001), and The Dimensional Card Sort task (cognitive flexibility). A teacher report of child behavioral regulations included attention control, which was assessed using The Child Behavior Checklist Teacher Report Form (Achenbach & Rescorla, 2001), work habits were reported using The Mock Report Card, and discipline/persistence was measured using the Discipline/Persistence subscale of the Learning Behaviors Scale (McDermott, 1999; Rikoon, McDermott, and Fantuzzo, 2012).

Key Findings. Results from the Bernier et al. (2012) study suggested parental behavior and child attachment composite scores were connected to how the child performed on EF tasks (working memory and cognitive flexibility). Bernier et al. (2012) discussed the possibility that securely attached infants have inner working models, which let the child know when a caregiver is available to help if needed; therefore, allowing the child more exploration time due to fewer cognitive resources being used to monitor caregiver's availability. Exploration time offers opportunities for children to develop self-regulation skills, such as problem-solving and flexibly adjusting impulses based on the play situation (Sroufe, 2005, as cited in Bernier et al., 2012). This research helped explain parent-child relationships and the possible connection with children's EF development. Findings from the Blair et al. (2014) study provided information on the quality of care given by parents, such as sensitivity and responsiveness, and the effect it has on EF development. Blair et al. (2014) stated that the developmental theory emphasized how the environment shapes child outcomes and how the child shapes the environment where the development is taking place. Results from Lagasse et al. (2016) showed higher levels of drug

exposure (prenatal) led to greater internalizing behaviors in children ages five and nine, but not children aged thirteen. An assumption made by Lagasse et al. (2016) was that thirteen-year-olds were able to compensate for the effects of the drug exposure.

Findings suggested that mothers and fathers who show sensitivity while caring for young children contributed to the development of early EF skills (Towe-Goodman et al., 2014). Although mothers and fathers approach parenting in different ways, both play a complementary role in EF development (Towe-Goodman et al., 2014). The study conducted by van der Kaap-Deeder et al. (2017) found that mothers, teachers, and siblings play a part in children's well-being or ill-being, which can affect the basic psychological needs (autonomy, competence, and relatedness); therefore, affecting children's satisfaction or frustration regarding socialization. Although findings from the Zeytinoglu et al. (2012) study indicated that maternal emotional support was not linked to EF and behavioral support, it was suggested that maternal emotional support could be a key contributor to various aspects of a child's self-regulation abilities (Zeytinoglu et al., 2012). Data from the Zeytinoglu et al. (2012) study can be used to understand how maternal emotional support affects different areas of a child's self-regulation based on the extent of maternal emotional support.

Limitations. Specific results could not be generalized to families with lower socioeconomic status (SES) due to most parents being middle-class and over half having a college degree; therefore, creating a limitation in the study (Bernier et al., 2012). The researchers' interpretation was restricted due to parenting measures being repeated the same way over time; therefore, only containing information the researchers were interested in, which created another limitation (Blair et al., 2014). Limitations in the Lagasse et al. (2016) study included not being able to assess the same EF tasks at each age, focusing on multiple drug effects

rather than a single drug, and due to prenatal substance exposure, all the children in the study were high risk. A limitation noted by Towe-Goodman et al. (2014) was that the sample consisted of families residing in poor rural areas where the father resided with the mother during the child's first two years; therefore, leaving it unclear as to how more advantaged populations or families with fathers not residing at home would compare. A limitation in the van der Kaap-Deeder et al. (2017) study consisted of missing data regarding father autonomy support. Limitations in the study by Zeytinoglu et al. (2017) included the single self-report measure used to measure maternal effortful control, and the measure of maternal caregiving behavior assessed during a single problem-solving activity in laboratory setting; therefore, mother-child interactions during emotionally frustrating tasks were not reflected.

Sibling Influence

Hill and Palacios (2019) explored the connection between kindergarten-age children's cognitive self-regulation and the influence of having an older sibling. Hill and Palacios (2019) utilized data from the Early Childhood Longitudinal Study: 2011 Kindergarten cohort (ECLS-K-2011). Participants in the ECLS-K-2011 included 17,020 kindergarten-age children between the ages of 45 and 94 months. The ethnically diverse sample consisted of 49.9% White, 14.1% Black, 26.9% Hispanic, and 9,1% Asian. Dichotomous variables were used to identify older sibling age range and gender which coded information, such as focal child had no siblings, or had at least one older sister, etc. Working memory was assessed using the Numbers Reversed subtest from the Woodcock-Johnson III tests of Cognitive Abilities (Woodcock, McGrew, & Mather, 2001). The Dimension Change Card Sort Task (DCCS; Zelazo, 2006) measured cognitive flexibility and inhibitory control.

