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## Kindergarten is Not Child's Play: An Exploration of Pedagogical Approaches Related to Learning in a Play-Based and a Contemporary Classroom at a Title I Elementary School

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KINDERGARTEN IS NOT CHILD'S PLAY: AN EXPLORATION OF PEDAGOGICAL  
APPROACHES RELATED TO LEARNING IN A PLAY-BASED AND A CONTEMPORARY  
CLASSROOM AT A TITLE I ELEMENTARY SCHOOL

by

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A dissertation submitted in partial fulfillment of the requirements  
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in the School of Teacher Education  
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## ABSTRACT

This dissertation is divided into three separate, related, naturalistic, quasi-experimental research studies, all using data from two kindergarten classes at Gator Elementary, a public Title I elementary school in Sunshine District in Central Florida. Each of these studies tested hypotheses that kindergarten children, especially those from low socioeconomic backgrounds, will show greater gains in receptive vocabulary, executive function, and academic achievement when purposeful play is used as a pedagogical approach than similar children in typical, contemporary kindergarten classrooms. The first study explored the effects of play-based and contemporary pedagogical approaches on students' receptive vocabulary using the PPVT-4, the second explored students' executive functions using the BRIEF2, and the third explored students' movements using Actigraph GT9X Link accelerometers. All three studies analyzed these data in relation to students' academic achievement as measured by i-Ready Diagnostic assessments. Statistically significant differences were detected in students' receptive vocabulary and reading growth as well as statistically significant differences in students' executive function health as reported by teachers and reading and math academic growth by classroom conditions. A strong association between receptive vocabulary and reading performances was revealed alongside strong negative correlations between levels of executive function concern and reading performance. No statistical differences in math growth between classrooms were found, although there was a moderate effect size, and less of an association between math performance and executive function presented. While strong correlations between academic achievement and total movement by day or movement types were revealed, these associations were inconsistent. Nor were there significant differences in movement by classroom conditions, although there was a moderate effect size suggesting some differences in movement by condition. The findings

from this dissertation, while limited, point to a burgeoning area of research connecting neuroscientific findings with developmentally appropriate practices to explore effective interventions to increase educational equity for vulnerable students.

This dissertation is dedicated to all marginalized and underserved children in our schools and to the educators determined to finally and permanently eradicate persistent gaps in opportunities for academic growth so that all our children can reach their full potential – for their own benefit and the world's.

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## GENERAL INTRODUCTION TO THE THREE MANUSCRIPTS

Each of these studies relied on related research that kindergarten children, especially those from low socioeconomic backgrounds, will show gains in:

- Receptive vocabulary (Cremin, Glauert, Craft, Compton, & Stylianidou, 2015; Hassinger-Das et al., 2016; McArdle, Harrison, & Harrison, 2013; Nolan, Taket, & Stagnitti, 2014; Ranz-Smith, 2007; Russo, 2013; Sandberg & Heden, 2011),
- Executive function (Copple & Bredekamp, 2009; Fisher, 1992; Fisher, Hirsh-Pasek, Golinkoff, Singer, & Berk, 2011; Lillard et al., 2012; Pellegrini, 2013; White, 2013), and
- Academic achievement (e.g., Armin et al., 2017; Barros, Silver, & Stein, 2009; Blom, Alvarez, Zhang, & Kolbo, 2011; James-Burdumy et al., 2013; Jarrett, 2002; Massey et al., 2017; Mullender-Wijnsma et al., 2015)

when purposeful play is used as a pedagogical approach (Bodrova & Leong, 2007; McDonald, 2018; Mraz, Porcelli, & Tyler, 2016; Riek, 2014) and when compared with demographically similar children in contemporary kindergarten classrooms. Increasingly, teachers in early childhood and early elementary classrooms are required to use research-based strategies to teach the most vulnerable students.

Neuroeducational findings over the past 15 years illuminate more concretely how specific conditions, such as poverty, affect brain and cognitive development and the related impacts on academic achievement. Recent improvements in neuroimaging, a relatively new discipline using various technologies to image the structure and function of the brain, allow better understanding as to how the brain develops, and this affects our understanding of teaching and learning, specifically in the areas of executive function and self-regulation. These increased

understandings allow educational professionals to tailor instructional practices to best meet the needs of students, especially students living in poverty who are at greater risk for underperforming compared to their more resourced peers. To meet the needs of all students, but especially our students living in poverty or other stressful environments, teachers must offer learning experiences that engage children emotionally, socially, and cognitively in growth-promoting classrooms to increase children's chances for success in school and beyond.

The three manuscripts that comprise this dissertation explored the ideas of creating growth-promoting classrooms that are language rich, emotionally rich, steeped in play (Hassinger-Das, Hirsh-Pasek, & Golinkoff, 2017), and protected from excessive stress, so as to possess the potential to “dramatically improve the life prospects of all young children” (Shonkoff, 2017, p. 15). In recent decades, the elementary school focus collectively has shifted to an environment of increased testing and decreased play and autonomy. One critical literature review of neuroeducational findings suggest a return to a more play-based constructivist pedagogical approach could significantly support students, especially those students living in poverty, experience greater academic success (Allee-Herndon & Roberts, 2018). Components of whole-child, constructivist classrooms often include language and literacy learning, dramatic or imaginary play, games and puzzles requiring logic and spatial awareness, gross motor play, as well as music and movement. The problem, however, is that contemporary instruction and assessment expectations and demands in primary grades, including kindergarten, do not align with the recommended instructional approaches from neuroscience.

## Objectives

The purpose of this collection of research was to explore the possible instructional benefits of a play-based approach to learning compared to the type of instruction more commonly demanded in typical, contemporary kindergarten classrooms. Contemporary kindergarten classrooms can be characterized by significant amounts of time spent doing seat work in whole and small group direct instruction, academic skill-building through structured and prescriptive curricula, preparation for and participation in assessments which are frequently administered digitally, and a significant reduction in a play-based, constructivist pedagogical approach. In the past four decades, early childhood researchers and advocates have called for a return to a focus on developmentally appropriate, constructivist learning practices that include play, social interactions, and exploration (Bassok, Latham, & Rorem, 2016; Miller & Almon, 2009; NAEYC, 2005; Pyle & Daniels, 2017; Ranz-Smith, 2007; Repko-Erwin, 2017) as well as a “reversal of the pushing down of the curriculum that has transformed kindergarten into *de facto* first grade” (Miller & Almon, 2009, p. 63).

The National Association for the Education of Young Children (NAEYC) published the first edition of *Developmentally Appropriate Practice in Early Childhood Programs* in 1987 (Copple & Bredekamp, 2009) advocating for exactly this type of pedagogical approach, but the legislation of the No Child Left Behind Act in 2001 dramatically shifted the educational landscape (McGuinn, 2006; No Child Left Behind [NCLB], 2002; Repko-Erwin, 2017) toward an increasing focus on standardized instructional accountability as measured by assessments. Unintended outcomes of this approach, however, have included a corresponding shift in the focus of elementary teacher preparation programs, a decreased focus on children’s social-emotional learning (SEL), an increase in the levels of “anger, misbehavior, and school expulsion



among young children” (Miller & Almon, 2009, p. 63), and the persistent gaps in opportunities for academic growth-among children from diverse cultural, linguistic, and economic backgrounds.

Culturally and economically recent neuroscientific findings, afforded in many cases by breakthroughs in brain imaging culturally and economically, provide another layer of support for a return to a focus on developmentally appropriate practice (DAP), particularly for vulnerable children (i.e., children living in low socioeconomic status (SES) households, children whose first language is not English, children of color). Poverty poses the single greatest threat to children’s wellbeing, especially if experienced in early childhood, persistent or generational poverty, or extreme poverty (Brooks-Gunn & Duncan, 1997; Child Trends Data Bank, 2016; Duncan, Yeung, Brooks-Gunn, & Smith, 1998; Koball & Jiang, 2018). Currently, more than 15.4 million (44%) U.S. children under the age of nine live in low-income households, 7.4 million (21%) live in poverty, and 3.3 million (>10%) live in deep poverty (Koball & Jiang, 2018). About 10.4 million of these children living in low-income homes are between the ages of three and eight (Koball & Jiang, 2018). “Although the percentages of children living in poverty or near poverty homes has declined somewhat since the recession in the early 2000s, most public school educators will teach children living with financial insecurities and all the related risk-factors associated with this stressor” (Allee-Herndon & Roberts, 2019, p. 346). Consequently, educators face a moral imperative to take advantage of every opportunity to improve the educational outcomes for these vulnerable learners. The emerging neuroscience research suggests an increased focus on learning experiences that build self-regulation (SR), executive function (EF), and social-emotional skills through a more traditional DAP approach. However, a gap persists in

our collective understanding of research-based interventions that can translate this research into practice for educators (Allee-Herndon & Roberts, 2019).

### **Background for the Studies**

Existing evidence suggests that poverty impacts language development and pre-academic skills (Blair & Raver, 2015; Brown & Low, 2008; Engle & Black, 2008; Sharkins, Leger, & Ernest, 2017; Vallotton et al., 2012). However, less is known regarding other learning gaps, such as how poverty affects young children's approaches to learning, persistence, resilience, and other less concrete or tangible skills or dispositions required for success in structured school environments. Blair explains SR as an umbrella set of skills that comprise the foundational demands required of formal schooling (as cited in Willoughby, Kupersmidt, Voegler-Lee, & Bryant, 2011). SR broadly includes self-control, emotional regulation, executive function, problem solving, and grit. EF can be defined as domain-specific mental skills including task completion, response inhibition, attention control, attention shifting or cognitive flexibility, and working memory. The brain's management of SR and EF occurs in the prefrontal cortex of the brain and affects judgment, differentiation, anticipating outcomes, time management, attention and switch focus, planning and organizing, remembering details, and social-emotional aptitude. Researchers believe early childhood is a critical period for developing SR and EF skills critical for school readiness (Blair, 2016; Blair & Raver, 2015; Fitzpatrick, McKinnon, Blair, & Willoughby, 2014).

To date, a nascent but growing body of empirical research exposes educational interventions addressing the effects of poverty on young children's SR/EF and school readiness, and researchers have recently begun to explore the role of EF on those in poverty, particularly young children's school readiness and academic achievement (Blair, 2016; Bowman-Perrott et

al., 2013; Brown & Steele, 2015; Burke, Oats, Ringle, Fichtner, & DelGaudio, 2011; McLear, Trentacosta, & Smith-Darden, 2016; Morgan et al., 2017; Skiba et al., 2011). Leading researchers are determining poverty's impacts on the development of SR and EF (Blair & Raver, 2015; Fitzpatrick et al., 2014). Shonkoff (2011) believes school readiness and achievement gaps can be reduced with high-quality, research-based pedagogy and curriculum in conjunction with a nurturing, supportive environment that reduces stress on developing brains. Existing neurocognitive research suggests a predictive relationship between SR and EF to literacy and numeracy skill development (Shonkoff, 2011). Blair and Raver (2015) and Morgan et al. (2019), among others, have provided evidence linking EF as a predictive agent for academic achievement and socioeconomic status for children of poverty.

“The foundational EF skills begin to emerge around three to four years of age and increase dramatically during the preschool period” (Jones et al., 2016, p. 4). Preliminary data suggests EF, especially working memory, and emotional SR are highly malleable and trainable in early childhood. Some prekindergarten and kindergarten curricula (e.g., *Research-based, Developmentally Informed (REDI)* program, *Tools of the Mind*, *Chicago School Readiness Project (CSR)*, and *Promoting Alternative Thinking Skills (PATHS)*) focus on language development in conjunction with social-emotional development aligned with EF (Blair, 2016). Concentration on EF and other SR development does not supplant a focus on learned skills such as letter knowledge, number sense, or the ability to use scissors, but does position children to succeed (Blair & Raver, 2015). Safe and nurturing environments, foundational early learning, and SR skills support the development of EF and school readiness (Allee-Herndon & Roberts, 2018; Pakulak et al., 2015; Shonkoff, 2011, 2017).

Morgan et al. (2019) put a point on the idea that gaps in children's SR/EF, whether poverty-induced or not, negatively affect their learning and academic achievement well into students' K-12 education. This study of 8,330 children in the Early Childhood Longitudinal Study, 2010-11 Cohort, found EF deficits predict kindergartener's risk of experiencing repeated academic difficulties through third grade. Morgan et al (2019) studied EF, specifically cognitive flexibility, working memory, and inhibitory control. Kindergarten children with EF deficits, especially in working memory, were ten times as likely to experience repeated academic difficulty in math, three times as likely to experience the same in reading, and twice as likely to experience difficulties in science than their peers without working memory deficits. Children with deficits in cognitive flexibility and inhibitory control were also at risk of failure.

Educational disadvantages associated with poverty are present prior to kindergarten. By improving children's skills at the outset of their educational careers, our findings suggest that effective child-directed educational approaches ... can perhaps go a long way toward fulfilling the promise of free and universal public education by equalizing opportunity for children to succeed despite initial disadvantage. By working to level the playing field for children at school entry, effective kindergarten education can be expected to lead to reduced social and economic burden associated with poverty (Blair & Raver, 2014, p. 11).

These findings reinforce prior research indicating that an academic gap at the beginning of elementary school frequently widens throughout K-12 for many children who begin school already disadvantaged. "Converging evidence from multiple fields of study, including cognitive neuroscience, education, and economics, suggests that one of the most promising approaches to ameliorating the SES-related achievement gap is via evidence-based interventions targeting

children from lower SES backgrounds early in development” (Pakulak et al., 2015, pp. 7-8). This body of literature reinforces the need and enormous potential to implement DAP approaches, which include play, in primary grades to build foundational concept knowledge and skills while also focusing on language development, SEL, and SR/EF. The overwhelming support of play and play-based interventions for typically developing healthy children, and especially vulnerable children seems obvious to provide opportunities to move, to talk, to negotiate, to plan, to explore, to make choices or decisions, and to engage with content, concepts, and exploring the processes of learning to grow cognitively (Piaget, 1977; Vygotsky, 1978).

Roughly half the students in many schools and the majority in others with these poverty-related needs (Koball & Jiang, 2018) require effective approaches and support to grow in all areas. Using interventions or instructional techniques that support SR and EF through SEL and content-based instruction can potentially reduce the amount of conduct-related disruptions in a classroom, the amount of time of related missed instruction because of exclusionary discipline issues and weak connections to school, and can increase academic and developmental outcomes for these students. This educational mandate for our nation cannot be ignored. Therefore, one important goal of this collection of studies for this dissertation was to begin the work exploring the effects of play-based instructional approaches on language, EF, and academic outcomes for children attending kindergarten in a public Title I elementary school.

To enact these explorations, this dissertation is divided into three separate, but related research studies, all using data from two kindergarten classes in a public Title I elementary school in Central Florida (Table 1). The first study, entitled *Let's Talk Play!*, focuses on children's receptive language and reading achievement using the Peabody Picture Vocabulary Test Fourth Edition (PPVT-4; Dunn & Dunn, 2007) and i-Ready Diagnostic assessments

(Curriculum Associates, n.d.). The second study, titled *What is the Function of Play?*, explores children's executive function using the Behavior Rating Inventory of Executive Function, Second Edition (BRIEF2; Gioia, Isquith, Guy, & Kenworthy, 2015). Last, the third study, *You've Got to Move It!*, took an innovative data collection strategy using accelerometers (ActiGraph GT9X Link; ActiGraph Inc, Pensacola, FL) to extract data related to kindergarteners' movement to explore potential differences in classroom environments and possible connections to student achievement. In the following pages, each of these research studies are presented as separate entities to enable expedited submissions to academic journals in the coming months (see Appendix A for a timeline of the three studies).

Table 1: Overview of the Research

	Language	Executive Function	Movement
Sample Size	$30 \leq n \leq 33$	$28 \leq n \leq 31$	$21 \leq n \leq 31$
Statement of Purpose	To explore the possible relationships between pedagogical approach and children's language and literacy development in Title I kindergarten classrooms.	To explore the possible relationships between pedagogical approach and children's executive function health and academic achievement in Title I kindergarten classrooms.	To explore the possible relationships between how students move and academic achievement in Title I kindergarten classrooms.
Measures	Peabody Picture Vocabulary Test Fourth Edition i-Ready Reading Diagnostic	Behavior Rating Inventory of Executive Function, Second Edition i-Ready Reading and Math Diagnostic	Actigraph GT9X Link accelerometers i-Ready Reading and Math Diagnostic
Analysis	Mixed Design MANCOVA Spearman's $r_s$	Mixed Design MANCOVA Spearman's $r_s$	Mixed Design ANCOVA or ANOVA Pearson's $r$
Essential Conclusions	There were statistically significant differences in students' PPVT-4 and i-Ready Reading Diagnostic growth by classroom condition. There were also strong associations between PPVT-4 and i-Ready Reading performance.	There were statistically significant differences in students' BRIEF2 health and i-Ready Reading Diagnostic growth by classroom condition as measured by teachers' observations, but not parents'. There were also negative correlations between levels of executive function concern and reading performance. There were no statistical differences in math growth between classrooms, although there was a moderate effect size, and less of an association between math performance and executive function.	While there were strong correlations between measures of academic achievement and some correlations between total movement by day or types of movement, these associations were inconsistent and did not include connections between movement and academic achievement. Nor were there significant differences in movement by classroom condition.

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# LET'S TALK PLAY!: EXPLORING THE POSSIBLE BENEFITS OF PLAY-BASED PEDAGOGY ON LANGUAGE AND LITERACY LEARNING IN TITLE I KINDERGARTEN CLASSROOMS

## Introduction

Kindergarten has changed dramatically, both in instructional content and teacher expectations of performance, since the 1990s (Bassok, Latham, & Rorem, 2016; Repko-Erwin, 2017). The current, typical, contemporary focus on rigorous academic standards and utilizing measures of accountability for instruction and learning has all but eliminated play as a pedagogical approach from elementary classrooms. However, a focus on rigorous academic standards and utilizing measures of accountability for instruction and learning need not be mutually exclusive to developmentally appropriate instruction with a focus on hands-on, language-rich, discovery-focused, and purposeful play pedagogy. As a culture, schools may be ready to explore a *both/and* approach to instruction, especially as schools are not experiencing the expected student gains based on contemporary, standardized test-driven models of direct, didactic instruction punctuated with drill and practice. Further, in an effort to force these outcomes leading to pedagogical implications, the pressure toward higher and higher test performance simply increases, all the while counter to existing research. The combination of children's developmental needs and suboptimal achievement outcomes have strong implications for researchers, practitioners, leaders, and policymakers to take a closer look at the emerging science behind play as it relates to curriculum, instruction, and pedagogy, specifically regarding the development of essential skills that go hand-in-hand with academic learning and student achievement.

### *Rationale and Statement of Purpose*

Teachers in early elementary classrooms increasingly require research-based strategies to teach the most vulnerable students. Neuroeducational findings over the past 15 years illuminate more concretely how specific conditions, such as poverty, affect brain and cognitive development and the related impacts on academic achievement. Recent improvements in neuroimaging, a relatively new discipline using various technologies to image the structure and function of the brain, allow us to better understand how the brain develops. This new knowledge of the brain holds the possibility to affect our understanding of teaching and learning, specifically in the areas of executive function and self-regulation. These increased understandings can allow educational professionals to tailor instructional practices to best meet the needs of students, especially students living in poverty who are at greater risk for underperforming when compared to their more resourced peers. To meet the needs of all our students, but especially our students living in poverty or other stressful environments, teachers must create learning experiences to engage children emotionally, socially, and cognitively to increase children's chances for success in school and beyond.

In recent decades, the elementary school focus collectively has shifted to an environment of increased testing and decreased play and autonomy, despite neuroeducational findings that suggest a return to a more play-based constructivist pedagogical approach could significantly support students, especially those students living in poverty, to experience greater academic success. Creating growth-promoting classrooms that are language rich, emotionally rich, steeped in play (Hassinger-Das, Hirsh-Pasek, & Golinkoff, 2017), and protected from excessive stress have the potential to “dramatically improve the life prospects of all young children” (Shonkoff, 2017, p. 15). Components of whole-child, constructivist classrooms often include language and

literacy learning, dramatic or imaginary play, games and puzzles requiring logic and spatial awareness, gross motor play, and music and movement. Current instruction and assessment expectations and demands in primary grades including kindergarten do not align with the recommended instructional approaches from neuroscience, however. Therefore, the purpose of this study, with an emphasis on poverty, was to explore the possible relationships between play-based pedagogy and contemporary pedagogy in Title I kindergarten classrooms through measures of receptive vocabulary and academic achievement.

### *Literature Review*

For many, kindergarten calls to mind images of children learning their alphabet letters, singing songs, playing dress up games, and hearing lots of stories. Educational researchers and practitioners have a more nuanced understanding of the language and foundational literacy demands and expectations in kindergarten. While language and literacy proficiency are essential for children's ongoing academic success, however, an interplay exists between these skills, children's socioeconomic backgrounds, their social-emotional skills and approaches to learning, and classroom environment and instruction that, in combination, facilitate or hinder children's success in school.

Children living in poverty typically have lower cognitive performance, increased behavioral issues, and historically underperform their peers on several important metrics like academic performance and pro-social school behaviors. Children living in low-income homes experience developmental delays that encompass interdependent skills: gross motor, sensory perception, social-emotional development, language development, and cognitive development (Blair & Raver, 2015; Brown & Low, 2008; Engle & Black, 2008). These impairments have a significant negative impact on readiness for kindergarten, which is correlated to later difficulties



in school. Indeed, when children begin school considerably behind their peers, the gap frequently widens rather than diminishes (Blair & Raver, 2015; Engle & Black, 2008; Morgan et al., 2019). Each element influences the others, and the challenge is to determine the best ways to maximize opportunities for all students, but especially vulnerable students, in our schools and in life. In the next sections, the relationships between poverty and language, poverty and approaches to learning, language and social-emotional skills, and play, language, and learning are explicated.

### ***Poverty and Language***

Persistent poverty conditions are known to impact the home learning and verbal environment as well as the social-emotional tone of the household. Chronically impoverished households contribute to children's decreased language abilities and cognitive growth, especially in early childhood (Blair et al., 2011; Sharkins et al., 2017; Vallotton et al., 2012). Poverty can negatively impact children's ability to learn, social and emotional development, and physical and emotional health (National Center for Children in Poverty, 2017), and achievement gaps are evident as early as kindergarten (Bumgarner & Lin, 2014). Children from low socioeconomic backgrounds demonstrate significantly reduced vocabularies and substantial difficulties with foundational literacy skills, comprehension, and concepts about print (Ackerman, Brown, & Izard, 2004a; Apthorp et al., 2012; Bernhard, Winsler, Bleiker, Ginieniewicz, & Madigan, 2008; Huang & Invernizzi, 2012; Vallotton et al., 2012). Additionally, children's socioeconomic status (SES) has a negative effect on narrative development and writing composition (Kim, Puranik, & Otaiba, 2015). Cumulative risk, or the conflation of multiple poverty-related risk factors, negatively affect children's early literacy skills, home literacy experiences, and vocabulary development (Marcella, Howes, & Fuligni, 2014; McCartney, Dearing, Taylor, & Bub, 2007;

McLeod, Hardy, & Kaiser, 2017; Stanton-Chapman, Chapman, Kaiser, & Hancock, 2004; Vallotton et al., 2012).

Recently, researchers have begun to explore the physiological impacts of poverty on the developing brain, and the evidence suggests children living in poverty have reduced gray matter and cortical surface area which contributes to 15% to 20% of the income-related achievement gap (Blair et al., 2011; Blair & Raver, 2016). The findings were strongly correlated to the extent and duration of poverty, with researchers noting that the effects of poverty on the developing brain can be seen as early as infancy (Blair & Raver, 2016). Other factors of poverty also are strongly correlated to reduced brain volumes including parental education, income-to-need ratios, stressful life events, and parenting quality. The chronic stressors of poverty are believed to affect brain development, which in turn affects IQ to some extent (Blair et al., 2011; Blair & Raver, 2016; Raver, Blair, & Willoughby, 2012). This impact on brain development and cognition works in combination with environmental factors to negatively impact children's early language and literacy abilities. Along with reduced home literacy experiences, children may experience less access to literacy materials at home or in high-quality childcare and preschool settings, and fewer opportunities for experiences contributing to background knowledge and vocabulary development.

### ***Poverty and Approaches to Learning***

Approaches to learning (ATL) can be defined as the skills and behaviors children use to learn, or put another way, ATL is how children go about learning. Head Start, for example, includes emotional, behavioral, and cognitive self-regulation in their ATL domain, as well as initiative, curiosity, and creativity (Head Start ECLKC, 2018). How children engage in learning, persist in the face of challenge or difficulty, and manage frustration or distraction are directly

related to academic achievement. Without positive approaches to learning, children, especially vulnerable one, are less likely to persist in the face of academic challenge and to find experiences that stretch them as enjoyable and achievable. Furthermore, these children are more likely to act out using externalizing, inappropriate behaviors that are not conducive to learning.

While ATL has been described or categorized slightly differently in other publications and resources, in this paper ATL comprises agency and autonomy, creativity and imagination, persistence, resilience, and risk-taking. Poverty negatively affects children's opportunities and capacities to engage in all of these behaviors or dispositions (Ackerman et al., 2004a; Ackerman, Brown, & Izard, 2004b; Brown, 2009; Razza, Martin, & Brooks-Gunn, 2015, 2016). These damaging effects are partially because poverty negatively affects gray matter and cortical surface area, cognitive development, and language development, but also because these poverty-related risk factors also negatively affect children's developing social-emotional learning (SEL), self-regulation (SR), and executive functions (EF) which are central to early academic achievement (Ackerman et al., 2004b; Blair et al., 2011; Blair, Ursache, Greenberg, & Vernon-Feagans, 2015; Blair & Raver, 2016; Brown, 2009; McLear, Trentacosta, & Smith-Darden, 2016; Razza et al., 2015, 2016). Behavioral and emotional self-regulation promote positive prosocial skills and relationships, but they are also predictive of early literacy, math, and vocabulary skills (Marcella et al., 2014; McLear et al., 2016; Sharkins et al., 2017). Multiple papers and studies, both qualitative and quantitative, indicate nurturing, play-based, child-driven classroom environments and instructional methods can build children's ATL (Fisher, 1992; Fisher, Hirsh-Pasek, Golinkoff, Singer, & Berk, 2011; Pellegrini, 2013; White, 2013), specifically in areas like agency and autonomy (Cremin et al., 2015; McArdle et al., 2013; Nolan et al., 2014), creativity and imagination (Cremin et al., 2015; Ranz-Smith, 2007; Russo, 2013), persistence (Brown,

2009; Cremin et al., 2015; Nolan et al., 2014; Sandberg & Heden, 2011), resilience (Nolan et al., 2014; Russo, 2013), and risk-taking (McArdle et al., 2013; Nolan et al., 2014; Russo, 2013).

### *Language and Social-emotional Skills*

The stressors involved in living in poverty can also negatively affect social-emotional development in young children (Ackerman et al., 2004a, 2004b; Bernhard et al., 2008; Blair & Raver, 2015, 2016; Raver et al., 2012; Sung, 2014). Social-emotional skills allow children to identify, express, and regulate their emotions in healthy, age-appropriate ways, and are necessary for resilience, empathy, and the ability to conform to the behavioral expectations of school. Social-emotional skills are closely tied to language ability; if children lack sufficient vocabulary to label and describe their feelings adequately, to express needs and wants, and to resolve conflicts appropriately, their social-emotional behaviors are likewise impaired. Reciprocally, social-emotional development, or the lack thereof, can affect children's early developmental processes in conjunction with poverty-related stressors (Sharkins et al., 2017; Sung, 2014). Additionally, children's cognitive and social-emotional development are bidirectionally correlated and have a direct, significant effect on language development, and language and fine-motor development have a direct effect on social-emotional development (Sharkins et al., 2017).

Economically disadvantaged young children begin school with fewer social-emotional and basic academic skills (Ackerman et al., 2004a, 2004b; Bernhard et al., 2008; Blair & Raver, 2015, 2016; Raver et al., 2012; Sharkins et al., 2017; Sung, 2014). When children lack language, either productive or receptive, they may struggle with social problem solving, use inappropriate language in the classroom or act out physically in frustration, and experience difficulty making connections to new concepts or accessing prior knowledge. Children who lack essential social-emotional, self-regulatory, and language skills often present with negative ATL as well as

internalising and externalizing behaviors. These behaviors result in increasingly frequent or exclusionary disciplinary consequences, even as early as kindergarten, which further reduces children's access to instruction and often widens an already present achievement gap (Bowman-Perrott et al., 2013; Brown & Steele, 2015; Burke, Oats, Ringle, Fichtner, & DelGaudio, 2011; Griner & Lue Stewart, 2012; McLear et al., 2016; Parker, Paget, Ford, & Gwernan-Jones, 2016; Razza et al., 2015, 2016; Skiba et al., 2011).

Given that these critical areas for kindergarten and future academic success are related, especially impactful for children from low SES backgrounds, educators must consider how best to provide frequent, quality classroom opportunities to nurture children's social-emotional skills, language growth, and cognitive development. Once again, research suggests play can improve children's social-emotional skills (Fisher, 1992; Fisher et al., 2011; Nicolopoulou, Barbosa De Sá, Ilgaz, & Brockmeyer, 2010; Pellegrini, 2013; White, 2013) in areas like behavioral control, which is also closely related to self-regulation (London, Westrich, Stokes-Guinan, & McLaughlin, 2015; McArdle et al., 2013; Russo, 2013), empathy (McArdle et al., 2013; Nolan et al., 2014; Sandberg & Heden, 2011), collaboration and cooperation (Cremin et al., 2015; Nolan et al., 2014; Sandberg & Heden, 2011), and prosocial behaviors (London et al., 2015; McArdle et al., 2013; Nolan et al., 2014; Russo, 2013).

### ***Play, Language, and Learning***

Play researchers note that play is critically important, not just as a vehicle for developing self-regulation and executive function, but also to promote social competence and emotional literacy, language and literacy development, cognition and content-related concept building, creativity and imagination, empathy and resilience, cooperation and collaboration, and persistence and intelligence (Copple & Bredekamp, 2009; Fisher, 1992; Fisher et al., 2011;

Lillard et al., 2013; Pellegrini, 2013; White 2012). Play may seem to many an obvious a way for children in elementary school to spend their time. It seems natural and instinctive that children must spend time engaged in play to grow and develop as people. In the past two decades, however, the general view of play in school has shifted in the wake of an increased focus on direct instruction, worksheets, scripted curricula, and regular and frequent assessment monitoring in an effort to leave no child behind (Fisher et al., 2011; Repko-Erwin, 2017). In our current educational climate, play is often seen as mutually exclusive to academic learning, and teachers in early elementary (kindergarten through second or third grade) are engaging in purposeful play far less during the school day than they did just 30 years ago (Bassok, Latham, & Rorem, 2016; Pyle & Daniels, 2017; Ranz-Smith, 2007; Repko-Erwin, 2017).

Classroom teachers in early education settings can incorporate purposeful play to children learn social-emotional skills and develop their SR and EF as well as developing foundational language and literacy skills and vocabulary (Center on the Developing Child, 2017). In some preschool and early elementary settings, more opportunity for play may exist, but play should be an important instructional and pedagogical approach well into elementary grades as well. Many classroom centers or learning spaces lend themselves to just this type of growth. In the classroom library, puppet stage area, or dramatic play center, children can engage in play that develops vocabulary, conceptual language mapping, and literacy skills while also building EF skills (Allee-Herndon & Roberts, 2018; Bodrova, Germeroth, & Leong, 2013; Bodrova & Leong, 2007, 2010; Center on the Developing Child, 2017; Massey, 2013; Moreno, Shwayder, & Friedman, 2017). Even with older children and increased academic standards, a classroom culture of purposeful play and nurturing, reciprocal relationships can develop EF, SR, and social-emotional skills. Purposeful or guided play should support the development of the whole child

and allows for active manipulation of learning materials to extend children's understandings and enhances their interest in the disciplinary subject matter (Bodrova & Leong, 2007; McDonald, 2018; Mraz, Porcelli, & Tyler, 2016; Riek, 2014). Specifically, play-based instruction can allow children to develop critical language and foundational literacy skills like vocabulary (Han, Moore, Vukelich, & Buell, 2010; Hassinger-Das et al., 2016; Massey, 2013; McLeod et al., 2017; Nicolopoulou et al., 2010). Additionally, language skills themselves promulgate learning gains in other content areas (Hassinger-Das et al., 2017).

The research literature is rich with studies supporting the use of play in learning to develop language and literacy (Cremin et al., 2015; Hassinger-Das et al., 2016; McArdle et al., 2013; Nolan et al., 2014; Ranz-Smith, 2007; Russo, 2013; Sandberg & Heden, 2011). In addition to learning content-based literacy skills, children also learn other skills to support ATL, SEL, SR, EF, and academic achievement (Bodrova et al., 2013; Bodrova & Leong, 2010; Fisher, 1992; Fisher et al., 2011; Moreno et al., 2017; Pellegrini, 2013; White, 2013). For example, remembering the story for retelling or dramatizing, organizing a script for a puppet show or dramatic play, and planning for storytelling and dramatization all require elements of working memory, cognitive flexibility, and inhibitory control. Dramatic and imaginary play, in similar ways, allows children to develop social-emotional skills as they navigate role playing and try on different personas during play while also affording them opportunities to stretch their EF, SR, and language skills (Center on the Developing Child, n.d. a, b).

### **Research Methodology and Design**

This is a naturalistic, quasi-experimental study with purposive sampling, which uses a pretest-posttest, non-equivalent control group design. The two kindergarten classes were nested within a single school and assigned to either the treatment (play-based) or control

(contemporary) condition by the school administration prior to the start of the school year.

While the assignment to condition was done at the classroom level, analyses were done at the student level. This study was approved by the University of Central Florida Institutional Review Board (SBE-18-14264) and by the appropriate authorities at the Title I school site per the ethical guidelines for research with human subjects (see Appendix C). Informed consent was obtained from all individual adult participants included in the study, parental consent from all parents of participating kindergarteners, and verbal assent was obtained from all student participants.

### ***Research Questions***

Because the purpose of this study was to explore the possible relationships between play-based pedagogy and contemporary pedagogy in Title I kindergarten classrooms through measures of receptive vocabulary and reading achievement, the following research questions drove the study design and analysis.

1. Does a play-based pedagogy influence receptive vocabulary and reading academic achievement among Title I kindergarten students?
2. Are there relationships between pretest and posttest measures of reading achievement and receptive vocabulary among kindergarteners in a Title I school?

### ***Participants and Recruitment***

The site for this study was a Title I elementary school in a small district, located in Florida, which serves 12,934 students at 15 schools. For the purposes of confidentiality, the pseudonyms Gator Elementary and Sunshine District are used in this manuscript. While a relatively small district, Sunshine's diversity score (rendered by the chance that two students selected at random would be members of different ethnic groups) is .48 where the state's diversity score average is .46. Sunshine District's minority enrollment is 37%, and the majority



of this district population is either African American or Hispanic. Although the district diversity score is higher than the state average, the minority enrollment is much lower than the state average of 61%. The nine elementary schools in the district serve 6,841 students.

Gator Elementary serves 924 students in grades PK-6, with six kindergarten classrooms. The Florida class size amendment limits kindergarten classrooms to 18 students per class, but Gator Elementary has an average student to teacher ratio of 15:1. Minority enrollment at the school is 41% (majority African American and Hispanic), which while still lower than the state average, is higher than the district average. Gator Elementary is a Title I school with 67% of students eligible to receive free or reduced-price lunch (FRPL), which is often used as a measure of socioeconomic status (SES; National Forum on Education Statistics, 2015).

Notably, one of the most significant recruitment challenges for this study was finding public, Title I kindergarten classrooms that relied on play in a district that would approve the request to conduct research. The participants in this study were purposively included. The target intervention classroom was an “advanced kindergarten” class of 20 students with no students qualifying for exceptional student education (ESE) and one English language learner (ELL). Their teacher, who volunteered to participate in the study after seeing a request for participants on social media, is passionate about using a play-based approach in kindergarten. Her daily instructional schedule has 30-minutes dedicated to free choice “play centers” and 30-minutes of “learning centers” aligned to daily instructional standards and learning targets daily in addition to outdoor recess time each day. Per this teacher and the school principal, the other kindergarten teachers at this school use a more didactic, contemporary instructional approach with lots of drill and practice on skills. Upon recommendation of the school principal who supported participation in this study, the control classroom teacher’s classroom and instructional approach

lie in stark contrast. The control teacher, who is newer to teaching kindergarten but has more experience in intermediate grades and at Department of Defense (DoDEA) schools, approaches play in the classroom to include only the required outdoor recess time and “playing” on instructional applications on iPads daily or every other day to meet the district-required i-Ready Instruction minutes. Thus, the sampling frame was unfortunately limited to a maximum of 40 children in both conditions.

Parents of each classroom were recruited at a school curriculum night in September 2018 where the principal investigator shared the details of the study, provided information about their rights in a human study, and provided consent forms to sign. Parents were incentivized to participate with the receipt of all testing data for their child with a letter explaining the results and implications in parent-friendly language upon their request. They may also be notified of the overall findings, if requested, of the study upon its conclusion. Both teachers supported recruitment by sending home information packets with consent forms in students’ Friday Folders, speaking with parents at teacher conferences, and (the treatment teacher) communicating with parents via a class Facebook page.

Only children who had parental consent to participate ( $n = 33$  before attrition,  $n = 31$  after attrition) were evaluated using the receptive language assessment, and the other measures of reading academic achievement were conducted by the school and district. The sample size for this study was admittedly small, unevenly distributed by condition, and not consistently diverse across demographic categories such as exceptional student education (ESE), English Language Learner (ELL), or Free-and Reduced-Price Lunch (FRPL) eligibility status (see Appendix B). This demographic data was collected for possible use as covariates, but upon analysis was

mostly unusable in the study because of a lack of variation in the sample. The only two possible covariates to test with sufficient variation in the sample were students' gender and FRPL status.

### *Classroom Conditions*

By examining Figures 1 through 8, clearly observable environmental differences between the two classroom conditions at Gator Elementary exist, but the study cannot determine if the differences among the variables were a result of either pedagogical approach, the teacher's attitudes and dispositions, or a combination of these or other factors. The play-based classroom utilizes instructional resources like anchor charts and environmental print, instruction that allows for choice and flexibility, and showcases student work. The contemporary classroom also has a rug and calendar area, a word wall, and some environmental print. Children's work is posted throughout the play-based classroom, but few postings of student work are evident in the contemporary classroom.



Figure 1: Morning Calendar and Rug Area in Play-Based Classroom



Figure 2: Word Wall, Morning Calendar, and Rug Area in Contemporary Classroom



Figure 3: Word Wall in Play-Based Classroom

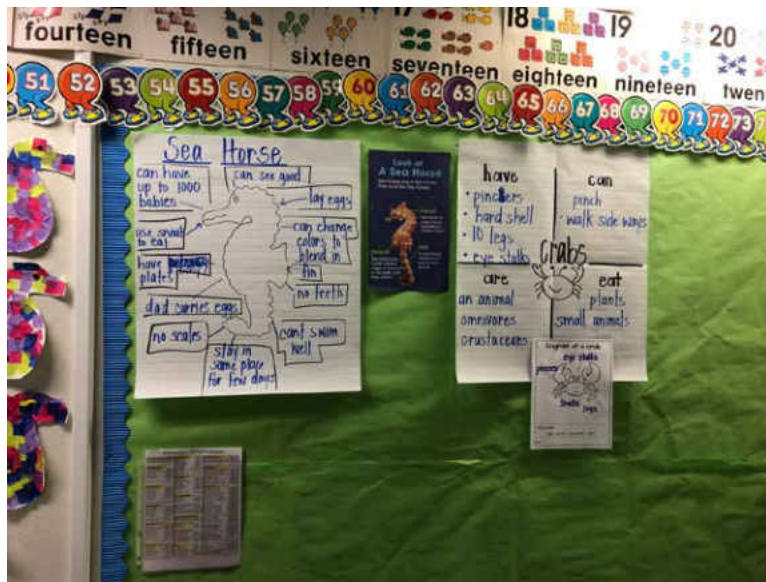


Figure 4: Example of Environmental Print in Play-Based Classroom



Figure 5: Example of Walls in Contemporary Classroom



Figure 6: Example of Book Reading Learning Center During Reading Block in Play-Based Classroom



Figure 7: Example of Students Working During Learning Centers and Reading Block in Play-Based Classroom



Figure 8: Example of Students Working During Reading Block in Contemporary Classroom

### *Instruments and Data Collection*

***Peabody Picture Vocabulary Test, 4th Edition (PPVT-4).*** The Peabody Picture Vocabulary Test, 4<sup>th</sup> Edition (PPVT-4) was used to measure receptive vocabulary. The PPVT-4 (Dunn & Dunn, 2007) and previous iterations have been used in prior studies as a proxy measure of children’s language development and of cognitive ability (McLear, Trentacosta, & Smith-Darden, 2016; Razza, Martin, & Brooks-Gunn, 2015, 2016). The PPVT-4 evaluates receptive vocabulary for Standard American English and has software to assist with scoring and reporting. Finally, this assessment is appropriate for school use and does not require a clinician to purchase, administer, or score the results. A qualification level of B is required for the overall administration of this measure, so anyone with a master’s degree or higher in education “or in a field closely related to the intended use of the assessment, and formal training in the ethical administration, scoring, and interpretation of clinical assessments” is eligible to purchase and interpret this assessment (Pearson Clinical, n.d.).

The PPVT-4 is intended for use with individuals ages 2.5 years to 90 plus. The assessment takes about 10 to 15 minutes to administer per child. The PPVT-4 contains enhancements over prior versions including a digital stimulus book for administering the assessment and has been co-normed with the Expressive Vocabulary Test, Second Edition. The PPVT-4 provides two distinct versions of the test to avoid repeated testing effects. Split-half reliability tests comparing scores on odd versus even numbered items generated good to excellent results; .89 to .97 for age groups and .87 to .93 for alternate versions of the test (Dunn & Dunn, 2013). The PPVT-4 is correlated to other tests (see Table 2) and to special populations representing specific clinical diagnoses or exceptional education categories. Differences between clinical samples representing language delays, hearing impairments, language disorders, and reading learning disabilities, all commonly seen by school speech and language pathologists, were significant at  $p < .001$  (Dunn & Dunn, 2013). Scores have been normed to a nationwide sample matched to the U. S. population estimates for SES, race, region, clinical diagnosis, and exceptional education status. Scores are available as standard scores, stanine, and percentile rank, and all reliability and validity coefficients are in the .90s range (Pearson Clinical, n.d.).

Table 2: Correlations of the PPVT-4 to Other Language and Literacy Measures

Tests	n	Correlations
Expressive Vocabulary Test, 2nd Edition (EVT-2)	3,540 examinees in 7 age groups	.80 to .84
Clinical Evaluation of Language Fundamentals, Fourth Edition (CELF-4)	111 examinees in 2 age groups	.67 to .75
Group Reading Assessment and Diagnostic Evaluation (GRADE)	487 examinees K-11	.43 to .79
Peabody Picture Vocabulary Test, Third Edition (PPVT-III)	322 examinees in 5 age groups	.81 to .91



*i-Ready Diagnostic.* The i-Ready Diagnostic was used to measure academic achievement. While no statewide assessments are required for kindergarten students in Florida, this district uses the i-Ready Diagnostic (Sunshine Schools, 2017) at the beginning, middle, and end of the year to assess students' progress and growth in reading and math. The i-Ready assessment is computer-based, adaptive, and aligned with i-Ready Instruction, which the district also uses for reading and math instruction. The reading assessment includes a composite score (which was used for this study) as well as scores for reading domains: phonological awareness, phonics, high-frequency words, vocabulary, literature comprehension, and informational text comprehension (Curriculum Associates, n.d. a).

i-Ready Diagnostic is intended for K-12 students. Percentile scores are nationally normed, and the diagnostic results also include a Lexile measure. Diagnostic score reports for individual students include information about typical growth for students at the same grade and placement level, "stretch growth" information intended to help students performing below grade level expectations reach proficiency, and placements by domain (Curriculum Associates, n.d. a). Classroom diagnostic score reports provide teachers with aggregated information at a glance and suggest instructional areas of foci, resources, and groupings. Overall reading placement score ranges for the 2018-2019 school year include "Emerging K" (100-361) and "Level K" (362-479), and on grade level kindergarten ranges are further parsed to "Early" (362-395), "Mid" (396-423), and "Late" (424-479) (Curriculum Associates, 2018). Per Curriculum Associates (2018), both i-Ready Diagnostic and i-Ready Instruction are aligned to state academic standards, Every Student Succeeds Act (Every Student Succeeds Act [ESSA], 2015), and What Works Clearinghouse (WWC, n.d.) research standards. Multiple published studies explore the alignment of i-Ready

Diagnostic to state standards and assessments including the Florida Standards Assessment (Curriculum Associates, n.d. b).

### *Procedures*

The Sunshine District and Gator Elementary already collect student demographic data upon student entry and i-Ready Reading Diagnostic data at the beginning, middle, and end of the academic year. The school and district provided the demographic data and the beginning (August to September 2018) and end (March to May 2019) of the year i-Ready Reading Diagnostic data for all children with parental consent to support the pretest-posttest, quasi-experimental study design. In addition, the principal investigator administered the PPVT-4 in the beginning and the end of the school year (October 2018 and May 2019).

In Sunshine District and at Gator Elementary, kindergarten students take the i-Ready Diagnostic in small groups with the teacher using iPads and headphones. Students are prompted by the assessment with oral directions, pictorial cues, and other supports for this non- or early readers to take this type of test. The PPVT-4 was administered by the researcher using Pearson's Q-Interactive platform with students one-on-one in a small office between kindergarten classrooms using two iPads, one for the test administrator and one for the student (Figure 9). This arrangement minimized classroom disruption and allowed for privacy without compromising student safety during the PPVT-4 administration. After obtaining student assent, students were given oral directions on how to "play the word game," were prompted to complete the practice screens, and commenced with the assessment. Each PPVT-4 assessment took approximately 10 to 15 minutes per child, and each child received a small token as a treat for "playing."



Figure 9: PPVT-4 Administration Using Two iPads

### **Data Analysis**

Table 3 outlines the sample sizes, variables, and statistical procedures used for each research question.

Table 3: Summary of the Study Design and Analysis

Research Questions	<i>n</i>	Independent Variables	Dependent Variables	Covariates	Statistical Tests
1. Does a play-based pedagogy influence receptive vocabulary and reading academic achievement among Title I kindergarten students?	$n = 30$	Classroom Condition (play-based or contemporary) Time (pre/post)	Receptive Vocabulary (PPVT-4 Pre/Post-Test Grade-Based Standard Score)  Academic Achievement (i-Ready Pre/Post Reading Overall Score)	<ul style="list-style-type: none"> <li>• Gender</li> <li>• FRPL</li> </ul>	Mixed Design MANCOVA
2. Are there relationships between pretest and posttest measures of reading achievement and receptive vocabulary among kindergarteners in a Title I school?	$30 \leq n \leq 33$	Classroom Condition (play-based or contemporary)	Receptive Vocabulary (PPVT-4 Post-Test Grade-Based Standard Score)  Academic Achievement (i-Ready Post-Test Reading Overall Score)		Spearman's $r_s$

### ***Research Question 1***

Does a play-based pedagogy influence receptive vocabulary and reading academic achievement among Title I kindergarten students?

***Assumptions.*** To ensure that the results from a multivariate analysis of covariance (MANCOVA) were valid, the relevant statistical assumptions were examined. Not all pairs of dependent variables were linearly related, as assessed by visual inspection of a scatterplot. There was multivariate homogeneity of variances and covariances, as assessed by Box's M test,  $F(10, 2024.653) = 1.608$ ,  $p = .098$ . Group variances were homogeneous for all four language and literacy univariate dependent variables except for the post-test i-Ready Reading Diagnostic composite scores,  $F(1, 28) = 8.647$ ,  $p = .007$ . No evidence of multicollinearity was found as measured by correlation coefficient values. All correlations between the dependent variables within each MANCOVA were less than  $r = .75$ . No univariate outliers were present in the data, as assessed by standardized residuals greater than  $\pm 3$  standard deviations. There were no multivariate outliers in the data, as assessed by Mahalanobis distance, ( $p > .001$ ). Residuals were normally distributed, as assessed by Shapiro-Wilk's test with the exception of the post-test i-Ready Reading Diagnostic scores ( $SW(31) = .928$ ,  $p = .040$ ). Based on these cumulative findings and the robustness of the MANCOVA against violations of statistical assumptions, the researcher proceeded with the inferential analyses.

***Results.*** Prior to examining the treatment effects, covariates were assessed for their contribution to the analytic model and were retained only if they were statistically significant or had a moderate effect size ( $\eta_p^2 \geq .06$ ). Although neither students' gender,  $F(2, 25) = 1.150$ , Wilks'  $\Lambda = .916$ ,  $p = .333$ , nor FRPL status,  $F(2, 25) = 1.447$ , Wilks'  $\Lambda = .896$ ,  $p = .104$ , were statistically significant, the moderate effect sizes,  $\eta_p^2 = .084$  and  $\eta_p^2 = .104$  respectively, suggest

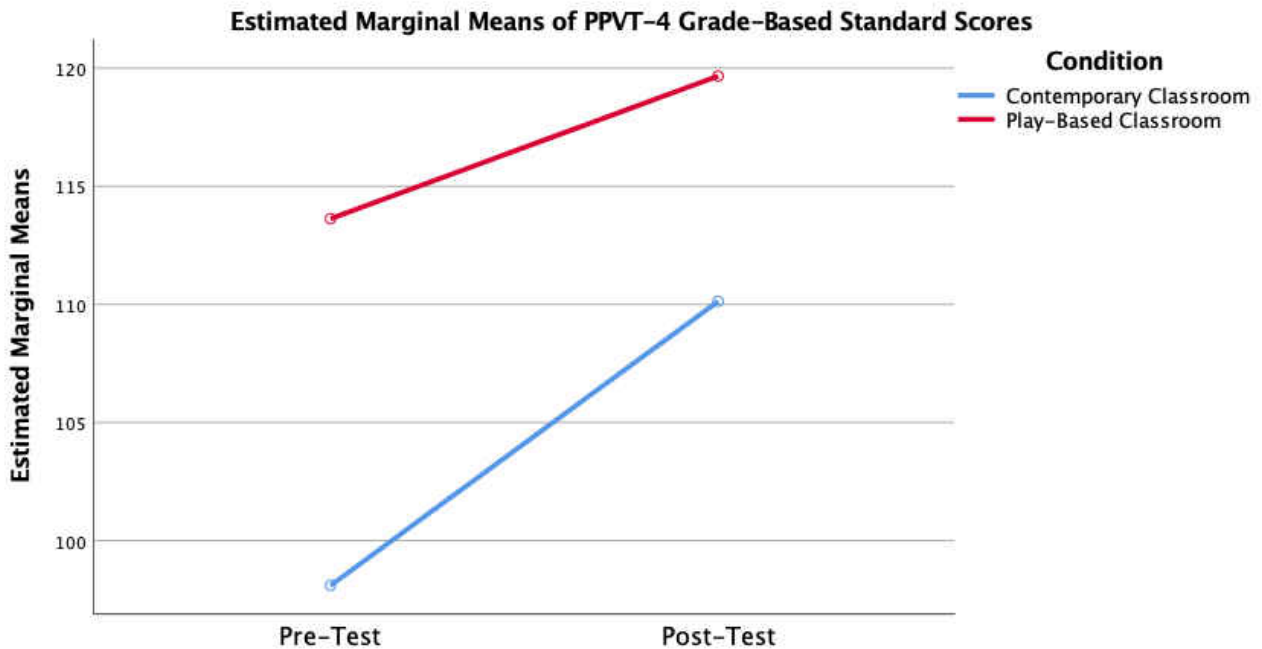
that they may contribute to the model. As such, the researcher elected to retain the covariates for the analysis as they account for the contributions of gender and SES to the language and literacy dependent variables and allow a better assessment of the unique contributions of the classroom condition. There was both a statistically significant interaction and a very large effect between classroom condition and time,  $F(2, 25) = 7.126$ , Wilks'  $\Lambda = .637$ ,  $p = .004$ ,  $\eta_p^2 = .363$ . This suggests that, for a least one of the two dependent variables (student's receptive vocabulary and reading achievement), the change in scores for the play-based class is different from the contemporary class.

After accounting for students' gender and FRPL status, there was not a statistically significant interaction between growth over time and classroom condition for students' receptive vocabulary,  $F(1, 26) = 2.846$ ,  $p = .104$ . However, there was a moderate effect size,  $\eta_p^2 = .099$ . Because of the decision to consider effect sizes as well as statistical significance, the researcher treated this as an interaction effect. Students in both classroom conditions demonstrated a statistically significant increase in receptive vocabulary with very large effect sizes from pre- to post-test, but the receptive vocabulary growth was greater for students in the play-based classroom,  $F(1, 16) = 1355.217$ ,  $p < .001$ ,  $\eta_p^2 = .988$ , than for students in the contemporary classroom,  $F(1, 8) = 1056.005$ ,  $p < .001$ ,  $\eta_p^2 = .992$ . Table 4 shows the adjusted means and standard deviations for each dependent variable by condition, and Figure 10 below illustrates a steeper incline for receptive vocabulary growth for the contemporary classroom than the play-based classroom, even though the students' scores are higher in the play-based classroom at both pre- and post-test.