Key Findings. Findings from the study revealed that having an older sibling was positively connected with kindergarten working memory, yet only marginally connected with kindergarten cognitive flexibility (Hill & Palacios, 2019). Another finding stated that having an older sister positively connected with both working memory and cognitive flexibility. Findings reinforced the significance that siblings have on scaffolding social interactions and the development of cognitive self-regulation in young children (Hill & Palacios, 2019).

Limitations. Limitations in this study included limited information on siblings and how the variables were coded, which led to the exclusion of children with only younger siblings and no older siblings (Hill & Palacio, 2019).

Socioeconomic Influence

A quantitative study conducted by Kao, Nayak, Doan, and Tarullo (2018) investigated the connection between parent and child EF and the association with parental characteristics and socioeconomic indicators. Participants of this study consisted of 117 preschool children (aged 3.5 to 4.5 years old) and primary caregivers (112 mothers and five fathers). Demographics included 50.4% European Americans, 16.2% Asian, 3.4% African American, 6.0% Hispanic, 1.7% Middle Eastern, and 22.2% multiracial. Kao et al. (2018) used procedures such as Dimensional Charge Card Sort, Flanker, parent questionnaires, picture vocabulary tests, and receptive language tasks to gather data for the study.

Key Findings. Results from the study suggested that socioeconomic status (SES) may be connected to the quality of parent scaffolding regarding the parent's ability to provide opportunities for children's EF development (Kao et al., 2018). Lower SES families may have fewer opportunities to interact with children due to SES factors such as exhaustion and working multiple jobs, which means less time is spent at home (Kao et al., 2018).

Limitations. Home learning information was not collected, and a behavioral parenting measure was not used; therefore, creating limitations.

Suggested Interventions for Home Environment Influences

Bernier et al. (2012) suggested targeting the family context during early EF development; therefore, improving young children's EF development. Bernier et al. (2012) discussed how assessments of early childhood caregiving environments could be useful in detecting social antecedents during a child's EF development. Examining developmental changes in parenting (during early childhood) could assist in the development of interventions to support children's cognitive functions by targeting areas of parenting that decline or increase with age (Blair et al., 2014). Lagasse et al. (2016) mentioned the importance of tailoring interventions to the family rather than individual drug-exposed children. To help reduce internalizing behavior in young children, Lagasse et al. (2016) also suggested research to focus on parental stress and psychopathology along with children's externalizing behaviors. Towe-Goodman et al. (2014) declared that targeting mothers' and fathers' abilities to provide sensitive care could enhance the quality of parent-child relationships due to the implications for developing flexible and goal-oriented behaviors; therefore, improving EF skills. Interventions aimed towards improving caregivers' effortful control could enhance the caregivers' ability to emotionally support child self-regulation outcomes (Zeytinoglu et al., 2017). Hill and Palacio (2019) mentioned the importance of considering older sibling age and gender when developing early childhood interventions, especially when young children and older children are paired to work together.

School Environment

Academic learning activities provide opportunities for children to practice skills associated with EF, such as problem-solving, working memory, inhibitory control, and attention

shifting (Best, Miller, & Jones, as cited in Abry et al. (2018). Children who lack skills needed to focus on academic work often have difficulties participating in classroom activities (Blair, 2002); therefore, these children are more at risk for lower academic achievement (as cited in Portilla et al., 2014). Portilla et al. (2014) also discussed how early experiences in school play a crucial role in shaping children's academic futures.