Table 4: Adjusted Means and Standard Deviations

Measure	Condition	Time	Mean	SD
Receptive Vocabulary	Contemporary Classroom	Pre-Test	98.104 <sup>a</sup>	43.038
		Post-Test	110.128 <sup>a</sup>	32.183
	Play-Based Classroom	Pre-Test	113.624 <sup>a</sup>	32.731
		Post-Test	119.663 <sup>a</sup>	24.471
Reading Achievement	Contemporary Classroom	Pre-Test	345.185 <sup>a</sup>	114.393
		Post-Test	401.711 <sup>a</sup>	79.515
	Play-Based Classroom	Pre-Test	375.998 <sup>a</sup>	87.008
		Post-Test	476.325 <sup>a</sup>	60.477

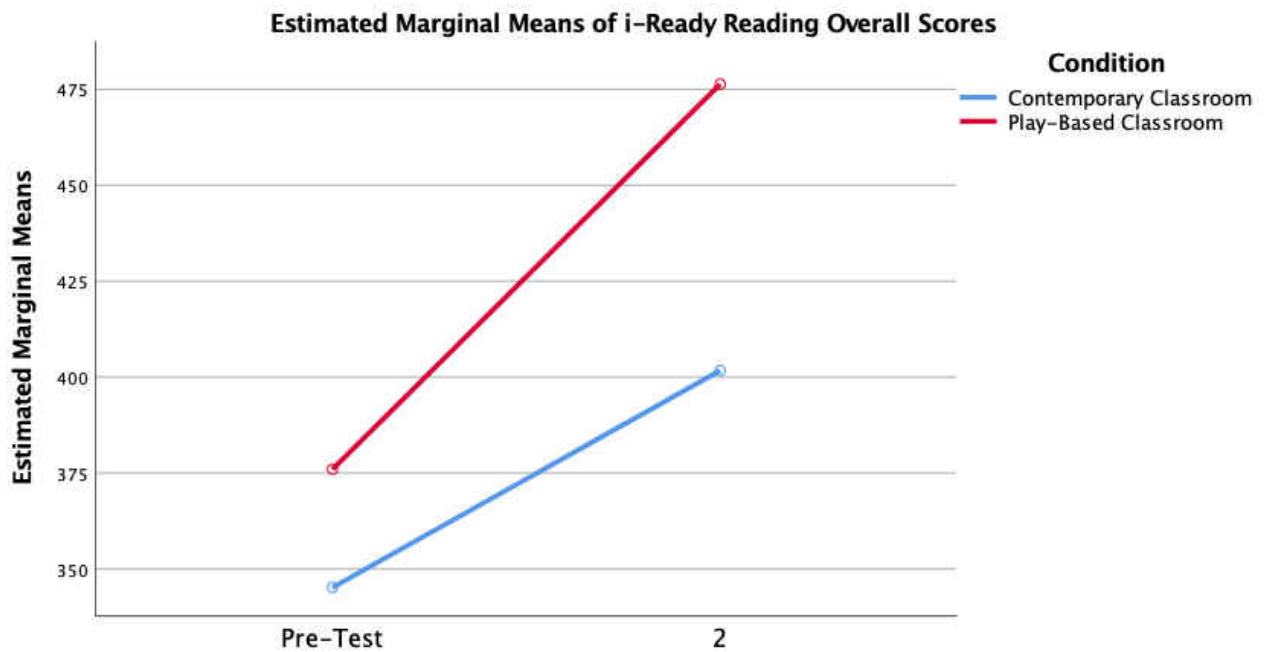
a. Covariates appearing in the model are evaluated at the following values: Gender = .60, FRPL = .73



Covariates appearing in the model are evaluated at the following values: Gender = .60, FRPL = .73

Figure 10: Adjusted Means of Receptive Vocabulary Assessment Growth by Condition

For the measures of students' reading achievement, there was also both a statistically significant interaction and a large effect,  $F(1, 26) = 11.020$ ,  $p = .003$ ,  $\eta_p^2 = .298$ . Students in the play-based classroom had greater reading gains,  $F(1, 16) = 58.133$ ,  $p < .001$ ,  $\eta_p^2 = .784$ , than students in the contemporary classroom,  $F(1, 8) = 6.692$ ,  $p = .032$ ,  $\eta_p^2 = .455$ , although reading achievement growth in both conditions were statistically significant with very large effect sizes. Figure 11 below illustrates both the steeper incline of reading achievement in the play-based classroom as well as the differences in mean scores.



Covariates appearing in the model are evaluated at the following values: Gender = .60, FRPL = .73

Figure 11: Adjusted Means of Reading Achievement Growth by Condition



## ***Research Question 2***

Are there relationships between pretest and posttest measures of reading achievement and receptive vocabulary among kindergarteners in a Title I school?

***Assumptions.*** To determine the most appropriate correlation test for this analysis, the relevant statistical assumptions were considered. All variables analyzed (i-Ready Reading Overall Scores and PPVT-4 Grade-Based Standard Scores at pre- and post-test) are continuous. Preliminary analyses showed predominantly linear relationship between the four variables, as assessed by visual analysis of the scatterplots with Loess lines at 90% of points to fit. This visual assessment of the scatterplots also suggests bivariate normality or homoscedasticity for the most part, but they do show some bivariate outliers that do not appear fundamentally problematic. Given the violations of the statistical assumptions for the Pearson Product-Moment Correlation, the researcher elected to use Spearman's Rank Correlation Coefficient, as this non-parametric test is more robust against violations of assumptions.

***Results.*** There were statistically significant correlations, with moderate to strong positive correlations between all variables in both classroom conditions. Students' receptive vocabulary scores at pre-test were strongly correlated to receptive vocabulary scores at post-test,  $r_s(31) = .652, p < .001$ , to reading achievement scores at pre-test,  $r_s(32) = .649, p < .001$ , and to reading achievement scores at post-test,  $r_s(31) = .697, p < .001$ . Additionally, there were statistically significant, moderate to strong positive correlations between students' receptive vocabulary scores at post-test and their reading achievement scores at both pre-test,  $r_s(30) = .506, p = .004$ , and post-test,  $r_s(31) = .434, p = .015$ . Further, there was a statistically significant, strong positive association between students' reading achievement scores at both pre- and post-test,  $r_s(30) =$

.626,  $p < .001$ . Students with higher levels of receptive vocabulary also tended to perform better on measures of reading achievement.

### **Discussion**

Prior studies link purposeful play to increased language and literacy outcomes (i.e., Han, Moore, Vukelich, & Buell, 2010; Hassinger-Das et al., 2016; Massey, 2013; McLeod et al., 2017; Nicolopoulou et al., 2010). Additionally, research shows that children from low-SES households may experience more vulnerability in school related to language (i.e., Blair et al., 2011; Sharkins et al., 2017; Vallotton et al., 2012), ATL (i.e., Razza, Martin, & Brooks-Gunn, 2015, 2016), and social-emotional skills (i.e., Sharkins et al., 2017). While the evidence that play supports children in developing these capacities, play in contemporary Title I kindergarten classrooms occurs with far less frequency (Bassok, Latham, & Rorem, 2016; Repko-Erwin, 2017). These results provide a small step in the direction of linking play-based pedagogy with improved language and literacy academic outcomes.

Table 5 offers an interpretation of the mean scores according to PPVT-4 grade level equivalents (Pearson Clinical, n.d.) and i-Ready Reading kindergarten placement ranges (Curriculum Associates, 2018). This table also shows the adjusted means by group and time for both PPVT-4 and i-Ready measures. While the students in the play-based classroom began the school year with higher summer screening (i.e., pretest) scores, it is interesting to consider how much difference is because students began school with different language and literacy capacities and how much difference is because of the pedagogical approach. Much more research needs to be done, however, to conclusively support connections between a play-based approach and improved language and literacy outcomes.

Table 5: Within and Between Mean Pre- and Post-Test Interpretations

Condition Time	Play-Based Kindergarten		Contemporary Kindergarten	
	Pre-Test	Post-Test	Pre-Test	Post-Test
PPVT-4	$M = 113.624,$ $SD = 32.731$ ~ 1.3 GLE $n = 19$	$M = 119.663,$ $SD = 24.471$ ~1.8 GLE $n = 19$	$M = 98.104,$ $SD = 43.038$ ~ <K GLE $n = 11$	$M = 110.128,$ $SD = 32.183$ ~ K.8 $n = 11$
i-Ready	$M = 375.998,$ $SD = 87.008$ Early K $n = 19$	$M = 476.325,$ $SD = 60.477$ Late K $n = 19$	$M = 345.185,$ $SD = 114.393$ Emerging K $n = 11$	$M = 401.711,$ $SD = 79.515$ Mid K $n = 11$

*GLE – Grade-Level Equivalent (i.e., 1.1 is the First Month of First Grade and <K is Pre-Kindergarten)*

### ***Educational Implications***

While differences in the amount and type of environmental print, the configuration of and options for student seating and working configurations, organizational style and overall aesthetics are evident to the casual observer (see images above in Classroom Condition), more information is needed to suss out what exactly drives the differences between the students' language and literacy outcomes by classroom condition. The exact extent, for example, that the wall décor and classroom aesthetic, organization and accessibility of resources and materials, or the inclusion of read alouds or singing or free play centers play a role in language and literacy growth is unknown. Are these differences more pedagogically based or personality driven? At this point, it would be impossible to pinpoint if the inclusion of free play and purposeful, guided play and a print-rich environment alone contributed to the differences, or if those differences in instructional approach and space work in combination with teacher dispositions and relationships. These exciting avenues await exploration in future studies, however, to be able to better prepare preservice teachers and support in-service teachers in the use of DAP and

purposeful play. Any information that educational researchers and practitioners can glean on how best to support students' developing language, ATL, and SED along with academic achievement would serve to narrow the persistent achievement gap.

### ***Limitations and Future Research***

While a preliminary analysis of these results is somewhat exciting, one must exercise caution in our interpretation about the generalizability of these results given the small sample size. Due to recruiting challenges with issues such as the lack of Title I kindergarten teachers using play-based approaches, the lack of administrators supporting that pedagogical approach, and the lack of districts willing to approve this study, a purposive convenience sample was determined for this research study. Because of the small sample size of 30, this study possessed some violations of statistical assumptions and low statistical power, that while corrected using adjusted effect size in addition to statistical significance and robust nonparametric statistical analyses, that may have changed the conclusions and possible interpretations of the results. Violations of these assumptions can influence Type I (incorrectly rejecting the null hypothesis that there are no differences or relationships) and Type II (incorrectly accepting the hypothesis that there are significant differences or relationships), and these violations may cause over- or under-estimations of inferential measures (Osborne, & Waters, 2002). Part of this challenge was addressed by using effect sizes ( $\geq .06$ ) in addition to statistical significance and adjusted statistics such as non-parametric tests when appropriate to strengthen the findings.

One significant limitation of this study was that, because the researcher only had access to two classrooms, the teacher and the classroom condition are confounded. Even adding one more class in each condition would provide more reliable results. There is no responsible or ethical way to suggest that, in this study, the play-based classroom caused the improved

performance or growth, especially when that classroom was intended to be the “advanced” classroom as determined by kindergarten summer screening data and there are differences in teacher experience and instructional philosophy. These confounds necessarily limit the inferences we can make. To better explain the differences, the statistical analysis explored growth instead of simply using students’ raw scores, and within this design there were statistically significant results. That said, these findings, set amidst its accompanying body of literature, are promising, especially within the context of justifying future studies with larger, more robust samples.

Hatch (2002) might suggest that many teachers, and by extension their administrators, are choosing a more directed instruction focused on increased seat time because of accountability shovedown and the standards-driven culture we currently inhabit. It is this researcher’s experience that many teachers and administrators may be using this more contemporary approach out an intense desire to meet specific educational outcomes, fear that play may not achieve these outcomes, or a lack of sufficient knowledge to plan for purposeful play aligned to learning goals and educational standards. That said, the contemporary approach, while contributing to some unintended consequences, has been grounded in research, specifically in intervention research. In truth, the best pedagogical approach likely focuses on a balanced use of a variety of research-driven strategies.

Future studies, including an extension and replication of this one with a larger, more diverse sample size capable of enough statistical power to address possible teacher or school effects, will be important for both extracting actionable interpretations from this study and for positively contributing to the field. In addition to simply having more students, classrooms, and schools, it will be important to better define the construct of play-based versus contemporary

classrooms. Mixed methods studies might help support this goal by using observation and interview tools, such as the School-Age Care Environment Rating Scale (SACERS; Harms, Jacobs, & White, 2013) and the Classroom Assessment Scoring System (CLASS; Pianta, La Paro, & Hamre, 2008) would better define the environmental factors in each condition. Other researchers around the globe, such as Hu, Fan, Gu, and Yang (2016) have adapted and used CLASS to identify literacy gains, and the effects of other instructional interactions on student outcomes. In short, however, this type of research will require a “ground up” approach as the current PK-12 educational climate eschews a play-based approach in daily practice, based on the fear that stringent accountability benchmarks cannot be met through play. These preliminary findings may serve to justify and provide support for implementation of play in kindergartens. This study may also serve as a pedagogical leap for many educators who currently feel significant pressure to double down their prescriptive instructional approach at the expense of more child-centered and play-based learning experiences that also better support the development of language, social-emotional skills, and “soft skills” like creativity and problem solving. Thus, advocating for play-based learning experiences to increase the likelihood of improved academic outcomes.

### **Conclusion**

While these findings are insufficient for broad-stroked policy changes in the current kindergarten climate, they do converge with the emerging neuroscientific findings about how poverty and stress, likely more prevalent among students in Title I schools, affect developing brains, how those effects contribute to educational challenges and persistent gaps in opportunities for academic growth. These findings also generally support a return to the more traditional approach from decades ago of DAP to include play for children in kindergarten.

Despite our best and unwavering intentions as a nation, our increased focus on seemingly rigorous instruction and standardized outcomes has not yet eliminated the persistent and predictable achievement gaps already so well-documented in the literature, especially for children facing multiple challenges and adverse conditions or circumstances. Additionally, some disturbing unintended consequences are bubbling to the surface as pedagogical shifts away from more constructivist approaches to learning, DAP, and best practice grounded in social learning theory (Piaget, 1977; Vygotsky, 1978). The increasing incidents of externalizing behaviors and exclusionary discipline with very young children could very well be backlash from the lack of DAP, play-based, naturalistic learning and teaching approaches. The time seems ripe to combine new neurological science discoveries about the brain with time-tested experiences that include play-based pedagogy in efforts to improve the classroom experiences, the behavioral climates, and academic outcomes for all children, especially those in Title I schools.

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# **WHAT IS THE FUNCTION OF PLAY? : EXPLORING THE POSSIBLE BENEFITS OF PLAY-BASED PEDAGOGY ON EXECUTIVE FUNCTION AND ACADEMIC ACHEIVEMENT IN TITLE I KINDERGARTEN CLASSROOMS**

## **Introduction**

For the last three decades, educators have seen dramatic shifts in the pedagogical practices in our kindergarten classes. Educators now note the dramatic shifts in what children are expected to learn as well as how children are expected to learn in early elementary grades (Bassok, Latham, & Rorem, 2016; Repko-Erwin, 2017). The current focus on accountability, high-stakes, standardized testing and rigorous academic standards for teaching and learning need not be considered mutually exclusive to purposeful play pedagogy with hands-on, language-rich, discovery-focused learning. Currently, schools are not experiencing the student gains based on contemporary, standardized test-driven models of direct, didactic instruction punctuated with drill and practice. Further, in an effort to force these outcomes leading to pedagogical implications, the pressure toward higher and higher test performance simply increases, all the while counter to existing research. The combination of children's developmental needs and suboptimal achievement outcomes have strong implications for researchers, practitioners, leaders, and policymakers to take a closer look at the emerging science behind play as it relates to curriculum, instruction, and pedagogy, specifically regarding the development of essential brain skills that go hand-in-hand with academic learning and student achievement. Critical prefrontal cortex skills like self-regulation (SR) and executive function (EF) are strongly linked to children's positive developmental and academic outcomes, but how are they best built to support success in school? This paper explores if a play-based pedagogy, which is a neuroscientifically supported approach, can work to increase academic achievement, especially with our most vulnerable students.



### *Rationale and Statement of Purpose*

Teachers in early elementary classrooms increasingly require research-based strategies to teach the most vulnerable students. Neuroeducational findings over the past 15 years illuminate more concretely how specific conditions, such as poverty, affect brain and cognitive development and the related impacts on academic achievement. Recent improvements in neuroimaging, a relatively new discipline using various technologies to image the structure and function of the brain, allow us to better understand how the brain develops. This new knowledge of the brain holds the possibility to affect our understanding of teaching and learning, specifically in the areas of executive function and self-regulation. These increased understandings can allow educational professionals to tailor instructional practices to best meet the needs of students, especially students living in poverty who are at greater risk for underperforming when compared to their more resourced peers. To meet the needs of all our students, but especially our students living in poverty or other stressful environments, teachers must offer learning experiences that engage children emotionally, socially, and cognitively in growth-promoting classrooms to increase children's chances for success in school and beyond.

Creating growth-promoting classrooms that are language rich, emotionally rich, steeped in play (Hassinger-Das, Toub, Hirsh-Pasek, & Golinkoff, 2017), and protected from excessive stress have the potential to “dramatically improve the life prospects of all young children” (Shonkoff, 2017, p. 15). In recent decades, the elementary school focus has collectively shifted to an environment of increased testing and decreased play and autonomy. Neuroeducational findings suggest a return to a more play-based constructivist pedagogical approach could significantly support students, especially those students living in poverty, to experience greater academic success. Components of whole-child, constructivist classrooms often include language

and literacy learning, dramatic or imaginary play, games and puzzles requiring logic and spatial awareness, gross motor play, and music and movement. The problem, however, is that current instruction and assessment expectations and demands in primary grades including kindergarten do not align with the recommended instructional approaches from neuroscience. Therefore, the purpose of this study, with an emphasis on poverty, was to explore the possible relationships between play-based pedagogy and contemporary pedagogy in Title I kindergarten classrooms through measures of executive function and academic achievement.

### *Literature Review*

Kindergarten has unquestionably changed since the enactment of No Child Left Behind legislation (No Child Left Behind [NCLB], 2002) as have our approaches to teaching and measuring learning (Bassok et al., 2016; McGuinn, 2006; Miller, & Almon, 2009; Pyle & Daniels, 2017; Ranz-Smith, 2007; Repko-Erwin, 2017). Since the 90s, kindergarten teachers now report having increased academic expectations of children at kindergarten entry, with children to be reading by the end of kindergarten, spend less time on music and art, have fewer opportunities for discovery or play, and increasingly use math and reading workbooks daily (Bassok et al., 2016; Repko-Erwin, 2017). Garnered in the past decade, neuroeducational insights indicate that executive functions and self-regulation, also related to social-emotional skills, are strongly correlated to both school readiness and academic achievement (Moreno et al., 2017). Executive function (EF) skills manifest as the ability to follow directions, to take turns, to engage in prosocial problem-solving, and to sustain attention on a challenging task, among other things (Allee-Herndon & Roberts, 2018, 2019; Center for the Developing Child, 2017; Gathercole et al., 2008).

Children living in poverty typically have lower cognitive performance, increased behavioral issues, and historically underperform compared to their peers on several important characteristics like academic performance and pro-social school behaviors (Dilworth-Bart, 2012; Micalizzi, Brick, Flom, Ganiban, & Saudino, 2019; Sattler, & Gershoff, 2019; St. John, Kibbe, Tarullo, 2019; Urasche, & Noble, 2016). Children living in low-income homes experience developmental delays that encompass interdependent skills: gross motor, sensory perception, social-emotional development, language development, and cognitive development (Blair & Raver, 2015; Brown & Low, 2008; Engle & Black, 2008). These impairments have a significant negative impact on readiness for kindergarten, which is correlated to later difficulties in school (Dilworth-Bart, 2012; Micalizzi, Brick, Flom, Ganiban, & Saudino, 2019; Sattler, & Gershoff, 2019; Urasche, & Noble, 2016). Indeed, when children begin school considerably behind their peers, the gap frequently widens rather than diminishes (Blair & Raver, 2015; Engle & Black, 2008; Morgan et al., 2019). Each element appears to influence the others, and the challenge is to determine the best ways to maximize opportunities for all students, but especially vulnerable students, in our schools and in life. In the next sections, the relationships between poverty and EF, EF and academic achievement, and play, EF, and learning are described.

### ***Poverty and Executive Function***

Existing evidence suggests the impact of poverty on language development and pre-academic skills. However, less is known regarding other learning gaps. Blair (2002) explains self-regulation (SR) is an umbrella set of skills that comprise the foundation for the demands required of formal schooling (as cited in Willoughby, Kupersmidt, Voegler-Lee, & Bryant, 2011). SR broadly includes self-control, emotional regulation, executive function, problem solving, and grit. EF can be defined as domain-specific mental skills including task completion,

response inhibition, attention control, attention shifting or cognitive flexibility, and working memory. Management of SR and EF occurs in the prefrontal cortex of the brain and affect judgment, differentiation, anticipating outcomes, time management, attention and switch focus, planning and organizing, remembering details, and social-emotional aptitude. Researchers believe early childhood is a critical period for developing SR and EF skills critical for school readiness (Blair, 2016; Blair & Raver, 2015; Fitzpatrick, McKinnon, Blair, & Willoughby, 2014; Zelazo, 2015; Zelazo, Blair, & Willoughby, 2016).

Sparse empirical research to date exposes data-driven educational interventions addressing the effects of poverty on young children's SR/EF and school readiness, but researchers have recently begun to explore the role of EF on those in poverty, particularly young children's readiness for school and the demands of structured academics (Blair, 2016; Blair & Raver, 2015; Dilworth-Bart, 2012; Fitzpatrick et al., 2014; Micalizzi, Brick, Flom, Ganiban, & Saudino, 2019; Sattler, & Gershoff, 2019; Urasche, & Noble, 2016; Vitiello, & Greenfield, 2017). Shonkoff (2011) and others believe school readiness and achievement gaps can be reduced with high-quality, research-based pedagogy and curriculum in conjunction with a nurturing, supportive environment that reduces stress on developing brains. Existing neurocognitive research suggests a predictive relationship between SR and EF to literacy and numeracy skill development (i.e., Duncan, McClelland, & Acock, 2017; Gilmore, Keeble, & Richardson, 2015; Gimbert, Camos, Gentaz, & Mazens, 2019; Meixner, Warner, Lensing, Schiefele, & Elsner, 2019; Nesbitt, Fuhs, & Farran, 2019; Skibbe, Montroy, Bowles, & Morrison, 2019; Shonkoff, 2011; Zhang, Bingham, & Quinn, 2017). Other researchers (i.e., Blair & Raver, 2015; Morgan et al., 2019; Nguyen, & Duncan, 2019; Pace, Alper, Burchinal, Golinkoff, & Hirsh-Pasek, 2019; Zelazo, Blair, & Willoughby, 2016) provide evidence linking

EF as a predictive agent for academic achievement and socioeconomic status for children of poverty.

Executive function, in fact, has become such a hot topic in educational research that some recent journals have dedicated entire special issues to related articles (i.e., *Early Childhood Research Quarterly*, 46(1); *Young Children*, 72(2)). While an increasing body of research helps us understand more how SES affects the developing brain, EF, readiness for school, and children's trajectories in school, the need to effectively translate this into actionable practice in classrooms is imperative. That said, still relatively few empirical studies exploring the effects of particular instructional interventions designed to mitigate these risks and improve young children's SR and EF, particularly in the early elementary grades (Allee-Herndon & Roberts, 2019). These studies, however, are exciting in that they suggest we, as educators, may be able to improve both experiences and outcomes for children in school.

“The foundational EF skills begin to emerge around three to four years of age and increase dramatically during the preschool period” (Jones, Bailey, Barns, & Partee, 2016, p. 4). Preliminary data suggests EF, especially working memory, and emotional SR are highly malleable and trainable in early childhood. Concentration on EF and other SR development does not supplant a focus on learned skills such as letter knowledge, number sense, or the ability to use scissors, but positions children to succeed (Blair & Raver, 2015; McClelland & Cameron, 2019) over providing academic interventions alone. Safe and nurturing environments, foundational early learning, and SR skills support the development of EF and school readiness. “Converging evidence from multiple fields of study, including cognitive neuroscience, education, and economics, suggests that one of the most promising approaches to ameliorating

the SES-related achievement gap is via evidence-based interventions targeting children from lower SES backgrounds early in development” (Pakulak et al., 2015, p. 7).

### ***Executive Function and Academic Achievement***

The chronic, toxic stress of daily life in a poverty environment contributes to the delayed development of EF and self-regulation (SR), increases cognitive and affective dysregulation, diminished pro-social behaviors or increased aggressive behaviors, and reduced cognitive abilities (Ackerman et al., 2004b, 2004a; Bernhard et al., 2008; Blair et al., 2011; Blair & Raver, 2016; Raver et al., 2012; Razza et al., 2015; Sung, 2014). Children from low-income homes often demonstrate reduced receptive and productive language abilities, diminished early literacy and foundational math skills, are often less willing to attend and persist with academically challenging tasks, and show a less positive approach to structured learning (Blair & Raver, 2015; Brown & Low, 2008; Engle & Black, 2008; Sharkins, Leger, & Ernest, 2017; Vallotton et al., 2012). Because of these challenges, low-income and poor students often experience decreased school readiness and classroom adjustment and engage in fewer behaviors conducive to learning and academic achievement which can be predictive of future learning difficulties in reading and math (Morgan et al., 2017; 2019), and often contributes to even further achievement gaps because of disciplinary removal from learning experiences in the classroom (Bowman-Perrott et al., 2013; Brown & Steele, 2015; Burke et al., 2011; Griner & Lue Stewart, 2012; McLear et al., 2016; Skiba et al., 2011). While these associations seem intuitive and logical to many educators, a need for evidence-based interventions to support parents, children, and educators with these challenges remains.

Researchers have been able to find relationships, even predictive ones, between EF and academic achievement. The researchers involved in the studies were able use extant,

longitudinal data sets and statistical tests to explore differences and correlations among large groups of children ( $n=381$  to  $n=18,080$ ) in regard to poverty, EF, and academic achievement (Allee-Herndon & Roberts, 2019). This body of literature suggests very strong relationships between learning or academic achievement, self-regulation or executive function, poverty, and education. In short, these studies support the claim that poverty poses a significant risk to children's wellbeing, explains much of the school readiness and achievement gaps, and is directly related to children's behaviors, approaches to learning (ATL), and familial conditions that make success in the structured school environment difficult.

Further adding to the field, recent experimental and quasi-experimental studies reinforce these connections and begin to explore the effects of interventions to reduce the effects of poverty on children's learning, behavioral, social-emotional, and academic outcomes. These studies represent leading-edge experiments, which may, with further replication and validation, lead early childhood policymakers and researchers to have actionable data and research-based strategies to improve academic performance negatively affected by poverty's impact on EF (Allee-Herndon & Roberts, 2019).

### ***Play, Executive Function, and Learning***

Play may seem like an obvious a way for children in elementary school to spend their time. It seems natural and instinctive that children must spend time engaged in play to grow and develop as people. In the past three decades, however, the general view of play in school has shifted in the wake of an increased focus on direct instruction, worksheets, scripted curricula, and regular assessment monitoring in an effort to leave no child behind (Bassok, Latham, & Rorem, 2016; Fisher, Hirsh-Pasek, Golinkoff, Singer, & Berk, 2011; Miller & Almon, 2009; NAEYC, 2005; Pyle & Daniels, 2017; Ranz-Smith, 2007; Repko-Erwin, 2017). In our current

educational climate, play is often seen as mutually exclusive to academic learning, and teachers in early elementary (kindergarten through second or third grade) are engaging in purposeful play far less during the school day than they did just 30 years ago (Bassok et al., 2016; Miller, & Almon, 2009; Pyle & Daniels, 2017; Ranz-Smith, 2007; Repko-Erwin, 2017). Among play researchers, however, play is critically important, not just as a vehicle for developing self-regulation and executive function, but also to promote social competence and emotional literacy, language and literacy development, cognition and content-related concept building, creativity and imagination, empathy and resilience, cooperation and collaboration, and persistence and intelligence (Copple & Bredekamp, 2009; Fisher, 1992; Fisher et al., 2011; Lillard et al., 2012; Pellegrini, 2013; White, 2013).

When children come to school without the prior academic knowledge we consider necessary, without the behaviors and dispositions and approaches to learning we consider appropriate, or with challenges in all areas, it can be difficult for classroom teachers to know what to do to close these gaps and build the skills necessary for children's classroom and school success. High-quality pedagogy and research-based instructional strategies used in an environment of care and support can reduce stress on growing children and developing minds (NAEYC, 2005; 2009; Shonkoff, 2011). This is especially important for children living with the chronic toxic stress of poverty. Our classrooms can become brain growth-promoting spaces where children experience emotional security and physical safety. Growth-promoting classrooms are language-rich, include purposeful play, and allow discovery and exploration with the support of peers, and teachers scaffolding metacognitive development of skills that support SR, EF, and social-emotional development (Allee-Herndon & Roberts, 2018).



These classrooms combine a focus on meeting the needs of the children where they are, using DAP or developmentally appropriate practice (NAEYC, 2009), and helping children grow and stretch to meet standards-driven learning goals and benchmarks. A comprehensive, effective curriculum must attend to both academic and social-emotional competencies. Instruction and assessment are driven by both an understanding of child development and appropriate learning standards like the *Common Core State Standards* and *Next Generation Science Standards* (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010; NGSS Lead States, 2013). High-quality, growth-promoting classrooms need not choose between DAP or academic standards, but rather should strive for a balanced, child-centered approach to employing both (Allee-Herndon & Roberts, 2018; NAEYC & NAECS/SDE, 2002). Because high-level, purposeful play affords so many socio-emotional and cognitive benefits, DAP purports that quality early childhood classrooms provide play-based learning opportunities supported by skilled facilitators (NAEYC, 2009).

### **Research Methodology and Design**

This is a naturalistic, quasi-experimental study with purposive sampling, which uses a pretest-posttest, non-equivalent control group design. The two kindergarten classes were nested within a single school and assigned to either the treatment (play-based) or control (contemporary) condition by the school administration prior to the start of the school year. While the assignment to condition was done at the classroom level, analyses were conducted at the student level. This study was approved by the University of Central Florida Institutional Review Board (SBE-18-14264) and by the appropriate authorities at the Title I school site per the ethical guidelines for research with human subjects (see Appendix C). Informed consent was obtained from all individual adult participants included in the study, parental consent from all

parents of participating kindergarteners, and verbal assent was obtained from all student participants.

### ***Research Questions***

Because the purpose of this study was to explore the possible relationships between play-based pedagogy and contemporary pedagogy in Title I kindergarten classrooms through measures of executive function and academic achievement, the following research questions drove the study design and analysis.

1. Does a play-based pedagogy influence executive function and reading and math academic achievement among Title I kindergarten students?
2. Are there relationships between posttest measures of reading and math academic achievement and parent and teacher posttest measures of students' executive function among kindergarteners in a Title I school?

### ***Participants and Recruitment***

The site for this study was a Title I elementary school in a small district, located in Florida, which serves 12,934 students at 15 schools. For the purposes of confidentiality, the pseudonyms Gator Elementary and Sunshine District are used in this manuscript. While a relatively small district, Sunshine's diversity score (rendered by the chance that two students selected at random would be members of different ethnic groups) is .48 where the state's diversity score average is .46. Sunshine District's minority enrollment is 37%, and the majority of this district population is either African American or Hispanic. Although the district diversity score is higher than the state average, the minority enrollment is much lower than the state average of 61%.

Gator Elementary serves 924 students in grades PK-6, with six kindergarten classrooms. The Florida class size amendment limits kindergarten classrooms to 18 students per class, but Gator Elementary has an average student to teacher ratio of 15:1. Minority enrollment at the school is 41% (majority African American and Hispanic), which while still lower than the state average, is higher than the district average. Gator Elementary is a Title I school with 67% of students eligible to receive free or reduced-price lunch (FRPL), which is often used as a measure of socioeconomic status (SES; National Forum on Education Statistics, 2015).

Notably, one of the most significant recruitment challenges for this study was finding public, Title I kindergarten classrooms that relied on play in a district that would approve the request to conduct research. The participants in this study were purposively included. The target intervention classroom was an “advanced kindergarten” class of 20 students with no students qualifying for exceptional student education (ESE) and one English language learner (ELL). Their teacher, who volunteered to participate in the study after seeing a request for participants on social media, is passionate about using a play-based approach in kindergarten. Her daily instructional schedule has 30-minutes dedicated to free choice “play centers” and 30-minutes of “learning centers” aligned to daily instructional standards and learning targets daily in addition to outdoor recess time each day. Per this teacher and the school principal, the other kindergarten teachers at this school use a more didactic, contemporary instructional approach with lots of drill and practice on skills. Upon recommendation of the school principal who supported participation in this study, the control classroom teacher’s classroom and instructional approach lie in stark contrast. The control teacher, who is newer to teaching kindergarten but has more experience in intermediate grades and at Department of Defense (DoDEA) schools, approaches play in the classroom to include only the required outdoor recess time and “playing” on

instructional applications on iPads daily or every other day to meet the district-required i-Ready Instruction minutes. Thus, the sampling frame was unfortunately limited to 40 children in both conditions.

Parents of each classroom were recruited at a school curriculum night in September 2018 where the principal investigator shared the details of the study, provided information about their rights in a human study, and provided consent forms to sign. Parents were incentivized to participate with the receipt of all testing data for their child with a letter explaining the results and implications in parent-friendly language upon their request. They may also be notified of the overall findings, if requested, of the study upon its conclusion. Both teachers supported recruitment by sending home information packets with consent forms in students' Friday Folders, speaking with parents at teacher conferences, and (the treatment teacher) communicating with parents via a class Facebook page.

Only children who had parental consent to participate ( $n = 31$ ) were evaluated using the executive function assessment, and the other measures of reading academic and math achievement were conducted by the school and district. The sample size for this study was admittedly small, unevenly distributed by condition, and not consistently diverse across demographic categories such as exceptional student education (ESE), English Language Learner (ELL), or Free-and Reduced-Price Lunch (FRPL) eligibility status (see Appendix B). This demographic data was collected for possible use as covariates but was mostly unusable in the study because of a lack of variation in the sample. The only two possible covariates to test with sufficient variation in the sample were students' gender and FRPL status.

### *Classroom Condition*

Simple observation of the daily schedules (Table 6) and the classroom learning spaces highlight some of the differences. “Free play” centers in the play-based kindergarten classroom are student self-selected, rotate and change regularly, and include options like “kitchen,” “blocks,” “art,” “writing center,” “books,” “puzzles,” and “imagination station” (Figure 12). “Learning” centers in this same classroom are more structured with fewer choices, and they include “iPad” for i-Ready Instruction, math, reading, and small group guided instruction (Figure 13). In contrast, the “small group activities,” which are also called play time in the contemporary classroom, include stations like “dry erase,” “read with me,” and “i-Ready” (Figure 14). Learning materials such as anchor charts, books, manipulatives, and toys are accessible to children in the play-based classroom (Figure 15), while the environment is more sterile and teacher-controlled in the contemporary classroom (Figure 16).

Table 6: Daily Instructional Schedule by Classroom Condition

Play-Based Classroom		Contemporary Classroom	
8:40-9:15	Attendance and Journals	8:55-11:00	Reading
9:15-10:55	Reading Block		
10:55-11:05	Prepare for Lunch/Storytime		
11:10-11:40	Lunch	11:10-11:40	Lunch
11:45-12:20	Recess and Water Break	11:40-12:10	Recess
12:25-1:10	Special Area Classes	12:25-1:10	Special Area Classes
1:15-2:00	Math	1:15-2:15	Math
2:00-2:20	Social Studies or Science	2:15-2:45	Small Group Activities
2:20-2:45	Centers		
2:45-3:00	Snack	2:45-3:15	Science/Social Studies
3:00-3:10	Prepare for Dismissal/Review		



Figure 12: Free Play Center Student Self-Scheduling in Play-Based Classroom



Figure 13: Teacher-Directed Learning Centers in Play-Based Classroom

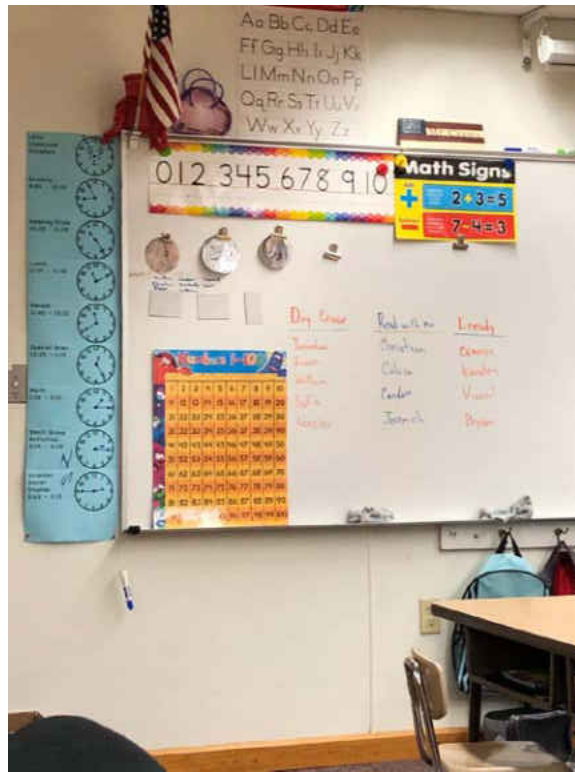


Figure 14: Teacher Selected Small Groups in Contemporary Classroom



Figure 15: Example of Accessibility of Play Materials in Play-Based Classroom



Figure 16: Example of Accessibility of Play Materials in Contemporary Classroom

### *Instruments and Data Collection*

*Behavior Rating Inventory of Executive Function, 2nd Edition (BRIEF2).* The BRIEF2 (PAR, Inc., n.d.) was selected as a measure of executive function, in part, because it has been used in over 1,000 other experimental studies to measure student executive function (i.e., Friedman-Krauss & Raver, 2015; McLear et al., 2016; Roy & Raver, 2014). The BRIEF2 evaluates impairment of executive function in children and adolescents (Gioia, Isquith, Guy, & Kenworthy, 2015). Using both teacher and parent forms provided a comprehensive picture of student abilities and challenges across settings. Additionally, the BRIEF2 can be hand-scored or computer scored, which was useful given the sample size of 31 students with four BRIEF2 data points each. Finally, this survey is appropriate for school use and does not require a clinician to purchase, administer, or score the results. A qualification level of B is required for the overall



administration of the full form of this measure, and the primary investigator on this study meets this standard per the specifications of PAR, Inc. (n.d.).

The BRIEF2 is intended for use with individuals ages 5 to 18 and includes parent, teacher, and self-report surveys, although the self-report surveys are only available for children ages 11 to 18. For consistency, this study used the parent and teacher reports for each child. The survey takes approximately 10 minutes to complete, and the survey is available in more than 60 languages. The BRIEF2 enables targeted assessment of individuals to evaluate behavioral, emotional, and cognitive competence. The teacher and parent forms provide a comprehensive picture across school and home settings. The BRIEF2 has been substantially revised from the previous BRIEF and includes updated norms, improved psychometric properties, and a new infrequency scale to assist with unusual responding. A large collection of reliability and validity evidence, with reliability coefficients for the parent and teacher forms is at above .90. Scores have been standardized based on a national stratified sample ( $n=3,600$  cases) matched to U. S. Census Bureau data by age, gender, ethnicity, and parent education level. The BRIEF2 is also correlated with other measures of behavior and IQ, including the Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV; PAR, Inc., n.d.). Scores are reported as *T* scores, which are linear transformations of the raw scale scores. *T* scores are dependent on the scale and not necessarily associated with a matching percentile score, and because the BRIEF2 focuses on problematic behaviors the distributions tend to be skewed right (Gioia et al., 2015). “For all BRIEF2 clinical scales and indexes, *T* scores from 60 to 64 are considered mildly elevated, and *T* scores from 65 to 69 are considered potentially clinically elevated. *T* scores at or above 70 are considered clinically elevated” (Gioia et al., 2015, p. 33).

*i-Ready Diagnostic.* The i-Ready Diagnostic was used to measure academic achievement. While no statewide assessments are required for kindergarten students in Florida, Sunshine District uses the i-Ready Diagnostic (Sunshine Schools, 2017) at the beginning, middle, and end of the year to assess students' progress and growth in reading and math. The i-Ready assessment is computer-based, adaptive, and aligned with i-Ready Instruction, which the district also uses for reading and math instruction. Both the reading and math assessments includes a composite score (used for this study) as well as scores for particular domains. The reading domains include phonological awareness, phonics, high-frequency words, vocabulary, literature comprehension, and informational text comprehension while the math domains include number and operations, algebra and algebraic thinking, measurement and data, and geometry (Curriculum Associates, n.d. a).

i-Ready Diagnostic is intended for K-12 students. Percentile scores are nationally normed, and the diagnostic results also include a Lexile measure. Diagnostic score reports for individual students include information about typical growth for students at the same grade and placement level, "stretch growth" information intended to help students performing below grade level expectations reach proficiency, and placements by domain (Curriculum Associates, n.d. a). Classroom diagnostic score reports provide teachers with aggregated information at a glance and suggest instructional areas of foci, resources, and groupings. Overall reading and math placement score ranges for the 2018-2019 school year are included in Table 7.

Table 7: i-Ready Diagnostic Kindergarten Placement Levels (Curriculum Associates, 2018).

	Reading	Math
Emerging K	100-361	100-361
Level K	362-479	362-454
Early K	362-395	362-372
Mid K	396-423	373-411
Late K	424-479	412-454

Per Curriculum Associates, both i-Ready Diagnostic and i-Ready Instruction are aligned to academic standards, Every Student Succeeds Act (Every Student Succeeds Act [ESSA], 2015), and What Works Clearinghouse (WWC) research standards. Multiple published studies explore the alignment of i-Ready Diagnostic to state standards and assessments including the Florida Standards Assessment (Curriculum Associates, n.d. b.).

***Procedures***

Because Sunshine District and Gator Elementary already collect student demographic data upon student entry and i-Ready Reading and Math Diagnostic data at the beginning, middle, and end of the academic year, this study was able to use the extant data provided by the district and school. The demographic data and i-Ready Reading and Math Diagnostic data collected only at the beginning (August to September 2018) and end of the year (March to May 2019) were used in this study. In addition, the principal investigator distributed paper versions of both the Parent and Teacher BRIEF2 surveys for completion in October 2018 and May 2019.

In Sunshine District and at Gator Elementary, kindergarten students take the i-Ready Diagnostic in small groups with the teacher using iPads and headphones. Students are prompted by the assessment with oral directions, pictorial cues, and other supports for these non- or early readers to take this type of test. While electronic versions of the BRIEF2 survey are available, paper forms were intentionally used in an effort to make parents feel more comfortable

completing and submitting the surveys. Email reminders and posts on classroom social media pages were sent to parents, and additional copies of the surveys were sent home when necessary to prompt return. Surveys were distributed and collected in the students' Friday Folders which are familiar means of communication between school and home. As extra incentive, each child received a small token as a treat for returning their Parent BRIEF2 surveys. Additionally, the principal at Gator Elementary offered each classroom teacher paid release time to complete the Teacher BRIEF2 surveys, since they both had to complete one for each participating child. Upon retrieval of the surveys, the researcher manually entered the scores into the PARiConnect online interface for scoring and data analysis. Minimal classroom disruptions were experienced for the distribution and collection of BRIEF2 surveys.

### **Data Analysis**

Table 8 summarizes the sample sizes, variables, and statistical procedures used for each research question.

Table 8: Summary of the Study Design and Analysis

Research Questions	<i>n</i>	Independent Variables	Dependent Variables	Covariates	Statistical Tests
1. Does a play-based pedagogy influence executive function and reading and math academic achievement among Title I kindergarten students?	<i>n</i> = 28	Classroom Condition (play-based or contemporary) Time (pre/post)	Executive Function (BRIEF2 Pre/Post Parent and Teacher Global Executive Composite T Scores)  Reading and Math Achievement (i-Ready Pre/Post Reading and Math Overall Scores)	<ul style="list-style-type: none"> <li>• Gender</li> <li>• FRPL</li> </ul>	Mixed Design MANCOVA
2. Are there relationships between posttest measures of reading and math academic achievement and parent and teacher posttest measures of students' executive function among kindergarteners in a Title I school?	<i>n</i> = 31	Classroom Condition (play-based or contemporary)	Executive Function (BRIEF2 Post-Test Parent and Teacher Global Executive Composite T Scores)  Reading and Math Achievement (i-Ready Post-Test Reading and Math Overall Scores)		Spearman's $r_s$

### *Research Question 1*

Does a play-based pedagogy influence executive function and reading and math academic achievement among Title I kindergarten students?

**Assumptions.** To ensure that the results from a multivariate analysis of covariance (MANCOVA) were valid, the relevant statistical assumptions were examined. While the study employed a quasi-experimental design using purposive sampling, the researcher had no reason to conclude that observations were not independent of one another. Additionally, there were at least two continuous dependent variables (i.e., parent and teacher evaluations of students' executive function). The independent variable, a play-based or contemporary classroom condition, was categorical; and the covariates were dichotomous. Not all pairs of dependent variables were linearly related, as assessed by visual inspection of a scatterplot. There were violations of multivariate homogeneity of variances and covariances, as assessed by Box's M test,  $F(36, 1188.016) = 2.137, p < .001$ . Therefore, Pillai's trace was used to assess multivariate statistics. There were also violations of univariate homogeneity of variance, as assessed by Levene's test for the following variables: Teacher BRIEF2 at both pre-test,  $F(1, 26) = 10.198, p = .004$ , and post-test,  $F(1, 26) = 4.780, p = .038$ , and i-Ready Reading at post-test,  $F(1, 26) = 7.164, p = .013$ . There was no evidence of multicollinearity, as measured by correlation coefficient values. All correlations between the dependent variables within each MANCOVA were less than  $r = .9$ . There were no univariate outliers in the data, as assessed by standardized residuals greater than  $\pm 3$  standard deviations. There were no multivariate outliers in the data, as assessed by Mahalanobis distance, ( $p > .001$ ). Residuals were normally distributed, as assessed by Shapiro-Wilk's test with the exception of the play-based Parent BRIEF2 ( $SW(19) = .877, p = .019$ ) and Teacher BRIEF2 ( $SW(19) = .734, p < .001$ ) at post-test. Based on these cumulative

findings and the robustness of the MANCOVA against violations of statistical assumptions, the researcher proceeded with the inferential analyses.

**Results.** Prior to examining the treatment effects, covariates were assessed for their contribution to the analytic model and were retained only if they were statistically significant or had a moderate effect size ( $\eta_p^2 \geq .06$ ). Although neither students' gender,  $F(4, 21) = .704$ ,  $V = .118$ ,  $p = .598$ , nor FRPL status,  $F(4, 21) = .696$ ,  $V = .117$ ,  $p = .603$ , were statistically significant; the moderate effect sizes,  $\eta_p^2 = .118$  and  $\eta_p^2 = .117$  respectively, suggest that they may contribute to the model. As such, the researcher elected to retain the covariates for the analysis as they account for the contributions of gender and SES to the dependent variables (Parent BRIEF2, Teacher BRIEF2, i-Ready Reading and Math Overall Scores at pre- and post-test) and better assess the unique contributions of the classroom condition. There was both a significant relationship and a very large effect for the interaction between classroom condition and time,  $F(4, 21) = 4.733$ ,  $V = .474$ ,  $p = .007$ ,  $\eta_p^2 = .474$ . This suggests that, for a least one of the four independent variables, the change in scores for the play-based class is different from the contemporary class.

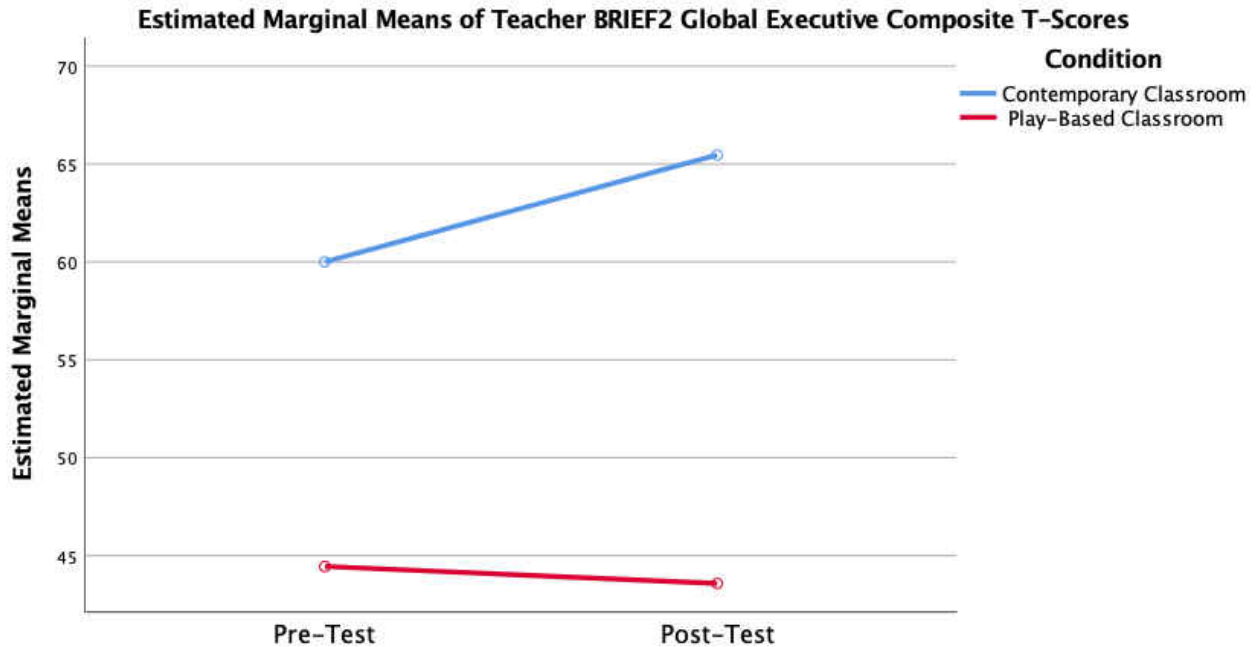
For the teachers' observations of students' executive function, there is both a statistically significant interaction and large effect,  $F(1, 24) = 6.725$ ,  $p = .016$ ,  $\eta_p^2 = .219$ . For students in the contemporary classroom, there was an increased level of executive function concern from pre- to post-test (see Table 9 for adjusted means and standard deviations),  $F(1, 9) = 1.216$ ,  $p = .299$ ,  $\eta_p^2 = .119$ . In contrast, there was a decreased level of teacher concern in the play-based classroom from pre- to post-test,  $F(1, 16) = 1.520$ ,  $p = .235$ ,  $\eta_p^2 = .087$ . Figure 17 illustrates both the opposite trajectories of the slopes and the differences in the teachers' level of concern.

Table 9: Adjusted Means and Standard Deviations by Condition and Time

Measure	Condition	Time	Mean	SD
Parent BRIEF2	Contemporary Classroom	Pre-Test	55.338 <sup>a</sup>	43.749
		Post-Test	53.384 <sup>a</sup>	45.365
	Play-Based Classroom	Pre-Test	49.034 <sup>a</sup>	32.583
		Post-Test	47.898 <sup>a</sup>	33.795
Teacher BRIEF2	Contemporary Classroom	Pre-Test	59.998 <sup>a</sup>	35.921
		Post-Test	65.461 <sup>a</sup>	38.854
	Play-Based Classroom	Pre-Test	44.446 <sup>a</sup>	26.761
		Post-Test	43.577 <sup>a</sup>	28.946
i-Ready Reading	Contemporary Classroom	Pre-Test	350.434 <sup>a</sup>	155.118
		Post-Test	400.689 <sup>a</sup>	111.025
	Play-Based Classroom	Pre-Test	373.425 <sup>a</sup>	115.545
		Post-Test	474.617 <sup>a</sup>	82.708
i-Ready Math	Contemporary Classroom	Pre-Test	350.185 <sup>a</sup>	83.187
		Post-Test	384.720 <sup>a</sup>	76.436
	Play-Based Classroom	Pre-Test	365.453 <sup>a</sup>	61.978
		Post-Test	412.878 <sup>a</sup>	56.934

*a. Covariates appearing in the model are evaluated at the following values: Gender = .61, FRPL = .68.*

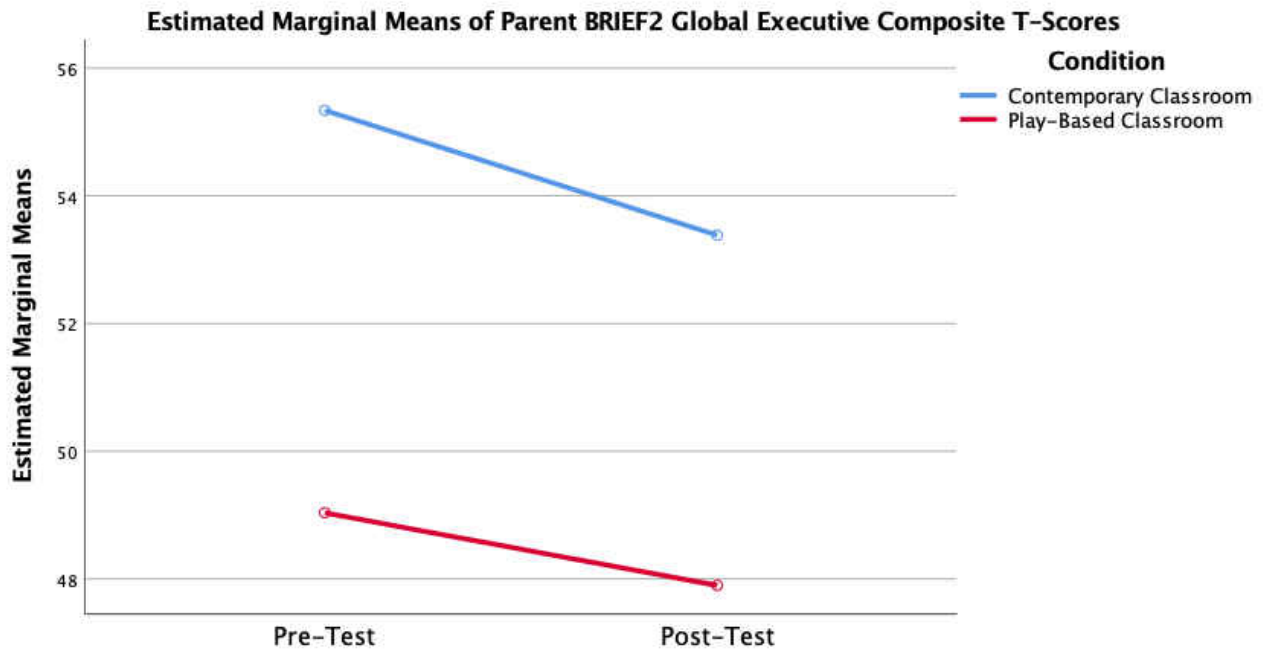




Covariates appearing in the model are evaluated at the following values: Gender = .61, FRPL = .68

Figure 17: Adjusted Means of Teacher BRIEF2 Results at Pre- and Post-Test by Condition

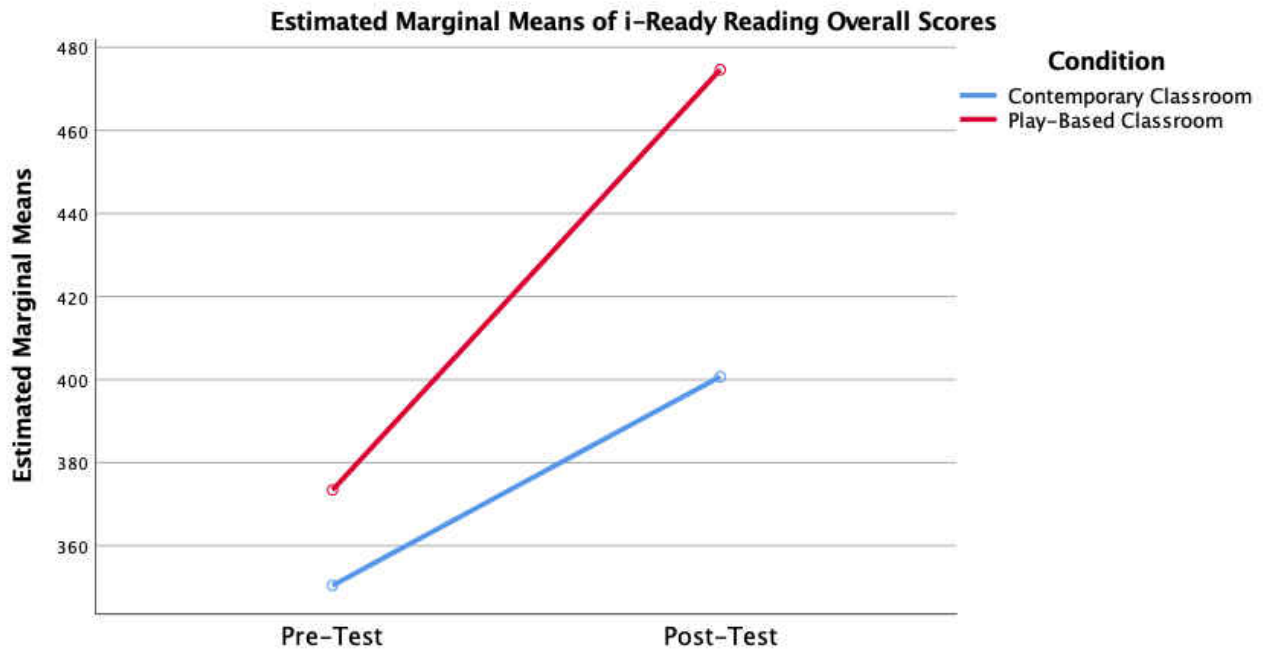
For the parents' observations of students' executive function, there was not a statistically significant interaction between classroom condition and time, nor was there a meaningful effect size,  $F(1, 24) = .117, p = .735, \eta_p^2 = .005$ . There was no change over time in either condition,  $F(1, 24) = .047, p = .831, \eta_p^2 = .002$ ; and Figure 18 illustrates the nearly parallel slopes of the data from both conditions. However, parents of students in the contemporary classroom expressed greater concerns about their children's executive function (see Table 9 for adjusted means and standard deviations) than parents of children in the play-based classroom,  $F(1, 24) = 2.806, p = .107, \eta_p^2 = .105$ .