Teacher Influence

A quantitative study performed by Abry et al. (2018) used data from the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development (SECCYD). A model-building approach was used for this study of 1,073 first grade children and teachers. Children in the study were between six and seven years of age. Demographics of child participants consisted of 82% White, 11% Black/African American, 6% Hispanic, 1% Asian/Pacific Islander, and 5% other. The study examined whether classroom-level adversity (CLA) was related to teaching practices (classroom management, controlling instruction, and amount of academic instruction) and if CLA directly assessed student literacy and math skills in first and third grade and EF in third grade (Abry et al., 2018). The Problems Preparing Children for Academic Success scale was used to measure classroom-level adversity. To assess teaching practices, trained observers used the Classroom Observation System (COS-1; NICHD ECCRN, 2002). A seven-point scale was used to assess classroom management and controlling instruction. Observers recorded the amount of academic instruction during a 30-minute timeframe. Literacy and math skills were assessed using the Woodcock-Johnson Psychoeducational Battery (WJ-R; Woodcock & Johnson, 1989). Children's EF was measured using the Tower of Hanoi task (Klahr & Robinson. 1981), which assessed working memory, attentional control, and planning/problem-solving skills (Abry et al., 2018).

A longitudinal study conducted by Portilla, Ballard, Adler, Boyce, and Obradović (2014) investigated the importance of self-regulation and school engagement and whether quality teacher-child relationships affect academic competence. Participants included 338 kindergarteners from twenty-nine classrooms (six public schools) in the Bay Area of California. A diverse sample of children included Caucasian (43%), African American (19%), Asian (11%), Latino (4%), multiethnic (22%), and other (2%). Measures included parent and teacher reports regarding levels of children's impulsivity and inattention, school engagement, and academic competence to see multiple perspectives of children's behavior (Portilla et al., 2014). A shortened version of the Student-Teacher Relationship Scale (STRS; Pianta, 1996) was used to assess teacher-child relationship quality. Scales from The MacArthur Health and Behavior Questionnaire (HBQ; Armstrong & Goldstein, 2003) were used to measure inattention/ impulsivity, school engagement, and academic competence (Portilla et al., 2014). Inattention/impulsiveness was measured using the Inattention and Impulsivity subscale from the HBQ (Armstrong & Goldstein, 2003). School engagement was assessed using the School Engagement subscale from the HBQ (Armstrong & Goldstein, 2003), which measured intrinsic motivation and school liking. Academic competence was measured using the Academic Competence subscale from the HBQ (Armstrong & Goldstein, 2003), which assessed school functioning (Portilla et al., 2014).

Shiu, Wang, and Chen (2020) used a quasi-experimental design to test whether a small-scale intervention improved self-regulation. Ninety-four, economically diverse, public school children in Taiwan participated in this study. The average age of participants was 67 months. The treatment classroom consisted of 27 children. Three control groups were used in this study. Control classroom one had 17 participants, control classroom two had 22 participants, and

control classroom three had 28 participants. Assessments, interviews, and observations were used during this study to try and connect with Vygotsky's theory (1978) and how certain psychology tools can help promote children's self-regulation; therefore, making language and mediators critical for children's mental development (Shiu et al., 2020). Self-regulation measures consisted of the Head-Toes-Knee-Shoulder task (HTKS; Ponitz et al., 2008), which measured attention, working memory, and inhibitory control. Intervention activities included the implementation of simple mediators into the classroom routine. Mediators included a daily routine chart, songs for clean-up time, students creating play plans, children taking turns holding a microphone to show whose turn it was to speak, and ear cards to help children know when to listen and concentrate during storytelling activities (Shiu et al., 2020). Seven circle games, which included the Chewing Gum Game, Red Light, Green Light, Falling, Falling Down, Freeze Game, Simon Says, Drum Beats Game, and Poker Card Game were included in the intervention. Other topics touched upon in this study included Tools of the Mind (Bedrova & Leong, 1996), the Montessori Curriculum (1949), and various self-regulation activities, such as play planning, peer storytelling, and pattern movement games (Shiu et al., 2020)

Key Findings. Results from the Abry et al. (2018) study showed that classroom-level adversity was negatively related to the quality of classroom management, yet positively associated with controlling instruction. Classroom-level adversity was negatively related to the amount of academic instruction and significantly negative with grade one literacy and grade three EF (Abry et al., 2018). This study showed how student adversity characteristics in elementary classrooms influenced children's academics and EF development. The study by Portilla et al. (2014) suggested that self-regulation skills influenced teacher-child conflict; thereby, placing students at risk for negative teacher relationships and lower academic

functioning. Results from Shiu et al. (2020) suggested small-scale interventions using external mediators and pattern play movements can improve self-regulation in young children. Using external mediators, such as play planning and clean-up songs allowed children the opportunity to be self-directed; therefore, children were more focused on work (Shiu et al., 2020). The article by Shiu et al. (2020) provided strategies for helping with self-regulation (play planning, using a microphone for taking turns, etc.).