Covariates appearing in the model are evaluated at the following values: Gender = .61, FRPL = .68

Figure 18: Adjusted Means of Parent BRIEF2 Results at Pre- and Post-Test by Condition

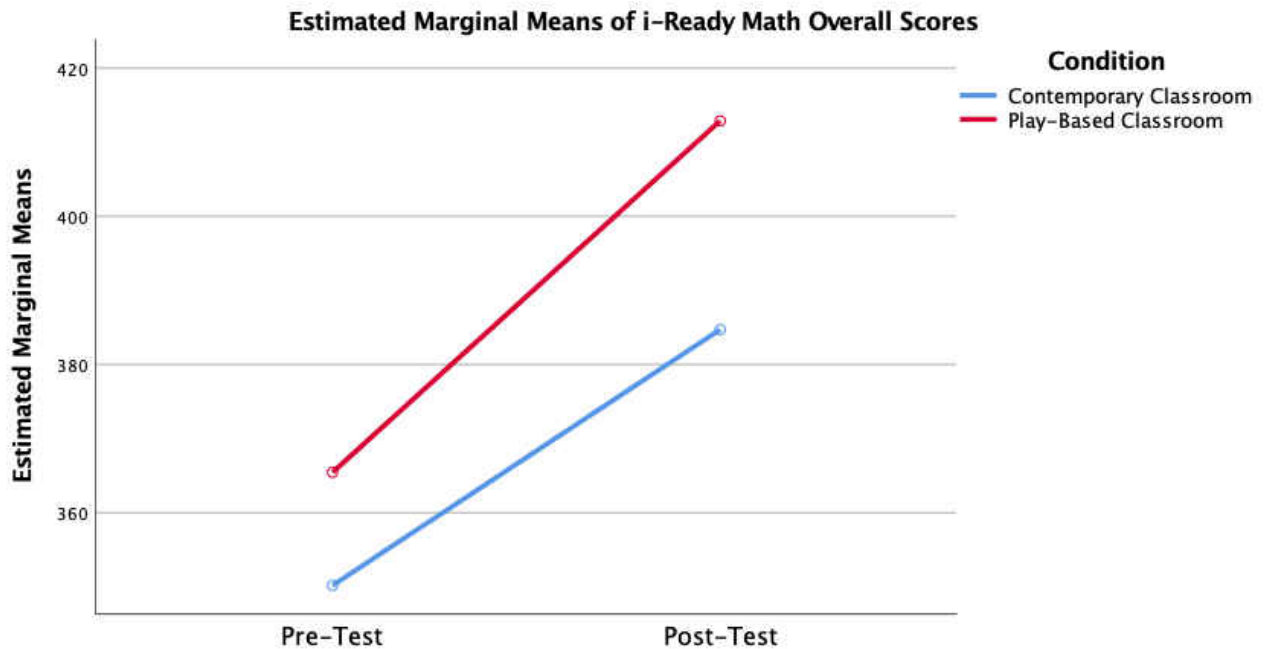
For the measures of students' reading achievement, there was also both a statistically significant interaction and a large effect,  $F(1, 24) = 14.901, p = .001, \eta_p^2 = .383$ . While students in both conditions significantly increased their scores from pre-test to post-test, students in the play-based classroom had greater reading gains,  $F(1, 16) = 54.243, p < .001, \eta_p^2 = .772$ , than students in the contemporary classroom,  $F(1, 8) = 6.029, p = .040, \eta_p^2 = .430$  (see Table 9 for adjusted means and standard deviations). Figure 19 below illustrates the change in scores over time for each classroom condition and that the play-based classroom had greater gains in reading achievement than the contemporary classroom.



Covariates appearing in the model are evaluated at the following values: Gender = .61, FRPL = .68

Figure 19: Adjusted Means of Reading Achievement Growth by Condition

For the measures of students’ math achievement, there was not a statistically significant interaction, but there was a moderate effect,  $F(1, 24) = 3.186, p = .087, \eta_p^2 = .117$ . Because of the decision to consider effect sizes as well as statistical significance, the researcher treated this as an interaction effect. Students in both classroom conditions demonstrated a statistically significant increase in math achievement with large effects from pre- to post-test, but the rate of change was greater for students in the play-based classroom,  $F(1, 16) = 35.867, p < .001, \eta_p^2 = .692$ , than for students in the contemporary classroom,  $F(1, 8) = 10.301, p = .012, \eta_p^2 = .563$  (see Table 9 for adjusted means and standard deviations). Figure 20 below illustrates the change in scores over time for each classroom condition and that the play-based classroom had greater gains in math achievement than the contemporary classroom.



Covariates appearing in the model are evaluated at the following values: Gender = .61, FRPL = .68

Figure 20: Adjusted Means of Math Achievement Growth by Condition

### *Research Question 2*

Are there relationships between posttest measures of reading and math academic achievement and parent and teacher posttest measures of students' executive function among kindergarteners in a Title I school?

**Assumptions.** To determine the most appropriate correlation test for this analysis, the statistical assumptions for a Pearson correlation were considered. Scatterplots of all 12 bivariate relationships between the eight variables showed predominantly linear relationships. Loess lines at 90% of points to fit. This visual assessment of the scatterplots also suggests mostly bivariate normality or homoscedasticity, but they do show some bivariate outliers. Given the violations of the statistical assumptions for the Pearson Product-Moment Correlation, the researcher elected to

use Spearman's Rank Correlation Coefficient, as this non-parametric test is more robust against violations of assumptions.

**Results.** There was a statistically significant, strong positive correlation between students' reading achievement scores at post-test and their math achievement scores at post-test,  $r_s(31) = .780, p < .001$ . Students who scored higher in reading also tended to score higher in math. Additionally, there is a statistically significant, strong negative correlation between students' reading achievement scores at post-test and teachers' observations of students' executive function at post-test,  $r_s(31) = -.650, p < .001$ . Further, there is a statistically significant, strong negative correlation between students' math achievement scores at post-test and teacher observations of students' executive function at post-test,  $r_s(31) = -.743, p < .001$ . Students who scored higher in reading or math also had fewer executive function concerns as reported by teachers. There were no statistically significant correlations between parents' observations of students' executive function and either students' reading academic achievement at post-test,  $r_s(31) = -.150, p = .420$ , math achievement at post-test,  $r_s(31) = -.076, p = .684$ , or teachers' observations of students' executive function,  $r_s(31) = .261, p = .156$ .

## **Discussion**

As previously mentioned, the neuroscientific findings about the importance of EF on school readiness and academic achievement and the effect of poverty on EF are growing, although less is known about actionable ways for classroom application. The evident relationships between executive function health and academic achievement in this study, as well as the evidence of greater gains and stronger outcomes for students in the play-based classroom over students in the contemporary classroom, are extremely exciting. These results offer one small step in the direction of linking play-based pedagogy with improved EF and academic

outcomes. Parent and teacher BRIEF2 measures of students' executive functions were reasonably consistent statistically indicating not much change overall from pre-test to post-test by respondent, but Figures 17 and 18 do show some aggregated trends within respondent groups over time. *T* scores below 59 are considered to be within the normal range (Gioia et al., 2015). The average pre- and post-test parent scores were all within this typical range regardless of condition, but the play-based teacher's perceptions of students' EF were even more positive than the parents' as indicated by lower average *T* scores. In contrast, the contemporary teacher's pre-test average scores were in the mildly elevated range at pre-test and potentially clinically elevated at post-test (see Table 10 for adjusted means and standard deviations). Interestingly, the play-based teacher's overall assessments of students' EF improved over the course of the academic year, while the contemporary teachers' overall assessments indicated increased EF concern.

Additionally, parent concerns about children's executive function remained fairly consistent across classroom conditions, but parents of children in the contemporary classroom expressed greater concern about their children's executive function even at pre-test. This suggests there are pre-existing differences among students' executive function regardless of the intervention. This is evident by lower academic scores at pre- and post-test in reading and math for students in the contemporary classroom and students in the play-based classroom. Since the play-based classroom was considered by Gator Elementary to be "advanced" based on pre-registration summer academic screenings, the analysis focused on academic growth rather than just end-of-the-year scores. Using this design, reading and math skills significantly improved for both classes, with greater gains for both occurring among students in the play-based classroom than for students in the contemporary classroom, with the BRIEF2 EF remained fairly consistent

among all measures in both groups. That said, the findings are promising with regards to EF, reading, and play-based learning, especially in terms of the role of purposeful play.

Table 10 includes the adjusted means by group and time for each measure and how those means relate to the BRIEF2 *T*-Scores, diagnostic levels of clinical executive function concern (Gioia et al., 2015), and i-Ready Reading and Math kindergarten placement ranges (Curriculum Associates, 2018). Once again, this study was able to detect that the control teacher's assessment of students' EF levels of concern was elevated over the course of the academic year. Further contemplation must be undertaken to determine if the classroom environment highlighted in either the play or contemporary classrooms already harbored existing EF disparities, or if the environment contributed to EF disparities, or perhaps, both. Similarly, did the play-based teacher's environment help improve students' EF capacities or allow those capacities to shine or both? Additionally, this study detected academic growth in both classrooms, but found greater gains in reading in the play-based classroom. This reading gain strongly, negatively correlates with increased EF capacity; stronger EF was associated with stronger reading. Much more research needs to be done, however, to conclusively support connections between a play-based approach and improved EF and academic outcomes.

Table 10: Within and Between Mean Pre- and Post-Test Interpretations

Condition Time	Play-Based Kindergarten		Contemporary Kindergarten	
	Pre-Test	Post-Test	Pre-Test	Post-Test
Parent BRIEF2	$M = 49.034,$ $SD = 32.583$ $n = 18$ Within Normal Limits (< 60)	$M = 47.898,$ $SD = 33.795$ $n = 18$ Within Normal Limits (< 60)	$M = 55.338,$ $SD = 43.749$ $n = 10$ Within Normal Limits (< 60)	$M = 53.384,$ $SD = 45.365$ $n = 10$ Within Normal Limits (< 60)
Teacher BRIEF2	$M = 44.446,$ $SD = 26.761$ Within Normal Limits (< 60)  $n = 18$	$M = 43.577,$ $SD = 28.946$ Within Normal Limits (< 60)  $n = 18$	$M = 59.998,$ $SD = 35.921$ Mildly Elevated Concern (60-64)  $n = 10$	$M = 65.461,$ $SD = 38.854$ Potentially Clinically Elevated Concern (65-69)  $n = 10$
i-Ready Reading	$M = 373.425,$ $SD = 115.545$ $n = 18$ Early K (362- 395)	$M = 474.617,$ $SD = 82.709$ $n = 18$ Late K (424- 479)	$M = 350.434,$ $SD = 155.118$ $n = 10$ Emerging K (100-361)	$M = 400.689,$ $SD = 111.025$ $n = 10$ Mid K (396-423)
i-Ready Math	$M = 365.453,$ $SD = 61.978$ $n = 18$ Early K (362- 372)	$M = 412.878,$ $SD = 56.934$ $n = 18$ Late K (412- 454)	$M = 350.185,$ $SD = 83.187$ $n = 10$ Emerging K (100-361)	$M = 384.720,$ $SD = 76.436$ $n = 10$ Mid K (373-411)

### *Educational Implications*

The findings described above are both exciting and promising, although it would be irresponsible to suggest that the data from this study are sufficient to recommend a play-based pedagogical approach. Based on the data from this study, there is evidence that corroborates the connection between executive function health and academic performance. The findings support the conclusion that increased executive function, measured here as reduced EF concern, are both strongly correlated to academic performance. Additionally, the data show that children in the



play-based classroom had improved EF health as measured by teacher compared to the children in the contemporary classroom who had increased levels of EF concern as measured by the teacher. When one considers all the findings of this research, compelling differences seem to exist between the two classroom environments at Gator Elementary; however, this study was unable to detect if indeed the pedagogical approach, the teacher's attitudes and dispositions, or a combination of these or other factors generated the differences. While these differences are evident to the casual observer (see images above in Classroom Condition), more information is needed to suss out exactly what drives the differences between the students' EF and academic achievement outcomes by classroom condition. However, yet unknown, the wall décor and classroom aesthetic, the organization and accessibility of educational materials, or the inclusion of read alouds, singing with charts, or free play centers may work to play a role. At this point, it would be impossible to pinpoint if play-based offerings, such as free play or learning centers contributed to differences, or if differences in schedules and classroom s combine to work with teacher dispositions and relationships. Future studies, however, should consider how to better support preservice and inservice teachers to develop SR, EF, and SED along with learning gains and narrow persistent achievement gaps, especially in Title I settings.

Additional implications that were not measured by this study but which potentially influenced the outcomes include parents' expectations for what their children should know and be able to do in school, parents' own personal experiences in and feelings about school, or the amount of extracurricular experiences and other health-supporting routines provided for in the home. It is interesting to note that while the parents' level of EF concern for their children was greater in the contemporary classroom than the play-based classroom, none of the parent BRIEF2 scores were correlated to academic outcomes. It will be both interesting and important

to explore ways to tap into the home-school connection and relationships more deeply to leverage the power of these partnerships for students and learning.

Finally, the Sunshine District's choice to use i-Ready Diagnostic assessments as measures of reading and math academic achievement may be a factor in the outcomes of this study. It would be interesting, too, to explore replicating this study using other measures of academic achievement, such as the Iowa Test of Basic Skills (ITBS) or the California Achievement Test (CAT), or measures of intelligence, such as the Wechsler Intelligence Scale for Children (WISC) or the Stanford-Binet Intelligence Scales. Exploring different measures as dependent variables may shed light on the appropriateness of specific measures to assess academic achievement aligned with local standards and learning goals. This could, in turn, support a potential shift in pedagogical approach and a change in the current ratio of instruction to testing.

### ***Limitations and Future Research***

These analyses of results evoke continued curiosity; however, caution must be exercised in terms of generalizability given the small sample size of 29. Some violations of statistical assumptions and low statistical power, that while corrected using adjusted effect size in addition to statistical significance and robust nonparametric statistical analyses, that may have changed the conclusions and possible interpretations of the results. Violations of these assumptions can influence Type I (incorrectly rejecting the null hypothesis that there are no differences or relationships) and Type II (incorrectly accepting the hypothesis that there are significant differences or relationships), and these violations may cause over- or under-estimations of inferential measures (Osborne, & Waters, 2002). Part of this challenge was addressed by using

effect sizes ( $\geq .06$ ) in addition to statistical significance and adjusted statistics such as non-parametric tests when appropriate to strengthen the findings.

One significant limitation of this study was that, because the researcher only had access to two classrooms, the teacher and the classroom condition are confounded. Even adding one more class in each condition would provide more reliable results. There is no responsible or ethical way to suggest that, in this study, the play-based classroom caused the improved performance or growth, especially when that classroom was intended to be the “advanced” classroom as determined by kindergarten summer screening data and there are differences in teacher experience and instructional philosophy. These confounds necessarily limit the inferences we can make. To better explain the differences, the statistical analysis explored growth instead of simply using students’ raw scores, and within this design there were statistically significant results. That said, these findings, set amidst its accompanying body of literature, are promising, especially within the context of justifying future studies with larger, more robust samples. That said, these findings, amidst the body of literature, are promising, especially as the field continues to consider the importance of play. Additionally, these results are important in justifying future studies focusing on purposeful play with larger, more robust samples.

In the first analysis, the covariates (students’ gender and FRPL status) were not statistically significant, but had moderate effect sizes, suggesting they were contributing to the model for this sample. Therefore, they were retained in the model to reduce the risk of a Type II error. Other tested analyses may also have yielded statistically significant results with a greater number of participants. For example, neither parents’ observations of students’ executive function nor students’ math achievement growth were statistically significant, although a

moderate effect for math growth by condition was found. Notably, these results may have been statistically significant with a larger sample size. The researcher conducted a *post hoc* sample size calculation for both of these instances. Limitations as to what can be gleaned from the analyses, however, persist because the G\*Power model does not account well for the mixed design, multivariate approach employed in this study. The output suggests a much larger sample size is required to have sufficient power for parents' observations of their children's executive function, yet only 48 participants needed to detect a significant interaction between classroom and time for math achievement.

Future studies, including replications with a larger, more diverse sample size capable of enough statistical power to address possible teacher or school effects and extensions across longer periods of time, will be important for both extracting actionable interpretations from this study and for positively contributing to the field. In addition to increasing the sample size with more kindergarteners in more classrooms at more schools, future research should work toward operational definitions of the construct of play-based versus contemporary classrooms. Likewise, future studies should include mixed methods designs to support this goal by using observation and interview tools, such as the School-Age Care Environment Rating Scale (SACERS; Harms, Jacobs, & White, 2013) and the Classroom Assessment Scoring System (CLASS; Hu, Fan, Gu, & Yang, 2016; Pianta, La Paro, & Hamre, 2008) would help define the environmental factors and the quality of classroom teacher interactions in each condition. In short, since the current PK-12 educational climate eschews a play-based approach in daily practice, based on the fear that stringent accountability benchmarks cannot be met through play, this type of research will require a "ground up" approach. These findings give future researchers justification for studying and supporting implementation of play-based approaches. Teachers are

currently pushed to double down their prescriptive instructional approach at the expense of DAP learning experiences. These findings begin to open the window they need to justify play-based activities to develop the language, social-emotional skills, and “soft skills” like creativity and problem solving, with accompanying improved academic outcomes increasingly shown to improve both future academic achievement, adult earning potential, and more (Bartik, 2012; Chetty et al., 2011; Dodge et al., 2015; Sorensen, Dodge, & Conduct Problems Prevention Research Group, 2015).

### **Conclusion**

The results from this study are compelling, in that they reinforce previous empirical evidence that identified relationships between students’ academic achievement and EF. Similarly, they also point toward an exciting arena of future research exploring play-based, DAP as an intervention for EF development. Quite possibly, the additional positive outcomes of improving students’ EF and SR in Title I schools may likely also reduce inappropriate externalizing behaviors, time spent away from instruction due to disciplinary actions, improved growth rates for academic gains, and increased “soft skills” such as creativity, problem-solving, and decision-making. Exploring ways to define play-related environmental and behavioral constructs could significantly affect how Title I schools approach teaching students in a more equitable manner, thus increasing opportunities for our most vulnerable students to reach their fullest potential.

While these findings are small and do not prove causation, they are exciting in their alignment with the developing neuroscientific findings about how poverty and stress, likely more prevalent among students in Title I schools, affect developing brains, how those effects contribute to educational challenges and opportunity. They are especially relevant given the

accumulative number of studies linking EF to children's success, both in the short- and long-term, in literacy and math related endeavors (i.e., De Franchis, Usai, Viterbori, Traverso, 2017; Gimbert et al., 2019; Meixner et al., 2019; Morgan et al., 2019; Nesbitt, Fuhs, & Farran, 2019; Puranik, Boss, & Wanless, 2019; Skibbe et al., 2019; Zhang et al., 2017) as well as outcomes affecting children long into adulthood (Bartik, 2012; Chetty et al., 2011; Dodge et al., 2015; Sorensen, Dodge, & Conduct Problems Prevention Research Group, 2015). These findings also generally support a return to the more traditional and previously established approach of DAP to include play and purposeful play in the daily activities of kindergartners.

Despite our best and unwavering intentions as a nation, with our increased focus on seemingly rigorous instruction and laser-focus on standardized outcomes, persistent achievement gaps, especially for children facing adverse circumstances, have not been reversed. In addition, some disturbing unintended consequences are appearing as classrooms shift away from purposeful play, constructivist approaches to learning, DAP, and best practice grounded in social learning theory (Piaget, 1977; Vygotsky, 1978). Increasing incidents of externalizing behaviors and exclusionary discipline with very young children could very well be backlash from the lack of DAP play-based, naturalistic learning and teaching approaches. The time seems ripe to combine new neurological science discoveries about the brain with time-tested experiences that include play-based pedagogy in an effort to improve the classroom experiences, the behavioral climates, and academic outcomes for all children, especially those in Title I schools.

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# **YOU'VE GOT TO MOVE IT!: EXPLORING THE POSSIBLE BENEFITS OF CHILDREN'S PHYSICAL MOVEMENT AND ACADEMIC ACHIEVEMENT IN PLAY-BASED AND CONTEMPORARY TITLE I KINDERGARTEN CLASSROOMS**

## **Introduction**

Throughout most of history, young children are naturally perceived as active learners, often in need of supervision and sometimes restraint. Recent dramatic shifts imposed from the top-down on teachers and students enforce teaching and learning expectations that focus on frequent measures of accountability and on practices void of play-based strategies, even in kindergarten (Bassok, Latham, & Rorem, 2016; Hatch, 2002; Repko-Erwin, 2017). No doubt, how children learn in early elementary grades has changed almost as dramatically as what they are expected to learn (Bassok, Latham, & Rorem, 2016; Repko-Erwin, 2017). However, excluding developmentally appropriate practice (DAP; Copple & Bredekamp, 2009) that enriches learning with movement, hands-on, language-rich, discovery-focused, and purposeful play pedagogy may deserve reconsideration. Recent studies on brain imaging have found a relationship between increased movement and positive cognitive, behavioral, social-emotional, and academic outcomes for students (e.g., Armin et al., 2017; Bell, 2014; Bidzen-Bluma & Lipowska, 2018; Egger, Benzing, Conzelman, & Schmidt., 2019; James-Burdumy et al., 2013; Massey et al., 2017; McArdle, Harrison, & Harrison, 2013; McClelland, Pitt, & Stein, 2015; Mullender-Wijnsma et al., 2015).

Yet, schools are not experiencing the expected student gains based on contemporary, standardized test-driven models of direct, didactic instruction punctuated with drill and practice. As schools are under increased pressure to focus on standardized test scores as the pinnacle of achievement, other activities that contribute to child development may be reduced or eliminated completely from the school day. The combination of children's developmental needs and

suboptimal achievement outcomes have strong implications for researchers, practitioners, leaders, and policymakers. It is both logical and imperative to take a closer look at the emerging science behind play as it relates to curriculum, instruction, and pedagogy, specifically regarding the development of essential skills that go hand-in-hand with academic learning and student achievement.

### ***Rationale and Statement of Purpose***

The term “play” as an education construct has been difficult to define within the context of research (Fisher, 1992; NAEYC, n.d.; Pellegrini, 2013; White, 2013). Several studies have focused on the various types of play (i.e., object, social, pretend, media, physical), while others focus on the intention or qualities of play (i.e., child-driven, functionless, exaggerated, fun), and still others focus on the degree of autonomy children have as being elemental to the determination of play (Fisher, Hirsh-Pasek, Golinkoff, Singer, & Berk, 2011; NAEYC, n.d.; Pellegrini, 2013; White, 2013). Much research indicates play is essential to children’s physical, social, and cognitive development, and imperative for an optimal learning environment (e.g., Cremin, Glauert, Craft, Compton, & Stylianidou, 2015; Fisher, 1992; Fisher et al., 2011; London, Westrich, Stokes-Guinan, & McLaughlin, 2014; McArdle, Harrison, & Harrison, 2013; Park, Chae, & Boyd, 2008; Pellegrini, 2013; Sandberg & Heden, 2011; White, 2013). Pellegrini (2013), however, indicates play is not critical and does not necessarily support learning, increased creativity or imagination, improved critical thinking or cognition, and greater capacity for empathy and social-emotional proficiency.

Certainly, classrooms, even kindergartens, allowing movement and play-based curriculum and instruction are becoming rare, with increased time spent completing online or hard copy worksheets, using adaptive computer programs, and in direct instruction are growing



significantly since the 1990s (Bassok, Latham, & Rorem, 2016; Miller & Almon, 2009; NAEYC, 2005; Pyle & Daniels, 2017; Ranz-Smith, 2007; Repko-Erwin, 2017). A problem persists, however, in identifying data points or behaviors to codify a construct of play which might inform researchers in their analyses of play-based classroom environments. One way that play can be operationalized is through physical movement. Therefore, the purpose of this study is to explore the possible relationships between how students move and academic achievement in Title I kindergarten classrooms. The use of students' daily school movement data may inform our definitions and understandings of the elements and differences between a play-based classroom and a contemporary classroom in a Title I school.