Limitations. Limitations mentioned by Abry et al. (2018) included the possibility that teachers with more controlling styles and weaker management had inflated CLA estimations. The likelihood of bidirectional influence may exist due to the absence of repeated measures involving teaching practices and CLA (Abry et al., 2018). Portilla et al. (2014) mentioned that measures regarding teacher's personal social-emotional competence were not included in the study. Another limitation mentioned by Portilla et al. (2014) was how the study included a decreased response rate due to the study being longitudinal. Although the study was limited since academic outcomes were not assessed, teachers still noticed growth in language, cognitive, and social cooperation (Shiu et al., 2020).

Peer Influence

Montroy, Bowles, and Skibbe (2016) organized a quantitative study aimed to replicate and extend literature regarding peer effects in preschool classrooms. Participants included 629 preschoolers from four Midwestern preschools who were assessed as part of the Michigan Longitudinal Study of Early Literacy Development. Measures used included the Head-Toes-Knees-Shoulder task (HTKS; Ponitz et al., 2008) and the Woodcock Johnson Test of Achievement (Woodcock & Mather, 2001). These methods assessed self-regulation skills, literacy skills, and the self-regulation skills of classroom peers. Montroy et al. (2016)

contributed to existing literature by showing the importance of classroom peers and how they play a key part in school readiness skills. Individual self-regulation growth occurred for lower self-regulated students who were exposed to higher self-regulated students. Students struggling with self-regulation needed higher self-regulated students to model self-regulation skills, which allowed self-regulation to be practiced and developed (Montroy et al., 2016).

A longitudinal study performed by Wang and Zhou (2019) examined the association of peer difficulty and poor academic performance to EF skills and internalizing problems for school school-age children. Data was drawn from the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development (NICHD Early Child Care Research Network, 1999). Measures in this study included tasks such as the continuous performance task (Rosvold, Mirsky, Sarason, Bransome, & Beck, 1956), which assessed inhibition, the Memory for Sentences subtest from the Woodcock-Johnson Psychoeducational Battery (Woodcock & Johnson, 1989), which assessed working memory, and the Tower of Hanoi task (Welsh, 1991), which assessed planning. Peer difficulty was assessed using the Relationship with Peers questionnaire (Kochenderfer & Ladd, 1996; Ladd & Profilet, 1996), which parents and teachers completed. The Academic Rating System (Meisels, Bickel, Nicholson, Xue, &Atkins-Burnett, 2001) measured academic performance in third, fourth and fifth grades. Children who begin school with poor EF skills often have negative experiences with peers and low academic achievements, which can cause internalizing problems (Wang & Zhou, 2019). Possible deficits in self-regulation may interfere with a child's ability to regulate emotion and cognition; therefore, making students vulnerable to stress and anxiety (Wang & Zhou, 2019). Wang and Zhou (2019) added that students with deficits in EF might fail to meet important goals, such as building positive peer relationships and performing well academically.

To engage in positive peer interactions, children need to inhibit emotions and behaviors that are inappropriate, such as being aggressive or mishandling tempers, which are all dependent on EF skills (Wang & Zhou, 2019).

Key Findings. Findings from Montroy et al. (2016) suggested children's acquisition of higher levels of self-regulation and literacy skills is often disrupted by peers with lower levels of self-regulation. Lower-level self-regulated students consumed more teacher resources and interventions, which lead to fewer opportunities for cooperative play and learning activities (Montroy et al., 2016). Individual children accessed more learning content when peers listened and followed classroom rules (Montroy et al., 2016). In contrast, classrooms consisting of multiple children with lower self-regulation skills have more disruptions; thereby, distracting more highly skilled students to disengage from learning since the teacher needs to intervene and focus attention on the disruptions (Lavy, Paserman, & Schlosser, 2011; as cited in Montroy et al., 2016). Findings from Wang and Zhou's (2019) study stated the importance of children's EF skills for identifying how EF impacts school-age children's internalizing problems. Understanding the connection between EF skills and internalizing problems allowed parents and teachers to assist children with managing and implementing EF skills (Wang & Zhou, 2019). Modeling positive EF skills at home and school, provides children opportunities to practice and understand how EF skills work; therefore, assisting children on how to deal with peer interactions (Wang & Zhou, 2019).

Limitations. A limitation mentioned in the Montroy et al. (2016) study was the specific focus on the effect of peers even though past research has demonstrated that teachers and the quality of instruction play a part in school readiness and development. Limitations noted in this

study included the sample size and how the assessment of the EF component involving the ability to switch flexibly between tasks was not assessed (Wang & Zhou, 2019).

Executive Function Skills and Academics/Behaviors

A longitudinal study was conducted by Fuhs et al. (2014) to explore the connection between EF and academic skills. Participants included 488 four-year-old children located in rural and semiurban school systems along with some childcare centers in a metropolitan area serving low-income families. Due to district policies ethnicity and socioeconomic status information was not collected. EF was measured using six tasks. These tasks included The Backward Digit Span (BDS; Davis & Pratt, 1995), which assessed working memory, The Copy Design task (Davie, Butler, & Goldstein, 1972; Osborn, Butler, & Morris, 1984), which assessed attentional flexibility, The Dimensional Change Card Sort (DCCS; Frye, Zelazo, & Palfai, 1995; Zelazo, 2006), which measured attention flexibility, The Head-Toes-Knees-Shoulders task (HTKS; Ponitz, McClelland, Matthews, & Morrison, 2009), which measured cognitive flexibility, working memory, and inhibitory control, the last assessment was The Peg Tapping task (Diamond & Taylor, 1996), which measured inhibitory control and working memory. Academic achievement was also measured using subtests from the Woodcock-Johnson III achievement battery (WJ-III; Woodcock, McGrew, & Mather, 2001). The WJ-III subtests included Applied Problems and Quantitative Concepts (to assess mathematics), Oral Comprehension (to assess language), and Letter-Word Identification (to assess literacy). A strong association was noticed between EFs and math achievement. EFs were noticed with language and literacy tasks, yet the association between EFs and math was much stronger (Fuhs et al., 2014).

Four elementary schools (22 classrooms) in southeastern Michigan participated in a quantitative study conducted by Moffett and Morrison (2019), which focused on the effect schooling has on EF development. One-hundred seventy-two kindergartners were given three EF tests (working memory, response inhibition, and attentional control) to observe how much time students spend off-task, which allowed Moffett and Morrison (2019) opportunities to see what type of off-task behavior was occurring. Working memory was measured using the Backwards Digit Span subtest of the Wechsler Scales (Wechsler, 1991). Response inhibition was assessed using the Head-Toes-Knees-Shoulders task (HTKS; Ponitz et al., 2008). Attentional control was measured using the Pair Cancellation subtest from the Woodcock-Johnson III Tests of Achievement (WJ-III; Woodcock, McGrew, & Mather, 2001). Academic achievement was assessed using subtests from the WJ-III (Woodcock et al., 2001), which included the Applied Problems subtest to measure math skills and the Letter-Word Identification and Passage Comprehension subtests measured literacy skills. Observational measures were also utilized in this study. Subtypes of off-task behavior included nonengaged, other activity (not engaging with current activity), interacting with peer, and other (off-task behavior that could not be coded with the other categories). The Individualized Student Instruction (ISI) Coding System (Connor et al., 2009) and the Noldus Observer XT 13 software (Noldus Information Technology, 2013) were used to observe off-task behavior and productive/unproductive non-instruction (Moffett & Morrison, 2019).