### *Literature Review*

Despite children's pervasive and natural magnetism to play of all types, from imaginary to gross-motor, play has been controversial for educational researchers, policymakers, and practitioners alike. While the literature suggests agreement, largely, that children need play for growth and play is developmentally appropriate for children (i.e., Copple & Bredekamp, 2009; Fisher, 1992; Fisher et al., 2011; Lillard et al., 2012; Pellegrini, 2013; White, 2013), many in the field believe play and structured academic learning are mutually exclusive. The reauthorization of the 1965 Elementary and Secondary Education Act as the Every Student Succeeds Act (ESSA; 2015) continues a trend of focusing increasingly on federal prescriptions for school improvement with an emphasis on standards-driven reform and test-based accountability (Bassok, Latham, & Rorem, 2016; Miller & Almon, 2009; NAEYC, 2005; Pyle & Daniels, 2017; Ranz-Smith, 2007; Repko-Erwin, 2017).

Inside the classroom, even for young learners, time for play of all types including purposeful or guided play, dramatic play, and music and movement, has been diminished, if not

eliminated. The accountability shakedown of standards-driven instruction and assessment (Bassok, Latham, & Rorem, 2016; Hatch, 2002; Miller & Almon, 2009; Repko-Erwin, 2017) since the implementation of high-stakes testing and Common Core State Standards (CCSS; NGACBP & CCSSO, 2010). Teachers are presented with competing demands and are often challenged to find approaches that take into consideration others' values and expectations, accountability, autonomy, and differentiated instruction (Boote, 2006; Copple, Daniel, & Tomlinson, 2008; Goldstein, 2007a, 2007b, 2008a, 2008b; Graue, 2008; Hatch, 2002; NAEYC, 2009). State standards and assessments, district expectations and curricula, building-level pressures, parent and family concerns, trickle-down stress from teachers in higher grade levels, individual student needs, and professional values and philosophies all attempt to demand equal attention from teachers. While teachers can use strategies to attempt a balanced instructional approach (Goldstein, 2007b), much of their success depends on their levels of professional discretion, freedom, controls, and access to resources. However, a focus on rigorous academic standards and utilizing measures of accountability for instruction and learning need not be mutually exclusive to developmentally appropriate instruction with a focus on hands-on, movement- and language-rich, discovery-focused, and purposeful play pedagogy (Allee-Herndon & Roberts, 2018). In the following sections, background research on play, movement, and learning as well as connections between the classroom environment, play, physical activity, and learning are reviewed.

### ***Physical Activity, Movement, and Learning***

A large body of research literature exists on the positive impacts of physical activity on learning and academic outcomes (e.g., Armin et al., 2017; Barros et al., 2009; Bidzen-Bluma & Lipowska, 2018; Blom, Alvarez, Zhang, & Kolbo, 2011; Egger, Benzing, Conzelman, &

Schmidt., 2019; James-Burdumy et al., 2013; Jarrett, 2002; Massey et al., 2017; Mullender-Wijnsma et al., 2015; Reeves, Miller, & Chavez, 2016). Additionally, play, both physical outdoor play as well as other types of play, have been shown to improve children's executive function (EF) and self-regulation (SR) skills as well as improve their social-emotional (SEL) skills (e.g., Bartlett, 2011; Bell, 2014; Bidzen-Bluma & Lipowska, 2018; Egger et al., 2019; Fede, 2012; Lillard et al., 2012; McArdle, Harrison, & Harrison, 2013; McClelland, Pitt, & Stein, 2015; White, 2013). Often, the children who lose out on recess are children of color, children in low-income or poor households, and children who live in urban areas (Barros, Silver, & Stein, 2009). These children are also more likely to begin school without prerequisite social-emotional skills and foundational content knowledge which begins a trend of widening the predictable school achievement gap throughout their K-12 experience. The lack of high-quality play and skills and knowledge necessary for success in school compounds the academic, behavioral, and social-emotional challenges in school for our most vulnerable students. For vulnerable children from at-risk backgrounds, prior research shows providing opportunities for safe movement and play both inside and outside of the classroom seems to be of particular benefit to develop:

- Language and literacy skills (Cremin, Glauert, Craft, Compton, & Stylianidou, 2015; Hassinger-Das et al., 2016; McArdle, Harrison, & Harrison, 2013; Nolan, Taket, & Stagnitti, 2014; Ranz-Smith, 2007; Russo, 2013; Sandberg & Heden, 2011),
- Executive function (Copple & Bredekamp, 2009; Fisher, 1992; Fisher et al., 2011; Lillard et al., 2012; Pellegrini, 2013; White, 2013), and

- Academic achievement (e.g., Armin et al., 2017; Barros, Silver, & Stein, 2009; Blom, Alvarez, Zhang, & Kolbo, 2011; James-Burdumy et al., 2013; Jarrett, 2002; Massey et al., 2017; Mullender-Wijnsma et al., 2015).

Research on recess intervention programs shows positive effects on children's social-emotional learning (SEL) and behaviors such as class readiness, on-task behavior, transitioning from recess to learning, anti-bullying, inclusiveness, student ownership of recess activities, student safety, and student use of positive language. Other studies related to physical activity, gross motor play, or recess interventions also find positive impacts on school climate, academic learning, social skills, and behavior, whether the play is highly structured and intentional or is free play in open spaces with found objects (Chaddock-Heyman et al., 2015; Farmer et al., 2017; McArdle et al., 2013; Resaland et al., 2015). Additionally, gross motor outdoor play and music and movement activities in the classroom both engage children's whole bodies with movements that cross the body's midline and use a variety of large muscle groups that scaffold physical and cognitive development and enhance neural networks to deepen learning (Allee-Herndon & Roberts, 2018; Hassinger-Das, Hirsh-Pasek, & Golinkoff, 2017). Obstacle courses, climbing and pedaling and balancing, games such as *Simon Says* or *Duck, Duck, Goose*, clapping rhythms, and dancing all work to develop working memory, cognitive flexibility, and inhibitory control (Center on the Developing Child, n.d. a, b). Research shows that learning can also be enhanced simply by taking advantage of outdoor classrooms and natural spaces (McArdle et al., 2013; Sahrakhiz, Haring, & Witte, 2018).

Given the range of examples above, defining physical, gross motor play, and movement can be as challenging as defining play. Blaydes (2000) categorized three types of movement as classifications for analyzing brain research: movement, physical activity, and exercise. Per

Blaydes (2000, p. 2), movement can be defined as “maneuvering the environment.” Examples of movement in a classroom might include retrieving materials for engaging in learning experiences, such as gathering paper, collecting a pan balance, or submitting completed work. In contrast, physical activity expends energy. In a classroom, this might include engaging in music and movement activities, such as indoor or outdoor recess, games like *Simon Says*, mindfulness yoga practice for stress reduction before a test, or sponge activities, such as bean bag toss games to practice multiplication facts. Exercise, while similar to physical activity, is less playful and focuses on specific health or fitness end goals. Play in elementary schools, then, is most likely to fall in the movement and physical activity categories. Blaydes (2002) emphasizes that “movement prepares the brain for optimal learning” (p. 2).

### ***Research on Play and Movement***

Play is considered by many researchers and theorists to be essential for human development. The study of play tends to concentrate on three interdependent areas: the influence of play on problem-solving and creativity, the relationship between pretend play and the development of language and symbolic thinking, and perhaps most studied, the effects of play on the development of prosocial behaviors (Fisher, 1992; White, 2013). Play can be challenging to define, but is often described as having certain fundamental characteristics: play is voluntary, play is fun, often the play behaviors are without function in the sense that no immediate developmental benefit is perceivable, and play behaviors are repetitive and exaggerated (Pellegrini, 2013). Play is also categorized differently by different researchers, but often these categories include social, object, pretend, physical, and media play (White, 2013).

Earlier reviews on this topic have examined the changing landscape of primary elementary school, particularly kindergarten, and the potentially competing demands of

standards-driven instruction, external expectations, and accountability in the newer, more academically-focused primary grades, they have not re-examined this issue within the context of Common Core State Standards (CCSS, 2010), new neurological insights into child development and the value of growth-promoting environments, and how a play-based developmentally appropriate practice (DAP) curriculum might achieve the accountability goals of state standards in kindergarten and beyond. Many have argued that DAP and standards-based instruction and assessment are mutually incompatible, but that need not be true (Allee-Herndon & Roberts, 2018; Boote, 2006; Copple & Bredekamp, 2009; Clements, Fuson, & Sarama, 2017; Goldstein, 2007a, 2007b, 2008; Graue, 2008; Hatch, 2002; Rushton, Juola-Rushton, & Larkin, 2009; Rushton & Larkin, 2001).

The study of play tends to concentrate on three interdependent areas: the influence of play on problem-solving and creativity, the relationship between pretend play and the development of language and symbolic thinking, and perhaps most studied, the effects of play on the development of prosocial behaviors (Fisher, 1992; White, 2013). The National Association for the Education of Young Children (NAEYC) states an experience must be comprised of five aspects to be considered play: child choice or decision-making, intrinsic motivation, immersive, spontaneous, and enjoyable (NAEYC, n.d.). Pellegrini (2013) declares play to occur in locomotor, object, social, and pretend play domains while White (2012) says play includes social, object, pretend, physical, and media play. Others suggest that, for the purposes of reaching instructional goals aligned to rigorous academic standards while still maintaining developmentally appropriate practice (DAP; Copple & Bredekamp, 2009), play can be guided, purposeful, and driven by adults (Weisberg, Hirsh-Pasek, Golinkoff, Kittredge, & Klahr, 2016). “Despite the variety of definitions, Bodrova and Leong (2003) point out that play is ordinarily

comprehended as an important and valuable activity, and high-level play is perceived as both fun and developmentally valuable” (Tsai, 2017, p. 153).

Pellegrini (2013) conducted a literature review on the value of play for children’s development and focused more on defining what play is over effects on cognition or social-emotional learning (SEL) as he contends that much of the differences in research outcomes (play is crucial versus play is inconsequential) can be attributed to how play is defined in each study. He defined play as voluntary, observed in a relaxed environment, non-functional (not serving an immediate functional purpose), repeated and exaggerated, segmented, and non-sequential (unlike functional behavior). Pellegrini categorized four domains of play: locomotor, object, social, and pretend, and all except social play can be either social or solitary. He suggests play likely has both immediate and deferred benefits, and the importance of recognizing both possible benefits of play and the possibility this importance may be limited. Pellegrini also suggests that deprivation of physical play is typically confounded with other forms of deprivation. His recommendations for future research focus on questions like, “What are the relative effects of different forms of "play breaks" in school (e.g., rest time, structured exercise, unstructured peer interaction) on children's cognitive performance? How do these vary with age of the child?” (Pellegrini, 2013, p. 295).

Fisher (1992) conducted a meta-analysis of 46 studies, for which play was the independent variable, beginning in 1974 to explore the value of play for development. Play has historically been a vague construct, but Fisher claimed consensus was forming that play involves basic elements (self-generated, intrinsically-motivated, hedonic, characterized by behavior and pretense) and that future path analysis and factor analysis may further define play. Pellegrini (2013) noted play studies tend to focus on three interdependent areas: play's influence on the

development of problem-solving and creative behavior, the relationship between make-believe play and language and symbolic thinking development, and (most studied) the effects of play-training interventions on improving prosocial behaviors. He, too, suggested the decline of play research can likely be attributed to the lack of consistent and organized findings in the (then) existing literature. Based on his analysis, he concluded play research has been plagued by methodological problems, but that effect size findings provided convincing evidence that play appears to promote improved cognitive-linguistic and affective-social performance outcomes. Pellegrini noted differences among the effects of different types of play with particularly robust results from socio-dramatic pretend play.

Lillard et al. (2013) conducted a descriptive analysis (the statistics were too weak to conduct a meta-analysis) on existing studies of the effects of pretend play on creativity ( $n=24$ ), intelligence ( $n=14$ ), problem solving ( $n=12$ ), reasoning ( $n=6$ ), conservation ( $n=9$ ), theory of mind ( $n=33$ ), social skills ( $n=16$ ), language ( $n=12$ ), narrative skills ( $n=14$ ), and executive function and emotion regulation ( $n=14$ ). The intention was to explore whether pretend play is crucial to and causes children's healthy development, one of many routes to positive developments (equifinality), or is an epiphenomenon of other factors that drive development. Common issues with the studies analyzed claiming causation included non-random assignment, small sample sizes, human and implementation confounding factors, and unsound statistical methods.

### ***Connections Between the Play-Based Classroom Environment and Learning***

In the past two decades, the general view of play in school has shifted in the wake of an increased focus on direct instruction, worksheets, scripted curricula, and regular assessment monitoring in an effort to leave no child behind (Fisher et al., 2011). In the current climate, play



is often viewed as opposition to academic learning, resulting in early elementary teachers (kindergarten through second or third grade) engaging in far less purposeful play throughout the school day than was present 30 years ago (Bassok et al., 2016; Repko-Erwin, 2017). Play research, however, shows the critical importance of play and movement, not just for developing self-regulation and executive function, but also for enhancing social competence and emotional literacy, language and literacy development, cognition and content-related concept building, creativity and imagination, empathy and resilience, cooperation and collaboration, motor and cross-functional skills, as well as persistence and intelligence (Copple & Bredekamp, 2009; Bunker, 1991; Fede, 2013; Fisher, 1992; Fisher et al., 2011; Lillard et al., 2012; Pellegrini, 2013; Reeves, Miller, & Chavez, 2016; White, 2013).

Emerging neuroscientific findings are aligned with and support DAP and constructivist, social, play-based approaches to learning (Allee-Herndon & Roberts, 2018; Copple & Bredekamp, 2009; Rushton, Juola-Rushton, & Larkin, 2009). DAP is a long-standing and highly-respected early childhood education (ECE) approach that values meeting children where they are developmentally and socially with age- and stage-appropriate rich, engaging content. Young children need access to enriched, intensive learning experiences which include purposeful play at an early age to mitigate the achievement disparities often associated with family income, ethnicity, and language background. In the revised DAP position statement, NAEYC (2009) advocates for a blending of the best of both the ECE world and the K-12 world since kindergarten and other primary grades are uniquely positioned as a bridge between ECE and K-12. A comprehensive, effective curriculum must attend to both academic and social-emotional competencies. This curriculum must incorporate scaffolding and differentiating learning in a prosocial environment to support each student's unique needs, the domain of the ECE world,

with an attention to robust content, learning progressions, quality systematic assessment, and effective curriculum and teaching, the domain of the K-12 world. Rushton, Juola-Rushton, and Larkin (2009) created a matrix aligning DAP, neuroscientific principles, and Cambourne's Conditions of Literacy Learning (Cambourne, 2001) to illustrate how brain science validates DAP and other related theories like Vygotsky's social constructivist theory (Bodrova et al., 2013; Bodrova & Leong, 2010; Nicolopoulou et al., 2010).

These, in turn, can also be aligned to subscales on classroom environmental rating scales, such as the School-Age Care Environment Rating Scale (SACERS; Harms, Jacobs, & White, 2013), to ensure and evaluate classroom environments to support growth-friendly learning environments. For example, where DAP reveals that children's social, emotional, physical, and cognitive domains are closely related and influenced by the others, Cambourne's (2001) Conditions of Learning purport that teachers should provide opportunities to immerse children in learning experiences, while neuroscience findings expose the brain's composition as a highly sophisticated neurological network connecting the different regions of the brain (Rushton et al., 2009). Rushton et al. (2009) then connects possible classroom practices aligned to these three understandings, such as creating active learning environments, building community, integrating curriculum, and providing meaningful context. These ideas echo other existing literature (i.e., Allee-Herndon & Roberts, 2018; Center on the Developing Child, 2017; Hassinger-Das, Hirsh-Pasek, & Golinkoff, 2017; Moreno, Shwayder, & Friedman, 2017). This type of playful, constructivist, child-focused approach to learning has been shown to support children in developing agency, creativity, logic, problem-solving, reasoning, language ability, empathy, persistence, prosocial skills, content-based learning and skills, and other important dispositions necessary for academic success (Ash, Bowling, & Davidson, & Garcia, 2017; Cremin et al.,

2015; London et al., 2015; McArdle et al., 2013; Nolan et al., 2014; Park, Chae, & Boyd, 2008; Ranz-Smith, 2007; Russo, 2013; Sandberg & Heden, 2011). A growing body of research suggests that gross-motor, physical play and movement positively affect students across multiple domains, and instructional approaches like recess and purposeful or guided play in classrooms can support children's health, learning, attention, and balanced behavior.

### ***The Study of Play and Movement in Elementary School Settings***

Evidence mounts showing the importance of play on children's development, a body of literature describing the myriad benefits of different types of instructional play from free play to teacher-directed guided or purposeful play, and research linking physical activity to improved outcomes. When searching for empirical studies or articles in peer-reviewed academic journals that explore the intersection of "play" and "movement" in elementary schools; however, the limited results were surprising. For example, in a search of four education databases using the search terms and limiters identified in Table 11 below, a total yield of five results were found even when including similar or related terms in the search. Of these five, only four sources appear in peer-reviewed, academic journals. While the information is helpful, especially in supporting the literature review for this study, the results also suggest that exploring this intersection of interdisciplinary foci may be of significant benefit toward achieving both improved outcomes for students and increased understanding of educational best practices. While classroom environmental and behavioral observation studies permeate, clarity is lacking in the ways to codify or explore a play-based pedagogical classroom using technology, room sensors, accelerometers, or other modern movement and activity trackers. Taking advantage of emerging technology to supplement other existing measures of environmental and instructional

differences offers the means to perhaps pinpoint differences in practice that have a significant impact on outcomes.

Table 11: Database Search Summary for Play, Movement, and Elementary Education

Database	Search Terms	Limiters	Results	Appropriate Results for This Study	Citations
ERIC (Ebsco Host)	(DE "Play") AND (DE "Movement Education") AND "elementary school"	Full Text, Scholarly (Peer Reviewed) Journals	$n = 6$	$n = 3^*$	*Bunker, 1991  Reeves, Miller, & Chavez, 2016  Sahrakhiz, Haring, & Witte, 2018
Education Source (Ebsco Host)	(DE "Play") AND (DE "Movement Education") AND "elementary school"		$n = 0$	$n = 0$	
Education Database (ProQuest)	play in early childhood education AND physical activity in children OR movement in the classroom AND elementary education	Full Text, Scholarly (Peer Reviewed) Journals, Age Groups: School Age (6-12 years)	$n = 5$	$n = 2^*$	*Bunker, 1991  Lehrer, Petrakos, & Venkatesh, 2014
PsycInfo (Ebsco Host)	((DE "Childhood Play Behavior" OR DE "Childhood Play Development") AND (DE "Physical Activity")) AND (DE "Elementary Education")		$n = 1$	$n = 1$	Hartman, 1922 (Chapter)

*\*The asterisk indicates a duplicate reference.*

### *The Inequities of Play in School*

Not only is play important for children's learning and development, it is not equally accessible to all children. Our most vulnerable students are most affected by the lack of play and movement and a focus instead on didactic, direct-instruction, "be still and quiet" approach to teaching. Children living in poverty typically have lower cognitive performance, increased behavioral issues, and historically underperform their peers on several important metrics like academic performance and pro-social school behaviors. Children living in low-income homes experience developmental delays that encompass interdependent skills: gross motor, sensory perception, social-emotional development, language development, and cognitive development (i.e., Allee-Herndon & Roberts, 2019; Blair & Raver, 2015; Brown & Low, 2008; Duncan, McClelland, & Acock, 2017; Engle & Black, 2008; Nesbitt, Fuhs, & Farran, 2019; Pace, Alper, Burchinal, Golinkoff, & Hirsh-Pasek, 2019; Sattler & Gershoff, 2019; Vitiello & Greenfield, 2017).

More commonly, elementary schools, especially failing schools, are mandated to reduce or even eliminate outdoor, gross motor play during recess periods in an effort to focus on teaching tested subject areas (Barros et al., 2009). Further, when recess does exist, it often lacks the structure needed to support healthy outcomes for children (Fortson et al., 2013).

Additionally, children who are disallowed recess most often are children of color, children in low-income or poor households, and children who live in urban areas (Barros et al., 2009).

These children are also more likely to begin school without prerequisite social-emotional skills and foundational content knowledge, creating a trend of widening the predictable school achievement gap throughout their K-12 experience (Allee-Herndon & Roberts, 2019). When children enter school less prepared academically, behaviorally, or emotionally to be successful

within contemporary school structures and confines, the lack of play-based learning activities, movement, and gross-motor skills necessary for success in school compounds existing challenges in school for our most vulnerable students.

### **Research Methodology and Design**

This is a naturalistic, quasi-experimental study with purposive sampling, which uses a pretest-posttest, non-equivalent control group design. The two kindergarten classes were nested within a single school and assigned to either the treatment (play-based) or control (contemporary) condition by the school administration prior to the start of the school year. While the assignment to condition was done at the classroom level, analyses were done at the student level. This study was approved by the University of Central Florida Institutional Review Board (SBE-18-14264) and by the appropriate authorities at the Title I school site per the ethical guidelines for research with human subjects (see Appendix C). Informed consent was obtained from all individual adult participants included in the study, parental consent from all parents of participating kindergarteners, and verbal assent was obtained from all student participants.

### ***Research Questions***

Because the purpose of this study was to explore the possible relationships between play-based pedagogy and contemporary pedagogy in in Title I kindergarten classrooms through measures of student's activity and movement as well as reading and math achievement, the following research questions drove the study design and analysis.

1. Does kindergarten students' classroom condition (play-based or contemporary) moderate differences in students' mean weekly movement type percentages, after accounting for students' gender and FRPL status?

2. Does kindergarten students' classroom condition (play-based or contemporary) moderate the relationship between day of the week (over five academic days) and total daily step count, after controlling for gender and FRPL status?
3. Are there relationships between children's daily step counts for each day of the week (over five academic days) and their academic achievement in reading and math at the end of the school year?

### **Participants and Recruitment**

The site for this study was a Title I elementary school in a small district, located in Florida, which serves 12,934 students at 15 schools. For the purposes of confidentiality, the pseudonyms Gator Elementary and Sunshine District are used in this manuscript. While a relatively small district, Sunshine's diversity score (rendered by the chance that two students selected at random would be members of different ethnic groups) is .48 where the state's diversity score average is .46. Sunshine District's minority enrollment is 37%, and the majority of this district population is either African American or Hispanic. Although the district diversity score is higher than the state average, the minority enrollment is much lower than the state average of 61%. The nine elementary schools in the district serve 6,841 students.

Gator Elementary serves 924 students in grades PK-6, with six kindergarten classrooms. The Florida class size amendment limits kindergarten classrooms to 18 students per class, but Gator Elementary has an average student to teacher ratio of 15:1. Minority enrollment at the school is 41% (majority African American and Hispanic), which while still lower than the state average, is higher than the district average. Gator Elementary is a Title I school with 67% of students eligible to receive free or reduced-price lunch (FRPL), which is often used as a measure of socioeconomic status (SES; National Forum on Education Statistics, 2015).

Notably, one of the most significant recruitment challenges for this study was finding public, Title I kindergarten classrooms that relied on play in a district that would approve the request to conduct research. The participants in this study were purposively included. The target intervention classroom was an “advanced kindergarten” class of 20 students, assigned prior to the beginning of the school year by the principal, with no students qualifying for exceptional student education (ESE) and one English language learner (ELL). Their teacher, who volunteered to participate in the study after seeing a request for participants on social media, was passionate about using a play-based approach in kindergarten. Her use of play in the classroom was an existing model of her own design. Her daily instructional schedule has 30-minutes dedicated to free choice “play centers” and 30-minutes of “learning centers” aligned to daily instructional standards and learning targets daily in addition to outdoor recess time each day. Per this teacher and the school principal, the other kindergarten teachers at this school use a more didactic, contemporary instructional approach with lots of drill and practice on skills. The control classroom was chosen based on the recommendation of the school principal, due to the traditional instructional approach preferred by the classroom teacher., The control teacher only encouraged unstructured movement during the required outdoor recess time and “playing” on instructional applications on iPads daily or every other day to meet the district-required i-Ready Instruction minutes. Thus, the sampling frame was unfortunately limited to a maximum of 40 children in both conditions, and the sample size was 23.

Parents of each classroom were recruited at a school curriculum night in September 2018 where the principal investigator shared the details of the study, provided information about their rights in a human study, and provided consent forms to sign. Parents were incentivized to participate with the receipt of all testing data for their child with a letter explaining the results



and implications in parent-friendly language upon their request. They were also notified of the overall findings, if requested, of the study upon its conclusion. Both teachers supported recruitment by sending home information packets with consent forms in students' Friday Folders, speaking with parents at teacher conferences, and (the treatment teacher) communicating with parents via a class Facebook page.

Only the academic achievement data (conducted and recorded by the school and district) for children with parental consent to wear the accelerometers were included in the analysis. The sample size for this study was admittedly small, unevenly distributed by condition, and not consistently diverse across demographic categories such as exceptional student education (ESE), English Language Learner (ELL), or Free-and Reduced-Price Lunch (FRPL) eligibility status (see Appendix B). This demographic data was collected for possible use as covariates, but upon analysis was mostly unusable because of a lack of variation in the sample. The only two possible covariates to test with sufficient variation across conditions were students' gender and FRPL status.

### *Apparatus, Instruments, and Data Collection*

*ActiGraph Link GT9X. The ActiGraph GT9X Link (ActiGraph Inc, Pensacola FL)* was used to measure children's movement throughout the school day. The Actigraph device is a small (4.6 cm X 3.3 cm X 1.5 cm) lightweight device that captures motion across three axes and has been validated in both laboratory and free-living environments in children (Troiano et al., 2008). Activity counts were averaged into 1-minute epochs or Counts Per Minute (CPM) and validated cut-point criteria were applied to the activity counts to calculate the number of minutes participants spent in sedentary, light, and moderate to vigorous physical activity (MVPA) (Evanson et al., 2008). Additionally, the average number of daily steps taken during the school

day were collected as well. Movement data was captured during 24-hour periods on school days (i.e., 12:00 AM through 11:59 PM Monday through Friday). All participating children from both the treatment and the control conditions were randomly selected to wear an activity tracker during one of three data collection windows. The accelerometer is similar to a fitness tracking device, such as a FitBit, measuring how often children move as opposed to sitting still. During each data collection period, children from both classroom conditions wore the accelerometers for seven consecutive days on their non-dominant wrists, removing them only to bathe or swim.

***Data Processing and Wear-Time Validation Criteria.*** Accelerometer data was analyzed using ActiLife software. For both Moderate to Vigorous Physical Activity (MVPA and Sedentary Behavior (SB), any periods of 60+ minutes of “0” activity counts were designated as “non-wear time” and removed from the analysis (Trost, Rosenkranz, & Dzewaltowski, 2008). Due to prior research that found an artificial increase of MVPA on the first day children receive the accelerometer device, the initial day participants were given the device was excluded from the analysis (Mattocks et al., 2008). Participants were required to have at least 4 full days of data (1 weekend day, 3 weekdays) to be included in the final analysis (Hildebrand et al., 2014; Kim & Yun, 2009). Days showing a wear-time of less than 10 hours were removed from the analysis (Hildebrand et al., 2014; Matthews, Ainsworth, Thompson, & Bassett, 2008). Cut point analysis algorithms were used to examine minutes of activity intensity and time spent in that intensity and are based on the characteristics of the participants. For this study, Evenson et al.’s (2007) cut points for healthy children and adolescents were used in this analysis.