A quantitative study conducted by Mills et al. (2019) focused specifically on African American (45%) and Latino (55%) children from low-income families. The study explored the development of self-regulation during preschool and the relationship to academic achievement in kindergarten and first grade. Simple response inhibition was measured using Snack Delay

(Kochanska, Murray, & Harlan, 2000), Wrapped Gift/Wait for Bow (Kochanska et al., 2000), Forbidden Toy (NICHD ECCRN, 1998), and Delay of Gratification (Mischel, Shoda, & Rodriguez, 1989). Complex response inhibition was assessed using Fruit Stroop (Kochanska et al., 2000) and Head-Toes-Knees-Shoulders (HTKS; Ponitz, 2008). The Dimensional Change Card Sort task (DCCS; Diamond, Carlson, & Beck, 2005) assessed set shifting. Working memory was measured using the Operation Span task (OS; Willoughby, Blair, Wirth, Greenberg, & The Family Life Project Investigators, 2010). Academic achievement outcomes were measured using the Applied Problems, Letter-Word Identification, and Word Attack subtests of the Woodcock-Johnson achievement battery (Woodcock, 1990).

Ahmed et al. (2018) examined the relationship between EF skills and academic achievement (early childhood through adolescence). Data from The National Institute of Child Health and Human Development (NICHD, 1989) Study of Early Child Care (SECC) was used in this quantitative, longitudinal study. Recruitment of 3,015 families was attempted using a random subset, yet only about half of the families consented. Demographics for the consented families included White (80%), Black (13%), Asian (2%), and Pacific Islander/other (5%). Measures used in this study included the NICHD-Study of Early Child Care and Youth Development (SEECYD) to assess EF skills. The Delay of Gratification task (Mischel, 1974) and the Woodcock-Johnson Psychoeducational Battery-Revised Memory for Sentences task (Woodcock & Johnson, 1989) assessed working memory. The Continuous Performance Task (CPT; Rosvold, Mirsky, Sarason, Bransome, & Beck, 1956) assessed sustained attention, a variation of the Children's Stroop task (Gerstadt, Hong, & Diamond, 1994) measured inhibition, and the Tower of London assessment (Berg & Byrd, 2002) measured planning.

Clark, Pritchard, and Woodward (2010) examined the connection between EF skills (before school entry) and math achievement. Participants included 104 children (from ages two to six) from a regionally representative cohort. Ethnicities in the study consisted of Maori (4.2%), New Zealand European (87.4%), other European ethnicities (6.3%), and Pacific Islanders (2.1%). EF was measured using the following tasks: The Tower of Hanoi (Simon, 1975; Welsh, 1991) measured complex executive planning, Flexible Item Selection Task (FIST; Jacques & Zelazo, 2001) measured set shifting/cognitive flexibility, and the Behavior Rating Inventory of Executive Function-Preschool (BRIEF-P; Gioia, Espy, & Isquith, 2003) measured EF behaviors in the preschool context. Academic achievement was assessed at age six using two subtests (Math Fluency and Passage Comprehension) from the Woodcock-Johnson III Tests of Achievement (WJ III; Woodcock, McGrew, & Mather, 2001). Teachers completed a questionnaire about children's academic performance and classroom behavior (Clark et al., 2010).

Key Findings. Findings from Fuhs et al. (2014) suggested that EF skills may assist in the development of early math and oral comprehension skills; therefore, making it easier to transition to a more formal learning environment where academic skills take up a large portion of the day. Results from the Moffett and Morrison (2019) study indicated that students who spent more time off-task had lower response inhibition based on being off-task engaging with other materials. Moffett and Morrison (2019) noticed children with a lower working memory spent a larger portion of time off-task (passively disengaged). This data helped with understanding EF and behavioral self-regulation in the classroom. Results from the study indicated that working memory and simple response inhibition are foundational processes that enabled more advanced functions, such as set shifting to emerge. Results also showed how self-regulation during early

childhood related differently to math and reading achievement (Mills et al., 2019). Findings indicated that working memory was the strongest EF skill to predict academic skills (Ahmed, et al., 2018). Findings suggested that differences in children's development of EF abilities have implications regarding the acquisition of mathematical knowledge (Clark et al., 2010).

Limitations. Although Fuhs et al. (2014) controlled for demographics, such as age and gender, potential effects of other demographic covariates, such as ethnicity (since this information was not available), could not be ruled out. This study was limited to children from low-income homes and may not generalize to higher socioeconomic status children (Fuhs et al., 2014). A limitation in the Moffett and Morrison (2019) study noted that students were only observed for a single day. The study sample also had limitations due to present findings being relevant only to a subsample of students (Moffett & Morrison, 2019). First grade academic achievement information was missing, therefore 30% of data was inputted based on researcher predictions (Moffett & Morrison, 2019). Mills et al. (2019) noted a small number of assessment points were used in this study. Another limitation discussed the shortened windows of utility due to the rapid development of cognitive skills during early childhood (Mills et al., 2019). A limitation in the Clark et al. (2010) study included the challenge of individualizing measures of EF to be suitable to use with young children due to some tasks being too difficult. A single laboratory-based measure was used for mathematical competence; thereby, creating another limitation.

Suggested Interventions for School Environment Influences

Prior student information, such as family engagement and family/home characteristics could benefit classroom compositions; therefore, avoiding the placement of specific risk factors in one classroom (Abry et al., 2018). Portilla et al. (2014) suggested the importance of

identifying strategies to promote children's self-regulatory skills before entering kindergarten; thereby, guiding children towards a positive academic trajectory. Interventions focusing on EF skills, peer interactions, and school performance should begin early to help alleviate internalizing problems dealt with by school-aged children (Wang & Zhou, 2019). To support the early academic achievement of low-income African American and Latino children adults need to understand the self-regulation development of these populations (Mills et al., 2019). Moffett and Morrison (2019) suggested that appropriate interventions could be developed by understanding how EF relates to the classroom. Clark et al. (2010) mentioned that programs intended to enhance EF skills be made available prior to school entry to help prevent difficulties before achievement is less malleable.

Conclusion

The analyzed studies in this literature review are connected by the idea that although children are not born with EF skills, children have the potential to develop EF skills (Center on the Developing Child, 2012). Each study provided a different angle for how children develop EF skills. Studies pertaining to home environmental influences concluded that parent-child relationships play a crucial role in the development of children's EF skills (Bernier et al., 2012). The quality of care provided by caregivers affects the outcome of how children develop (Blair et al., 2014 & Towe-Goodman et al., 2014). Maternal emotional support, as well as teacher and sibling emotional support contribute to children's self-regulation abilities (van der Kaap-Deeder et al., 2017 & Zeytinoglu et al., 2017). Furthermore, siblings can assist in scaffolding social interactions to help with cognitive development and self-regulation skills in younger siblings (Hill & Palacios, 2019). The quality of parent scaffolding is connected to socioeconomic status due to parent's ability to provide opportunities for children to develop EF skills (Kao et al.,

2018). Studies pertaining to school environmental influences concluded that external mediators help promote self-directed behaviors (Shiu et al., 2020). As far as peer influences, having higher level self-regulated students in class impacts the learning and behavior of lower self-regulated students by modeling appropriate EFs, such as inhibitory control (Montroy et al., 2016 & Wang et al., 2019). Lastly, EF skills assist in the development of math knowledge and literacy comprehension (Clark et al., 2010 & Fuhs et al., 2014) as well as determining children's on-task and off-task behaviors (Moffett & Morrison, 2019). The following chapter will summarize the research findings about EF skills, discuss the application of these findings, and offer suggestions for future studies involving environmental influences on young children's EF skill development.

Chapter Three: Discussion/Application/Future Studies

Chapter Three will discuss the knowledge gained throughout the literature review, which pertained to environmental influences on young children's development of executive function (EF) skills. First, findings from the literature review are summarized. Secondly, the application of findings to educational practices are discussed. Lastly, future research studies regarding EF development are suggested.

Summary of Findings

The analyzed studies in chapter two used similar assessments, such as the Head-Toes-Knee-Shoulder task (HTKS; Ponitz et al., 2008) and subtests from the Woodcock-Johnson III achievement battery (WJ-III; Woodcock, McGrew, & Mather, 2001). The WJ-III subtests included Applied Problems and Quantitative Concepts (to assess mathematics), Oral Comprehension (to assess language), and Letter-Word Identification (to assess literacy). Findings from these assessments (and others) provided data that supported the researcher's theories regarding the connection between home and school environments and the development of children's EF skills.