***i-Ready Diagnostic.*** To measure the extent to which kindergarten students in play-based classrooms may or may not have demonstrated higher levels of academic achievement at the end of the academic year than peers in contemporary classrooms and if relationships exist between academic achievement and movement, academic achievement scores were used. While no statewide assessments are required for kindergarten students in Florida, this district uses the i-

Ready Diagnostic (Sunshine District Schools, 2017) at the beginning, middle, and end of the year to assess students' progress and growth in reading and math. The i-Ready assessment is computer-based, adaptive, and aligned with i-Ready Instruction, which the district also uses for reading and math instruction. The reading assessment includes an Overall Score (used for this study) as well as scores for reading domains: phonological awareness, phonics, high-frequency words, vocabulary, literature comprehension, and informational text comprehension (Curriculum Associates, n.d. a.).

i-Ready Diagnostic is intended for K-12 students. Percentile scores are nationally normed, and the diagnostic results also include a Lexile measure. Diagnostic score reports for individual students include information about typical growth for students at the same grade and placement level, "stretch growth" information intended to help students performing below grade level expectations reach proficiency, and placements by domain (Curriculum Associates, n.d. a). Classroom diagnostic score reports provide teachers with aggregated information at a glance and suggest instructional areas of foci, resources, and groupings. Overall reading placement score ranges for the 2018-2019 school year include "Emerging K" (100-361) and "Level K" (362-479), and on grade level kindergarten ranges are further parsed to "Early" (362-395), "Mid" (396-423), and "Late" (424-479) (Curriculum Associates, 2018). Per Curriculum Associates (2018), both i-Ready Diagnostic and i-Ready Instruction are aligned to state academic standards, the Every Student Succeeds Act (Every Student Succeeds Act [ESSA], 2015), and What Works Clearinghouse (WWC, n.d.) research standards. Multiple published studies explore the alignment of i-Ready Diagnostic to state standards and assessments including the Florida Standards Assessment (Curriculum Associates, n.d. b).

### *Procedures*

The Sunshine District and Gator Elementary already collect demographic data upon student entry and i-Ready Reading and Math Diagnostic data at the beginning, middle, and end of the academic year. The school and district provided the demographic data and the beginning (August to September 2018) and end (March to May 2019) of the year i-Ready Reading Diagnostic data for all children with parental consent to support the pretest-posttest, quasi-experimental study design. In Sunshine District and at Gator Elementary, kindergarten students take the i-Ready Diagnostic in small groups with the teacher using iPads and headphones. Students are prompted by the assessment with oral directions, pictorial cues, and other supports for this non- or early readers to take this type of test. In addition, the principal investigator distributed the accelerometers to students with parent consent between March 25 and April 30. Approximately six students from each classroom condition were randomly selected to wear the

accelerometer during each of three distribution periods using an online random generator (Figure 21).



Figure 21: Child Wearing ActiGraph Link GT9X Accelerometer

The trackers were distributed on Mondays, and the devices were collected again the following Tuesday. The data from this initial day was intentionally not analyzed to allow time for students to get used to wearing the devices. Likewise, data from the last morning were not included either. Thus, the viable data were from Tuesday through Monday, with a focus exclusively on school days for this study. When the activity trackers were collected at the end of the data collection window, the researcher talked with each child and asked simple interview questions, such as, “Did you wear the tracker the whole time?” and “If not, what made you take it off?” Some children wore their devices inconsistently, one child refused to wear his, and two other children’s parents revoked consent for wearing the accelerometers, thus further reducing

the viable sample size to for this study. For the academic data collection, kindergarteners at Gator Elementary take the i-Ready Diagnostic in small, teacher-directed groups using iPads and headphones. For the nonreaders or emergent readers, teachers enhanced the assessment with oral directions, pictorial cues, and other supports as needed for this type of test.

### **Data Analysis**

Table 12 outlines the sample sizes, variables, and statistical procedures used for each research question.

Table 12: Summary of the Study Design and Analysis

Research Questions	<i>n</i>	Independent Variables	Dependent Variables	Covariates	Statistical Tests
1. Does kindergarten students' classroom condition (play-based or contemporary) moderate differences in students' mean weekly movement type percentages, after accounting for students' gender and FRPL status?	<i>n</i> = 23	Classroom Condition (play-based or contemporary)	Students' Movement (Mean Weekly Total Percentage of Movement by Type, Daily Total Step Count)	<ul style="list-style-type: none"> <li>• Gender</li> <li>• FRPL</li> </ul>	Mixed Design ANCOVA
2. Does kindergarten students' classroom condition (play-based or contemporary) moderate the relationship between day of the week (over five academic days) and total daily step count, after controlling for gender and FRPL status?	<i>n</i> = 23	Classroom Condition (play-based or contemporary)	Students' Movement (Daily Total Step Count)	<ul style="list-style-type: none"> <li>• Gender</li> </ul>	Mixed Design ANCOVA
3. Are there relationships between children's daily step counts for each day of the week (over five academic days) and their academic achievement in reading and math at the end of the school year?	21 ≤ <i>n</i> ≤ 31	Classroom Condition (play-based or contemporary)	Students' Movement (Daily Total Step Count)  Academic Achievement (i-Ready Post-Test Reading and Math Overall Scores)		Spearman's $r_s$

\*The sample size in these individual analyses may be lower than the overall sample size for this study because some parents consented to allow their child to participate in other aspects of the study but declined accelerometer consent, one child refused to wear the accelerometer, and some children wore them so inconsistently as to have corrupted or unviable data.

### ***Research Question 1***

Does kindergarten students' classroom condition (play-based or contemporary) moderate differences in students' mean weekly movement type percentages, after accounting for students' gender and FRPL status?

***Assumptions.*** To ensure that the results from an analysis of covariance (ANCOVA) were valid, the relevant statistical assumptions were examined. While the study employed a quasi-experimental design using purposive sampling, the researcher concluded observations were independent of one another because students wore individual accelerometers during randomly assigned windows. There were no violations of sphericity, as assessed by Mauchly's test of sphericity,  $W=.957$ ,  $X^2(2) = .789$ ,  $p = .674$ . There were no violations of homogeneity of variance, as assessed by Levene's test of equality: Mean Percentage of Sedentary Activity,  $F(1, 21) = 1.867$ ,  $p = .186$ , Mean Percentage of Light Activity,  $F(1, 21) = 2.760$ ,  $p = .111$ , and Mean Percentage of Moderate Activity,  $F(1, 21) = 3.358$ ,  $p = .081$ . There were no univariate outliers in the distributions of mean weekly movement type percentages and classroom condition, as assessed by standardized residuals greater than  $\pm 3$  standard deviations. Based on these cumulative findings and the robustness of the ANCOVA against violations of statistical assumptions, the researcher proceeded with the inferential analyses.

***Results.*** Prior to examining the treatment effects, covariates were assessed for their contribution to the analytic model and were retained only if they were statistically significant or had a moderate effect size ( $\eta_p^2 \geq .06$ ). When exploring the relationships between students' weekly movement type and classroom condition, the interaction between student's FRPL status and type of activity was statistically significant with a large effect size,  $F(2, 38) = 3.480$ ,  $p = .041$ ,  $\eta_p^2 = .155$ . Although the interaction between students' gender and type of activity was

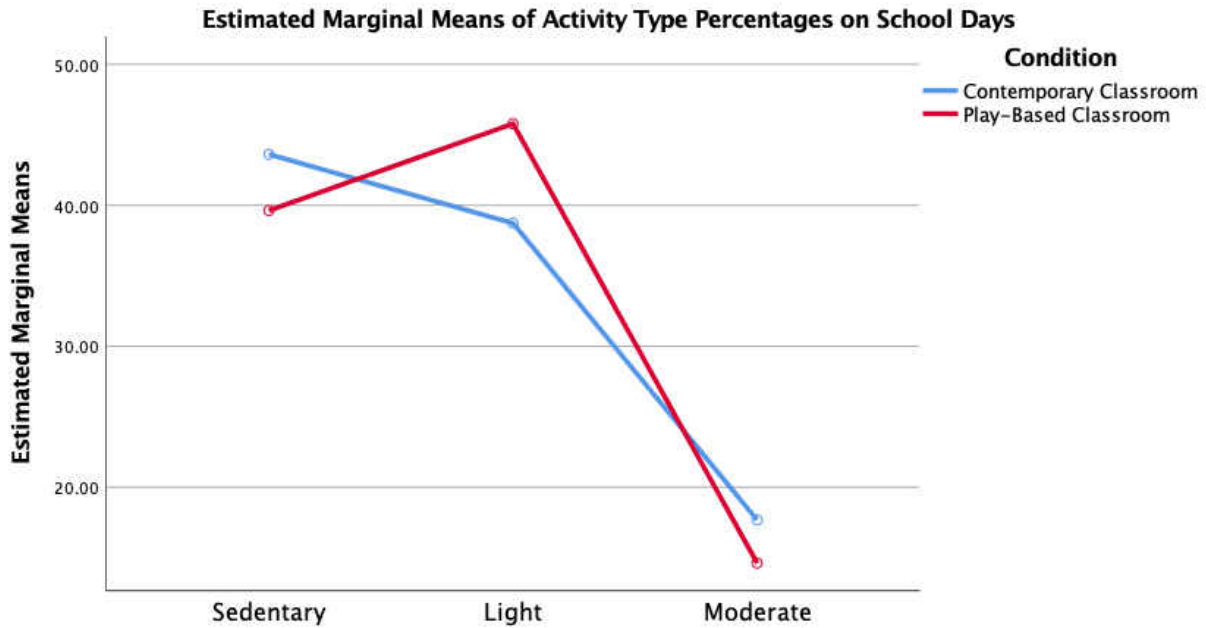


small and not statistically significant ( $F(2, 38) = 1.132, p = .333, \eta_p^2 = .056$ ), there was a moderate main effect for gender,  $F(1, 19) = 1.488, p = .237, \eta_p^2 = .073$ . Therefore, both FRPL status and gender were retained as covariates in the model. After controlling for these covariates, the interaction between the movement type and classroom condition was moderate, but not statistically significant,  $F(2, 38) = 1.658, p = .204, \eta_p^2 = .080$ . This suggests that movement types vary depending on whether students are in the contemporary or play-based classrooms. For students in the play-based class, a greater percentage of time was spent in light activity (46.4%) than in sedentary activity (39%) during the week. Among students in the contemporary class, 45% of time during the week was spent in sedentary activity and 37.3% of time was spent in light activity. For both classrooms, the amount of time spent in moderate activity was the smallest percentage. See Table 13 for the adjusted means and standard deviations for weekly movement type percentages by classroom condition and Figure 22 for the for a graphical representation of the weekly movement type percentages by classroom condition.

Table 13: Adjusted Means and Standard Deviations for Weekly Movement Type Percentages

Classroom Condition	Activity Type Percentages on School Days	Mean	SD
Contemporary Classroom	Daily Percentage of Sedentary Activity	43.613 <sup>a</sup>	23.716
	Daily Percentage of Light Activity	38.725 <sup>a</sup>	27.438
	Daily Percentage of Moderate Activity	17.667 <sup>a</sup>	28.343
Play-Based Classroom	Daily Percentage of Sedentary Activity	39.623 <sup>a</sup>	15.418
	Daily Percentage of Light Activity	45.783 <sup>a</sup>	17.835
	Daily Percentage of Moderate Activity	14.606 <sup>a</sup>	18.425

a. Covariates appearing in the model are evaluated at the following values: Gender = .65, FRPL = .74.



Covariates appearing in the model are evaluated at the following values: Gender = .65, FRPL = .74

Figure 22: Adjusted Means of Students' Weekly Movement Type Percentages by Condition

### Research Question 2

Does kindergarten students' classroom condition (play-based or contemporary) moderate the relationship between day of the week (over five academic days) and total daily step count, after controlling for gender and FRPL status?

**Assumptions.** To ensure that the results from an analysis of covariance (ANCOVA) were valid, the relevant statistical assumptions were examined. While the study employed a quasi-experimental design using purposive sampling, the researcher concluded observations were independent of one another because students individually wore the individual accelerometers during randomly assigned windows. Mauchly's Test of Sphericity indicated violations of sphericity,  $W = .101$ ,  $X^2(9) = 37.582$ ,  $p < .001$ . There were no violations of homogeneity of variance, as assessed by Levene's test of equality: Monday Step Counts  $F(1, 20) = .126$ ,  $p = .726$ , Tuesday Step Counts  $F(1, 20) = 2.705$ ,  $p = .116$ , Wednesday Step Counts  $F(1, 20) = .208$ ,

$p = .653$ , Thursday Step Counts  $F(1, 20) = .009$ ,  $p = .925$ , and Friday Step Counts  $F(1, 20) = .253$ ,  $p = .620$ . There were no univariate outliers in the distributions of step counts for each day and classroom condition, as assessed by standardized residuals greater than  $\pm 3$  standard deviations. Based on these cumulative findings and the robustness of the ANCOVA against violations of statistical assumptions, the researcher proceeded with the inferential analyses using Greenhouse-Geisser statistics for interpretation as it is particularly robust to violations of sphericity.

**Results.** Prior to examining the treatment effects, covariates were assessed for their contribution to the analytic model and were retained only if they were statistically significant or had a moderate effect size ( $\eta_p^2 \geq .06$ ). When exploring the relationships between students' total daily step counts and classroom condition, neither students' gender,  $F(2.119, 38.141) = .354$ ,  $p = .716$ , nor FRPL status,  $F(2.119, 38.141) = 1.024$ ,  $p = .372$ , were statistically significant, and there was only a small effect,  $\eta_p^2 = .019$  and  $\eta_p^2 = .054$  respectively. Although the interaction between students' gender and total daily step counts was small and not statistically significant, there was a moderate main effect for gender,  $F(1, 18) = 2.701$ ,  $p = .118$ ,  $\eta_p^2 = .130$ . This indicates there is a relationship between gender and daily total step counts and therefore, only gender was retained as a covariate in the model. After controlling for gender, the interaction between day of the week and classroom condition was not significant and had only a small effect,  $F(2.415, 38.646) = .883$ ,  $p = .439$ ,  $\eta_p^2 = .052$ . There are also no main effects for day of the week ( $F(2.415, 38.646) = .699$ ,  $p = .529$ ,  $\eta_p^2 = .042$ ) or classroom condition ( $F(1, 16) = .013$ ,  $p = .910$ ,  $\eta_p^2 = .001$ ). Therefore, step counts were similar across the days of the week and between the contemporary ( $M = 16,632.756$ ,  $SD = 8316.535$ ) and play-based classrooms, ( $M = 16,632.756$ ,  $SD = 4274.544$ ). See Table 14 for the adjusted means and standard deviations for

daily total step counts by classroom condition, Table 15 for the adjusted means and standard deviations by days of the week across conditions, and Figure 23 for the for a graphical representation of the daily total step counts by classroom condition.

Table 14: Adjusted Means and Standard Deviations for Daily Total Step Counts by Classroom Condition

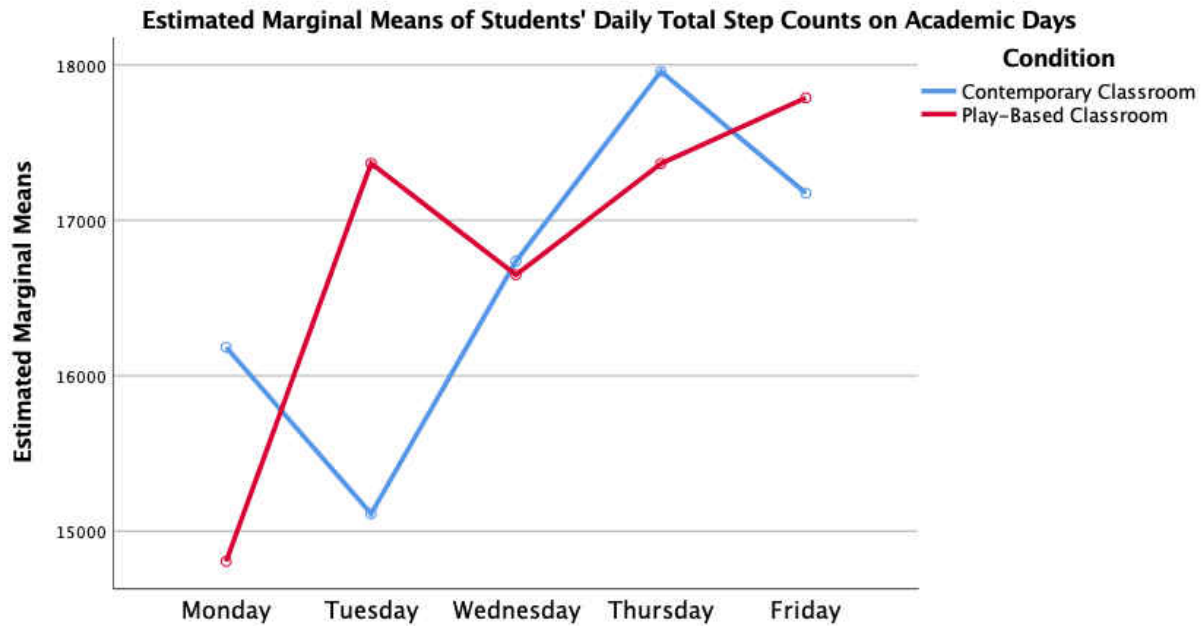
Classroom Condition	Academic Day of the Week	Mean	SD
Contemporary Classroom	Monday	16182.918 <sup>a</sup>	20,563.360
	Tuesday	15111.488 <sup>a</sup>	19,393.204
	Wednesday	16736.953 <sup>a</sup>	14,289.522
	Thursday	17958.103 <sup>a</sup>	13,180.857
	Friday	17174.316 <sup>a</sup>	20,772.155
Play-Based Classroom	Monday	14804.688 <sup>a</sup>	10,569.188
	Tuesday	17366.603 <sup>a</sup>	9,967.743
	Wednesday	16648.746 <sup>a</sup>	7,344.558
	Thursday	17365.172 <sup>a</sup>	6,774.713
	Friday	17787.982 <sup>a</sup>	10,676.501

a. Covariates appearing in the model are evaluated at the following values: Gender = .63.

Table 15: Adjusted Means and Standard Deviations for Daily Total Step Counts Across Classroom Condition

Daily Total Step Counts	Mean	SD
Monday	14580.342 <sup>a</sup>	10,629.945
Tuesday	15793.157 <sup>a</sup>	8,632.820
Wednesday	15844.178 <sup>a</sup>	7,217.024
Thursday	17108.785 <sup>a</sup>	6,122.821
Friday	16397.466 <sup>a</sup>	10,294.654

a. Covariates appearing in the model are evaluated at the following values: Gender = .68, FRPL = .77.



Covariates appearing in the model are evaluated at the following values: Gender = .63

Figure 23: Adjusted Means of Students' Daily Total Step Counts by Condition

### *Research Question 3*

Are there relationships between children’s daily step counts for each day of the week (over five academic days) and their academic achievement in reading and math at the end of the school year?

**Assumptions.** To determine the most appropriate correlation test for these analyses, statistical assumptions for Pearson correlations were tested. Scatterplots of all 21 bivariate relationships between the seven variables showed that 12 relationships appeared to be nonlinear. This visual assessment of the scatterplots also suggests a lack of bivariate normality or homoscedasticity, as well as some bivariate outliers. Given the violations of the statistical assumptions for the Pearson Product-Moment Correlation, the researcher elected to use

Spearman’s Rank Correlation Coefficient, as this non-parametric test is more robust against violations of assumptions.

**Results.** Most of the associations between daily step count totals were statistically significant with strong positive correlations. Correlations between Tuesday, Wednesday, Thursday, and Friday ranged between  $r_s = .473$  and  $r_s = .859$ , suggesting consistent daily activity. However, the relationships between Monday total step counts and the other days of the week were not statistically significant, but still had moderate effect sizes ( $.225 \leq r_s \leq .420$ ). There is also a very strong, positive correlation between students’ reading and math achievement,  $r_s(31) = .780, p < .001$ . Each of the relationships between students’ movement and students’ academic achievement, however, were not statistically significant and had small effect sizes ( $\pm .040 \leq r_s \leq .154$ ). The correlations between students’ total step counts for each day of the academic week and academic achievement are shown below in Table 16.

Table 16: Spearman Correlations Between Students' Daily Total Step Counts and Academic Achievement

	1	2	3	4	5	6	7
1. Post-Test i-Ready Reading Overall Scores	–						
2. Post-Test i-Ready Math Overall Scores	.780**	–					
3. Mean Monday Total Step Counts	-.092	-.065	–				
4. Mean Tuesday Total Step Counts	.097	.079	.225	–			
5. Mean Wednesday Total Step Counts	.071	.040	.420	.700**	–		
6. Mean Thursday Total Step Counts	.112	.154	.419	.729**	.565**	–	
7. Mean Friday Total Step Counts	.047	-.060	.271	.658**	.473*	.859**	–

\*\**. Correlation is significant at the 0.01 level (2-tailed).*

\**. Correlation is significant at the 0.05 level (2-tailed).*

## **Discussion and Educational Implications**

The analyses of these results are somewhat surprising, since results showed only slight differences in the physical activity between the two classroom conditions. Given that the play-based teacher had more student choice, flexible seating, and play in the instructional plan, the presumed outcomes were that there would be increased levels of movement in that class. Additionally, there were greater reading and math achievement gains in the play-based classroom than the contemporary classroom (Cite Study B) that the researcher thought might be reflected in correlation with the increased student movement. Given the small sample sizes, however, the data trending toward increased light activity over sedentary activity in the play-based classroom, while not yet at the level of statistical significance, is promising. While the researcher anticipated more marked differences between student movement in the two classroom conditions, some educational implications can be gleaned. Whereas casual observations, and even more formal observations of the classroom environments and interactions, suggest real differences between the classrooms, these differences did not translate to statistically significant differences in students' movement.

The researcher collected classroom environment data using School-Age Care Environment Rating Scale (SACERS; Harms, Jacobs, & White, 2013) as part of a separate but related study, and the data is available upon request. Yet, even though the treatment classroom teacher placed a greater priority and emphasis on play-based pedagogy, the overall levels of movement detected by the accelerometers were still far too similar. This may suggest equalizing factors were at work, such as the colloquially known "Florida Recess Law" (Florida House Bill 7069 of 2017, CS/HB 7069: Education (2017) requiring K-5 students to have a minimum of 20 minutes of recess per day (Figures 24 through 26). Therefore, in the current study, students in

both classroom conditions had daily opportunities for gross motor play. In fact, both classrooms were outside for daily recess at the same time. Finally, even though the treatment teacher prioritized 30 minutes of “learning centers” and 30 minutes of “free play centers” each day, today’s instructional demands and expectations seemed to create a floor effect ensuring minimal differences in students’ movement overall.



Figure 24: Ball Play on the Playground





Figure 25: Digging (and Time Out) on the Playground



Figure 26: Swings on the Playground

As educational researchers and practitioners, this study urges educators to contemplate how the observable differences in pedagogy and tone did not translate to physical movement measured by accelerometers. This suggests that, even with a philosophical approach more aligned to DAP, students in today's kindergarten classrooms either are not moving much during the school day or may require specific, strategic movement interventions to bolster the academic and personal gains associated with movement. Future research with an explicit focus on how much, how often, and how students move throughout the school day is necessary and exciting. For example, recent studies suggest breaks for physical activity using classroom-based, possibly commercial, interventions, such as Walkabouts (Reznik, Wylie-Rosett, Kim, & Ozuah, 2015), and recess-based interventions, such as Playworks, can have significant effects on student engagement and performance (Fortson et al., 2013).

What is also not factored into this study, but has potentially enormous implications, is the amount of movement students engage in after school in experiences such as Boys and Girls Club or organized sports. Additionally, it would likely be important to understand more about the children's home lives, such as sleep routines and quality and nutrition and physical health, as there may be significant relationships between these data and students' movement and academic achievement.

If nothing else, the results from this study illustrate how much more educators need to study and consider how play and movement are aligned. This study suggests that simply providing regular outdoor free play, while beneficial, and supporting play-based learning in the classroom space may be insufficient to intentionally increase student movement. The play-based teacher, for example, did not have exclusive control over the outdoor recess environment which most certainly contributes to students' movement and physical activity. She did, however,

contribute balls and digging toys to the playground resources toward the midpoint of the school year. Because the contemporary teacher was also outside at the same time, there is not much opportunity to differentiate students' playground experiences and movement for this study. To truly help support students, especially students with specific poverty-related vulnerabilities, teachers may need to add regular, purposeful physical activity interventions (i.e., Ash et al., 2017). These conclusions bolster Pellegrini's (2013) suggestions for future study on play in school. Administrators, curriculum specialists, and educators must exercise caution, however, not to move toward overly-scripted, rigid interventions in efforts to capitalize on the benefits of play and movement.

### ***Limitations and Future Research***

Caution must be exercised in interpretations regarding the generalizability of these results given the small sample size. Due to recruiting challenges with issues such as the lack of Title I kindergarten teachers using play-based approaches, the lack of administrators supporting that pedagogical approach, and the lack of districts willing to approve this study, a purposive convenience sample was determined for this research study. Because of the small sample size of, there were some violations of statistical assumptions, that while corrected using adjusted values, changed the conclusions and possible interpretations of the results. Violations of these assumptions can influence Type I errors (incorrectly rejecting the null hypothesis that there are no differences or relationships) and Type II errors (incorrectly accepting the hypothesis that there are significant differences or relationships), and they can cause over- or under-estimations of inferential measures (Osborne, & Waters, 2002). Part of this challenge was addressed by using adjusted statistics like Greenhouse-Geisser statistics when appropriate and effects size in addition to statistical significance to strengthen the findings.

One significant limitation of this study was that, due to the purposive convenience sample selection, the teacher and the classroom condition are confounded. Even adding one more class in each condition would result in a stronger approach. Future studies that can extract actionable implementation and that positively contribute to the field must include extended time frames for study as well as replications of the current study with large, more diverse sample sizes capable of enough statistical power to address possible teacher or school effects. *A priori* calculations of sample size may also be helpful to design future studies with sufficient power for statistical analysis. In addition to simply having more participants in more classrooms at more schools in nested designs and/or with a more randomized selection and assignment process, accelerometer studies offer the hope of better definitions of the construct of play-based versus contemporary classrooms. Unexpected smaller sample sizes resulted from parents who declined to allow their children to wear accelerometers. This suggests that the information and recruitment of families for the study must be refined for future studies.

An additional limitation was the researcher's choice to use Evenson Children (2008) cut points for children. While they are aligned to be used with children aged five to eighteen, another cut point may have been a better way to analyze the data for this particular population. For example, Butte Preschoolers (2014) cut points may be a better fit for students who are both very young and have very small wrists. Additionally, the choice to use step counts instead of vector magnitudes likely affected the results. Vector magnitude captures movement data from multiple points to create a more accurate and comprehensive picture of children's movement whereas step counts, as with FitBits, can be elevated simply by a student moving their wrists excessively while sitting. Similarly, exploring bouts of activity would likely provide more accurate and comprehensible data. Future research should attempt to design a true randomized

control trial, explore home and school physical and movement behaviors and data, and use different metrics for analysis within the ActiLife software.