Emotionally responsive caregivers provide supportive environments, which allow children to engage in rich opportunities for developing self-regulation skills (Zeytinoglu et al., 2017). In contrast, Talwar, Carlson, and Lee (2011) investigated children exposed to harsh punitive environments. Results from the study indicated that children may be at higher risks for behavioral problems related to lack of EF skills since opportunities for learning and practicing EF skills are unlikely. Depending on the environment and role models within the environment, EF development can be enabled or hindered. A child's academic trajectory is set by the developed EF skills. Buyse, Verschueren, and Doumen (2011) stated that sensitive teachers have

been able to buffer effects of negative family context for children struggling with attachment to the caregiver. By buffering this type of situation, teachers help reduce a child's risk for aggressive behavior (as cited in Portilla et al., 2014). When attentional and inhibitory control processes are lacking, children tend to have difficulties with learning and participating in classroom activities (Blair, 2002), which puts students at a risk for academic problems (as cited in Portilla et al., 2014). The quality of teacher-child relationships is important for children's social and academic performance. Children can successfully navigate social environments and form close relationships with teachers; thereby, setting off on a positive developmental trajectory (Portilla et al., 2014). Moffett and Morrison (2019) mentioned that peers are one of the most distracting parts of the classroom environment; therefore, even children with high self-regulation may give in to the temptation of talking with peers. Children with lower self-regulation who are exposed to children with higher self-regulation have opportunities for EF skills to be modeled and reinforced (Montroy et al., 2016).

Application of Findings to Educational Practices

A classroom environment supports the development of EF skills when children feel secure enough to take risks in the learning process (Kryza, 2014). Teachers need to assist students in developing the EF skills needed to succeed; therefore, consistently implementing these skills into teaching practices (Kryza, 2014). When teachers are knowledgeable about EF skills, behaviors in the classroom can be explained more clearly. An impulsive behavior noticed in the classroom may be considered defiance or a characteristic of attention deficit hyperactivity disorder (ADHD), yet it could simply be that the child is lacking inhibitory control. Interventions can be implemented based on specific skills students need. Communication with parents will provide insight as to the EF skills being learned in the home environment. This

communication creates an opportunity to discuss the importance of EF skills and strategies families can implement to assist with the child's development of these skills.

Suggestions for Future Studies

Findings from this literature review indicated a research gap regarding older sibling's influences on younger sibling's EF development. Ideas for future research on this topic include researching the effects of older siblings on younger sibling's EF development using multiple ages, more than one older sibling, and twin siblings. Another idea consists of conducting a study to analyze how high school aged siblings affect EF development in early childhood aged siblings. A future study could also focus on how different teaching styles and classroom environments affect student's EF development and academic achievement across different grade levels. A final research suggestion includes researching additional interventions, strategies used in the interventions, and overall results from the interventions for teachers to implement in the classroom. Knowledge from current and future studies could provide administrators with possible professional development opportunities; therefore, educating the educators on the benefits of understanding EF development and the three main components: working memory, inhibitory control, and cognitive flexibility.

Conclusion

The future of programming and practice in early education regarding current research and best practices (Concordia, 2021) is to gain a better understanding of what is developmentally appropriate for children and ways for educators to assist in the development of early learning skills. Understanding factors that influence the development of EF skills in young children is beneficial because EF skills affect academic achievement and behavior. The research question

guiding this paper is, "In what ways can home and school environments influence the development of children's executive function skills in early childhood?"

What might be considered a behavior problem in the classroom (or home) environment, may be a child who is lacking EF skills. Adults working with children need to be able to understand the difference. A child who repeatedly talks out of turn, is easily distracted, or is in constant motion may not have control over these actions due to a lack of inhibitory control. A child who forgets a concept shortly after it has been taught or has a hard time recalling previous information may be struggling with working memory skills. Children unable to use information from one task and relay it to another task may be struggling with cognitive flexibility. Working memory, inhibitory control, and cognitive flexibility are the three main components of EF. Children are not born with these skills. These skills are modeled and taught to children. When EF skills are underdeveloped in the home environment, teachers need to be ready to assist children with these critical learning skills within the school environment. The Center on the Developing Child (2012) pointed out how a society will see future dividends when it invests in building children's EF skills. Furthermore, to ensure that children develop EF capacities, it needs to be understood that the quality of interactions and experiences provided by the community can either strengthen or undermine the development of EF skills (Center on the Developing Child, 2012). Kao et al. (2018) stated that emerging EF skills have critical applications regarding functions needed for school readiness, academic success, and self-regulation abilities needed later in life.

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