Codifying the definitions of what constitutes a play-based kindergarten classroom as opposed to a contemporary kindergarten classroom would also likely support stronger findings by better defining play in classroom and outdoor environments. Mixed methods designs using observation and interview tools, such as the School-Age Care Environment Rating Scale (SACERS; Harms, Jacobs, & White, 2013) and the Classroom Assessment Scoring System (CLASS; Hu, Fan, Gu, & Yang, 2016; Pianta, La Paro, & Hamre, 2008), will better define the environmental factors for each classroom condition. There is growing concern, both in American and internationally, about the decline of play in daily instructional practice, both indoors and outdoors (i.e., Hu, Kong, & Roberts, 2014) out of fear that rigorous accountability benchmarks cannot be met through without scripted, didactic instruction. Additionally, developing a matrix or tool similar to the one created by Rushton et al. (2009), that adds a component to define and measure the construct of physical movement in relationship to play-based, DAP, would contribute significantly to the field. In concert with this matrix, creating and validating a tool to be used in combination with accelerometers which better define play and movement as classroom constructs would potentially be of great value.

Currently, a dearth of research explores the intriguing intersections between play-based pedagogy, movement and activity, and positive student outcomes. Parsing out with more specificity the components of each classroom that contribute to student outcomes would provide us with better data. Given the growing body of evidence linking physical movement with improved focus, attention, retention, cognition, behavior, self-regulation, executive function, and academic achievement, one of the most defensible conclusions is that this particular study was

too flawed and small to be meaningful. Yet, these conclusions supporting further study and highlight the importance of movement as an important factor in DAP kindergarten classroom, especially in Title I schools charged with leveling the field in terms of academic and socio-emotional gains for students who are often denied opportunities for movement.

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## **APPENDIX A: OVERALL RESEARCH TIMELINE FOR THE THREE STUDIES**



*Overall Research Timeline for the Three Studies*

Instrument	Treatment or Control	Pre- or Post-Test	Aug. 2018	Sept. 2018	Oct. 2018	Nov. 2018	Dec. 2018	Jan. 2019	Feb. 2019	Mar. 2019	Apr. 2019	May 2019
FS i-Ready Testing	Both	Pre-Test	█									
PPVT-4 A	Both	Pre-Test			█							
BRIEF2 Parent Survey	Both	Pre-Test			█							
BRIEF2 Teacher Survey	Both	Pre-Test			█							
Actigraph GT9X Link	Both	N/A								█		
PPVT-4 B	Both	Post-Test								█		█
BRIEF2 Parent Survey	Both	Post-Test								█		█
BRIEF2 Teacher Survey	Both	Post-Test								█		█
FS i-Ready Testing	Both	Post-Test								█	█	█

**APPENDIX B: OVERALL PARTICIPANT DEMOGRAPHICS BY CONDITION FOR  
THE THREE STUDIES**

*Overall Participant Demographics by Condition for the Three Studies*

	Play-Based Kindergarten		Contemporary Kindergarten	
<i>n</i>	<i>n</i> = 19 (After Attrition) 100%		<i>n</i> = 12 (After Attrition) 66.6%	
Gender	Female = 11 (58%)	Male = 9 (42%)	Female = 7 (58%)	Male = 5 (42%)
Race/Ethnicity	Asian = 1 (5%) Hispanic = 5 (26%) Caucasian = 10 (53%) African American = 3 (16%)		Asian = 0 (0%) Hispanic = 2 (17%) Caucasian = 9 (75%) African American = 1 (8%)	
ESE	Yes = 0 (0%)	No = 19 (100%)	Yes = 0 (0%)	No = 12 (100%)
Gifted/Talented	Yes = 0 (0%)	No = 19 (100%)	Yes = 0 (0%)	No = 12 (100%)
504 Plan	Yes = 0 (0%)	No = 19 (100%)	Yes = 0 (0%)	No = 12 (100%)
ELL	Yes = 1	No = 18	Yes = 1	No = 11
FRPL	Yes = 13	No = 6	Yes = 8	No = 4
Age at Pre-Test	<i>M</i> = 67.75 months (5.65 years)		<i>M</i> = 68.31 months (5.69 years)	

**APPENDIX C: UCF IRB APPROVAL LETTER**



University of Central Florida Institutional Review  
Board Office of Research & Commercialization  
12201 Research Parkway, Suite 501  
Orlando, Florida 32826-3246  
Telephone: 407-823-2901 or 407-882-2276  
[www.research.ucf.edu/compliance/irb.html](http://www.research.ucf.edu/compliance/irb.html)

## Approval of Human Research

From: UCF Institutional Review Board #1 FWA00000351, IRB00001138

To: Karyn Anne Allee-Herndon

Date: September 18, 2018

Dear Researcher:

On 09/18/2018 the IRB approved the following modifications until 08/16/2019 inclusive:

Type of Review: IRB Addendum and Modification Request Form Expedited Review

Modification Type: Change in study location; minor change in learning achievement instrument

Project Title: Dissertation: School Readiness and Academic Achievement in Kindergarten: Executive Function, Cognitive Development, and Academic Performance in Play-Based and Business as Usual Classrooms

Investigator: Karyn Anne Allee-Herndon IRB

Number: SBE-18-14264

Funding Agency:

Grant Title: Research ID: N/A

The scientific merit of the research was considered during the IRB review. The Continuing Review Application must be submitted 30 days prior to the expiration date for studies that were previously expedited, and 60 days prior to the expiration date for research that was previously reviewed at a convened meeting. Do not make changes to the study (i.e., protocol, methodology, consent form, personnel, site, etc.) before obtaining IRB approval. A Modification Form **cannot** be used to extend the approval period of a study. All forms may be completed and submitted online at <https://iris.research.ucf.edu>.

If continuing review approval is not granted before the expiration date of 08/16/2019, approval of this research expires on that date. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

Use of the approved, stamped consent document(s) is required. The new form supersedes all previous versions, which are now invalid for further use. Only approved investigators (or other

approved key study personnel) may solicit consent for research participation. Participants or their representatives must receive a copy of the consent form(s).

All data, including signed consent forms if applicable, must be retained and secured per protocol for a minimum of five years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained and secured per protocol. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

In the conduct of this research, you are responsible to follow the requirements of the [Investigator Manual](#).

This letter is signed by:

A handwritten signature in black ink, appearing to read 'Racine Jacques', is centered below the text 'This letter is signed by:'. The signature is written in a cursive style with a large initial 'R'.

Signature applied by Racine Jacques on 09/18/2018 08:44:23 AM EDT Designated Reviewer

## **APPENDIX D: INFORMED EDUCATOR CONSENT**



**Title of research study:** School Readiness and Academic Achievement in Kindergarten: Executive Function, Cognitive Development, and Academic Performance in Play-Based and Business as Usual Classrooms

**Informed Consent from a Teacher/Principal in a Non-Exempt Research Study**

**Principal Investigator(s):** *Karyn A. Allee-Herndon, PhD Candidate*

**Faculty Supervisor:** *Sherron Killingsworth Roberts, EdD*

**Investigational Site(s):** Flagler Schools Title I Kindergarten Classrooms at Wadsworth Elementary School



### **Why am I being invited to take part in a research study?**

You are being invited to take part in a research study because you teach kindergarten at Wadsworth Elementary, a Title I elementary school in Flagler Schools that has agreed to participate in this study.

### **What should I know about a research study?**

Someone will explain this research study to you.

Whether or not you take part is up to you.

You can agree to take part and later change your mind.

Your decision will not be held against you.

You can ask all the questions you want before you decide.

### **Who can I talk to?**

If you have questions, concerns, or complaints, talk to the primary research investigator, Karyn Allee-Herndon, at [Karyn.Allee-Herndon@ucf.edu](mailto:Karyn.Allee-Herndon@ucf.edu) or 407-739-4613. You may also contact Dr. Sherron Roberts, advisor to this research, at [Sherron.Roberts@ucf.edu](mailto:Sherron.Roberts@ucf.edu).

This research has been reviewed and approved by an Institutional Review Board (“IRB”). You may talk to them at 407-823-2901 or [irb@ucf.edu](mailto:irb@ucf.edu) if:

Your questions, concerns, or complaints are not being answered by the research team.

You cannot reach the research team.

You want to talk to someone besides the research team.

You have questions about your child’s rights as a research subject.

You want to get information or provide input about this research.

### **Why is this research being done?**

Kindergarten can be an exciting time of learning and growth for many children, and we want their first experiences in formal schooling to be engaging and meaningful. This research is being done to explore how children learn best in kindergarten, including how using play as a learning strategy might help children do better in school. This study will explore the role of play on children’s language use, their executive function, and their learning and academic achievement.

### **How long will the research last?**

We expect that you will be in this research study periodically during the 2018-2019 school year. The total time involvement for you during this study would vary throughout the year.

At the beginning of the year, you will probably invest about 5 hours of time. You will distribute and collect the parent surveys, complete the teacher surveys, and facilitate the release of children for PPVT-4 testing (i.e., providing the researcher with times or dates to avoid pulling children for PPVT-4 assessment), distributing and collecting the activity trackers if necessary with the help of the researcher, and 30 minutes of classroom observation.

The total time involvement for you during the middle of the year would be between 1-2 hours for distributing and collecting the activity trackers if necessary with the help of the researcher and 30 minutes of classroom observation

At the end of the year, you will probably invest another 5 hours of time to repeat the beginning of the year assessments.

All told, your total time investment for this study would be less than 15 hours for the entire school year.

### **How many people will be studied?**

The total number of teachers involved in this study is estimated to be two teachers, and the total number of student participants is estimated to be 40.

Analysis for this study will occur at the children level. All kindergarten children from the two selected classrooms participating in the study will be invited to join the project. We expect about 40 children will be in this research study.

## **What happens if I say yes, I want to be in this research?**

- If you give your permission to be in this research, you can expect the following:
- The parents of children in your classroom will be approached to explain the study and provide consent for their children to participate in the study. If you decide not to participate in this study, the students in your class will be unable to participate in this study.
- The researcher will coordinate with you to determine the best times of the day or days of the week or dates to avoid during the study.
- Unless otherwise specified, the PPVT-4 testing, classroom observations, and activity tracker distribution and collection would occur at any time throughout the school day. You may be asked to help remind parents and students to return the activity tracker if it has not been returned to school at the designated time, but the researcher will be responsible for the actual distribution and collection of trackers. Neither the parents or schools will be held responsible or bear any financial liability if the activity trackers are lost or damaged, but we do urge parents and teachers encourage and help children take care of the fitness trackers while they are wearing them.
- Distributing and collecting parent BRIEF2 surveys would occur during the school day when you typically collect or distribute documents for parents and families. These windows are currently estimated to be during the month of September 2018 for beginning of the year and April/May 2019 for the end of the year, but the timing is pending IRB and SCPS approval to proceed and may shift.
- Completing the teacher BRIEF2 surveys would be done during a specified window of time at whatever time of day is convenient for you. These windows are currently estimated to be during the month of September 2018 for beginning of the year and April/May 2019 for the end of the year, but the timing is pending IRB and SCPS approval to proceed and may shift.
- You will be asked to complete a short 10-minute survey on each of your children twice during the 2018-2019 school year: once at the beginning of the school year and once again at the end of the school year. To measure your children's growth in the executive function areas measured by the BRIEF2, you will receive the same version of the BRIEF2 survey at the beginning and the end of the year. This survey is called the Behavior Rating Inventory of Executive Function, 2<sup>nd</sup> Edition (BRIEF2), and it measures children's executive function skills.
- You will also be asked to help facilitate the parent survey portion of the research. You will send the parent surveys home from school in your children's planners in a sealed envelope with their name on the outside. Inside the envelope, parents will find the survey and a return envelope with their child's name and your name. You will collect all the parent surveys for the researcher to pick up. It would be very helpful to remind parents to return the surveys if you notice you are missing any, but you are not obligated to do so.
- Your students will be given the Peabody Picture Vocabulary Test, Fourth Edition (PPVT-4) at the beginning and the end of the school year. This picture identification test measures children's vocabulary. It requires no preparation on your part or your student's, will have no adverse effect on their learning experiences. Your students will be escorted by the researcher from the classroom to a quiet testing area at the school in small groups of two children. The researcher will administer the test individually to each child. One child will be working on the PPVT-4 with the researcher while the other reads books quietly. When both children have completed their assessment, the researcher will escort them back to your classroom. This process will be repeated until all participating kindergarten children in your class have completed the assessment.
- The researcher will occasionally visit your child's classroom for about 30 minutes per visit to observe the physical environment and the learning in the classroom. The researcher will visit each classroom three times during the school year.

Each year, Flagler County Public Schools (FS) administers i-Ready web-based adaptive diagnostic tests in reading and math to all kindergarten students at the beginning, middle, and end of the school year. Because these assessments are administered throughout the academic year, they are a good measure of kindergarten achievement. The researcher would like to use the i-Ready scores along with the PPVT-4 and BRIEF2 scores and other data collected during this study to explore the effects of different types of kindergarten instruction on children's achievement. The Reading and Math scores for each student will be used for this study. Because FS already administers this assessment to all kindergarten students, no additional time or effort is required on your part or your students.

Otherwise, your (and your students') kindergarten experience will be exactly the same as the kindergarten experiences of children at your child's school who do not participate in this study. All kindergarten children at this school will complete the same academic assessments and use the same curriculum standards regardless of their participation in this study.

### **What are my responsibilities if I take part in this research?**

If you take part in this research, you will be responsible for the following:

Completing the 10-minute BRIEF2 survey about each of your students' executive function twice: once at the beginning of the school year and once at the end of the school year.

Facilitating the distribution and collection of parents BRIEF2 surveys once at the beginning of the school year and once at the end of the school year.

Communicating any scheduling concerns or preferences to the researcher for PPVT-4 assessments at the beginning and end of the school year, classroom observations, and activity tracker distribution and collection.

### **What happens if I do not want to be in this research?**

Participation in research is completely voluntary. You can decide to participate or not to participate. If you do not want to be in this research, your students will still participate in all the learning experiences as a child who does participate. The only difference will be they will not complete the PPVT-4 with the researcher and you will not complete the BRIEF2 survey, be observed, or help with the activity trackers.

### **What happens if I say yes, but I change my mind later?**

You can leave the research at any time. It will not be held against you. If you decide to leave the research, contact the investigator so that the investigator can remove your data from any files related to the study and from any future evaluation. Any data already collected on you or the teacher version of the BRIEF2 up until the point of withdrawal will be deleted.

### **Is there any way being in this study could be bad for me?**

There is little to no risk to you or your students involved in this study.

### **Will being in this study help me in any way?**

We cannot promise any benefits to you or others from taking part in this research. However, possible benefits include getting aggregated findings on your students' receptive vocabulary and executive function skills at the beginning and end of the school year. Possible benefits to other researchers and teacher educators include finding out more about teaching strategies and approaches that help develop critical brain skills to improve academic achievement in children. Findings from this research study will be disseminated within the academic community to help inform educational best practices.

### **What happens to the information collected for the research?**

Efforts will be made to limit the use and disclosure of your students' personal information, including research study records, to people who have a need to review this information. We cannot promise complete secrecy. Any data that is received with identifying information will be kept in a password protected file on a password protected computer in a locked office at the University of Central Florida. Once all data files are merged into a

single file, identifying information will be removed. Organizations that may inspect and copy your child's information include the IRB and other representatives of this organization.

**What else do I need to know?**

If you are interested in receiving aggregated BRIEF2 and PPVT-4 results for your class, please contact the Principal Investigator, Karyn Allee-Herndon, at [Karyn.Alee-Herndon@ucf.edu](mailto:Karyn.Alee-Herndon@ucf.edu) or 407-739-4613. You may also contact the research advisor, Dr. Sherron Roberts, at [Sherron.Roberts@ucf.edu](mailto:Sherron.Roberts@ucf.edu).

**APPENDIX E: INFORMED PARENTAL CONSENT – ENGLISH**



**Title of research study:** School Readiness and Academic Achievement in Kindergarten: Executive Function, Cognitive Development, and Academic Performance in Play-Based and Business as Usual Classrooms

**Informed Consent from a Parent for a Child in a Non-Exempt Research Study**

**Principal Investigator(s):** *Karyn A. Allee-Herndon, PhD Candidate*

**Faculty Supervisor:** *Sherron Killingsworth Roberts, EdD*

**Investigational Site(s):** *Flagler Schools Title I Kindergarten Classrooms at Wadsworth Elementary School*

**How to Return this Consent Form:** *You are provided with two copies of this consent form. If you give consent for your child to participate in the research, please sign one copy and return it to the researcher and keep the other copy for your records. If you are attending an information session, you can return your signed consent form to the researcher directly. Otherwise, you can send the signed consent form into school in your child's planner for the teacher to collect and give to the researcher or you can bring your signed consent form the front office of your child's school for the staff to collect and give to the researcher.*

### **Why is my child being invited to take part in a research study?**

Your child is being invited to take part in a research study because he or she is a kindergarten student at Wadsworth Elementary, a Title I elementary school in Flagler Schools that has agreed to participate in this study.

### **What should I know about a research study?**

Someone will explain this research study to you.

Whether or not your child takes part is up to you.

You can choose not to allow your child to take part.

You can agree to let your child take part and later change your mind.

Your decision will not be held against you or your child.

You can ask all the questions you want before you decide.

### **Who can I talk to?**

If you have questions, concerns, or complaints, or think the research has hurt your child, talk to the primary research investigator, Karyn Allee-Herndon, at [Karyn.Alee-Herndon@ucf.edu](mailto:Karyn.Alee-Herndon@ucf.edu) or 407-739-4613. You may also contact Dr. Sherron Roberts, advisor to this research, at [Sherron.Roberts@ucf.edu](mailto:Sherron.Roberts@ucf.edu).

This research has been reviewed and approved by an Institutional Review Board ("IRB"). You may talk to them at 407-823-2901 or [irb@ucf.edu](mailto:irb@ucf.edu) if:

Your questions, concerns, or complaints are not being answered by the research team.

You cannot reach the research team.

You want to talk to someone besides the research team.

You have questions about your child's rights as a research subject.

You want to get information or provide input about this research.

### **Why is this research being done?**

Kindergarten can be an exciting time of learning and growth for many children, and we want their first experiences in formal schooling to be engaging and meaningful. This research is being done to explore how children learn best in kindergarten, including how using play as a learning strategy might help children do better in school. This study will explore the role of play on children's language use, their executive function, and their learning and academic achievement.

### **How long will the research last?**

We expect that your child will be in this research study periodically during their time in kindergarten during the 2018-2019 school year. Participation would include children taking a brief (10-15 minutes) vocabulary assessment at the beginning and end of the school year, a parent survey (10 minutes) about their learning twice during the school year (once at the beginning and once again at the end of kindergarten), and classroom observations of the teacher and learning environment three times per year for about 30 minutes each. Your child may also be randomly selected to wear a movement tracking device similar to a FitBit for a period of 7 days. If selected, your child might wear this device during the beginning of the school year, at the middle of the school year, or toward the end of the school year. The total time involvement for you and your child during this study would range from about 45 minutes to one week, depending on if your child was selected to wear the movement tracker.

### **How many people will be studied?**

All kindergarten children from the two selected classrooms participating in the study will be invited to join the project. We expect about 40 children will be in this research study.

### **What happens if I say yes, I want my child to be in this research?**

If you give your child permission to be in this research, you can expect the following:

- You will be asked to complete a short 10-minute survey on your child twice during the year your child is in kindergarten: once at the beginning of the school year and once again at the end of the school year. To measure your child's growth in the executive function areas measured by the BRIEF2, you will receive the same version of the BRIEF2 survey at the beginning and the end of the year. This survey is called the Behavior Rating Inventory of Executive Function, 2<sup>nd</sup> Edition (BRIEF2), and it measures your child's executive function skills. You may request a copy of your child's report if you would like. The survey will come home from school in your child's planner in a sealed envelope with your child's name on the outside. Inside the envelope, you will find the survey and a return envelope with your child's name and your child's teacher's name. You can either return the completed survey in the return envelope in your child's planner or bring it to the school's front office.
- Your child will be given the Peabody Picture Vocabulary Test, Fourth Edition (PPVT-4) at the beginning and the end of the school year. This picture identification test measures your child's vocabulary. Unless otherwise specified by the teacher, would occur at any time throughout the school day. It requires no preparation on your part or your child's, will have no adverse effect on your child's learning experiences, and you may request a copy of your child's report if you would like. Your child will be escorted by the researcher from his or her classroom to a quiet testing area at the school in small groups of two children. The researcher will administer the test individually to each child. One child will be working on the PPVT-4 with the researcher while the other reads books quietly. When both children have completed their assessment, the researcher will escort them back to their classroom. This process will be repeated until all participating kindergarten children have completed the assessment.
- The researcher will occasionally visit your child's classroom for about 30 minutes per visit to observe your child's teacher and the learning in the classroom. The researcher will visit each classroom three times during the school year.
- Your child may be selected to wear an activity tracker called the ActiGraph GT9X to measure their movement for a small portion of the research study at the beginning, middle, or end of the school year. This device is similar to a fitness tracking device and is helpful for measuring how often children move in the classroom as opposed to sitting still. The Actigraph is similar to a FitBit in that it is an activity tracker. The only difference is that the FitBit is commercially available and users can view their activity data, while these accelerometers are for research purposes and only the investigators can view participant's activity.
- The total time for investigators to explain and administer the activity trackers will take no more than 10 – 15 minutes. Child assent will be established prior to administration of the activity trackers. If you did not return your consent form during the first visit, you may return your form before any of the study procedures take place. We will then fit your child with the activity tracker, called the ActiGraph GT9X (similar to a FitBit), *th*at he/she will wear on his/her non-dominant wrist (i.e. if your child is right-handed, he/she will wear the device on the left wrist).
- If selected, your child will be asked to wear the activity tracker for the next 7 days and nights, only removing it for water-based activities (e.g. showering, swimming)
- You and your child will be provided with instructions for wearing the activity trackers (e.g. do not remove unless showering, bathing, or swimming).
- The investigator will return to the school or organization site after the 7-day period to collect the activity trackers. During collection, we will ask your child three short questions regarding his/her experience with wearing the device: 1) Were you able to wear your activity tracker the whole time?; 2) If you took it off, when did you take it off or why? 3) Was it comfortable to wear? Do you have any ideas to make wearing the activity tracker more fun or comfortable? The researcher will repeat or



rephrase questions as necessary to help your child. The total time for this portion of the visit will take no more than 15 minutes.

- Parents will be contacted with a reminder to return the activity tracker if it has not been returned to school at the designated time. Neither the parents or schools will be held responsible or bear any financial liability if the activity trackers are lost or damaged, but we do urge parents and teachers encourage and help children take care of the fitness trackers while they are wearing them.
- Each year, Flagler Schools (FS) administers i-Ready web-based adaptive diagnostic tests in reading and math to all kindergarten students at the beginning, middle, and end of the school year. Because these assessments are administered throughout the academic year, they are a good measure of kindergarten achievement. The researcher would like to use the i-Ready scores along with the PPVT-4 and BRIEF2 scores and other data collected during this study to explore the effects of different types of kindergarten instruction on children's achievement. The Reading and Math scores for each student will be used for this study. Because FS already administers this assessment to all kindergarten students, no additional time or effort is required on your part or your student's.
- Flagler Schools (FS) gathers and maintains the following demographic data on all enrolled students in the district: student age, gender, ethnicity, free or reduced-price lunch status, exceptional student education status, and English language learner status. The researcher will use this data in the analysis for the study.

Otherwise, your child's kindergarten experience will be exactly the same as the kindergarten experiences of children at your child's school who do not participate in this study. All kindergarten children at this school will complete the same academic assessments and use the same curriculum standards regardless of their participation in this study.

### **What are my responsibilities if I take part in this research?**

If your child takes part in this research, you will be responsible to complete the 10-minute BRIEF2 survey about your child's executive function twice: once at the beginning of the school year and once at the end of the school year.

Your child will also be given the PPVT-4 at the beginning and end of the school year. This test only takes 10-15 minutes to administer, and it is used to measure your child's vocabulary. No preparation is needed on your part or your child's. This child-friendly picture identification assessment is used only to explore the vocabulary your child knows. There will be no adverse effects on your child's kindergarten experiences as a result of participating in the Peabody.

### **What happens if I do not want my child to be in this research?**

Participation in research is completely voluntary. You can decide to allow your child to participate or not to participate. If you do not want your child to be in this research, they will still participate in all the learning experiences as a child who does participate. You may also indicate if you do not want your child to wear the activity tracker. If you consent to your child wearing the tracker, they may or may not be randomly selected for this portion of the study. The only difference for participating and non-participating students will be they will not complete the PPVT-4 with the researcher, you will not complete the BRIEF2 survey on your child at the beginning and end of kindergarten, and students may or may not be included to wear the activity tracker.

### **What happens if I say yes, but I change my mind later?**

You can have your child leave the research at any time. It will not be held against you or your child. If you decide to have your child leave the research, contact the investigator so that the investigator can remove your child from any files related to the study and from any future evaluation. Any data already collected on your child up until the point of withdrawal will be deleted.

### **Is there any way being in this study could be bad for my child?**

There is little to no risk to you or your child involved in this study. There is a slight chance that your child, if selected, may feel uncomfortable wearing the activity tracker, however, study investigators will make every attempt to make the watch band as comfortable as possible.

**Will being in this study help my child in any way?**

We cannot promise any benefits to your child or others from taking part in this research. However, possible benefits include getting a detailed report on your child’s receptive vocabulary and executive function skills at the beginning and end of the school year. Possible benefits to other researchers and teacher educators include finding out more about teaching strategies and approaches that help develop critical brain skills to improve academic achievement in children. Findings from this research study will be disseminated within the academic community to help inform educational best practices.

**What happens to the information collected for the research?**

Efforts will be made to limit the use and disclosure of your child’s personal information, including research study records, to people who have a need to review this information. We cannot promise complete secrecy. Any data that is received with identifying information will be kept in a password protected file on a password protected computer in a locked office at the University of Central Florida. Once all data files are merged into a single file, identifying information will be removed. Organizations that may inspect and copy your child’s information include the IRB and other representatives of this organization.

**What else do I need to know?**

If you are interested in receiving a copy of your child’s BRIEF2 and PPVT-4 results, please either let your child’s teacher know or contact the Principal Investigator, Karyn Allee-Herndon, at [Karyn.Alee-Herndon@ucf.edu](mailto:Karyn.Alee-Herndon@ucf.edu) or 407-739-4613. You may also contact the research advisor, Dr. Sherron Roberts, at [Sherron.Roberts@ucf.edu](mailto:Sherron.Roberts@ucf.edu).

### Signature Block for Children

Your signature documents your permission for the named child to take part in this research.

\_\_\_\_\_  
Printed name of child

\_\_\_\_\_  
Signature of parent

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed name of parent

Parent  
Individual legally authorized to  
consent to the child's  
participation in the study

Parent email: \_\_\_\_\_

Parent phone number: \_\_\_\_\_

**Note:** Investigators are to ensure that individuals who are not parents can demonstrate their legal authority to consent to the child's participation. Contact legal counsel if any questions arise.

**APPENDIX F: INFORMED PARENTAL CONSENT – SPANISH**



**Título del estudio de investigación:** Preparación escolar y rendimiento académico en Kindergarten: Función ejecutiva, desarrollo cognitivo y rendimiento académico en clases basadas en juegos y negocios como clases habituales

**Consentimiento informado de un padre para un niño en un estudio de investigación no exento**

**Investigador (es) principal (es):** Karyn A. Allee-Herndon, PhD  
Candidato

**Supervisor de la facultad:** Sherron Killingsworth Roberts, EdD

**Sitio (s) de investigación:** Escuelas de Kindergarten del Título I de las Escuelas Flagler en la Escuela Primaria Wadsworth

**Cómo devolver este formulario de consentimiento:** Se le proporcionan dos copias de este formulario de consentimiento. Si da su consentimiento para que su hijo participe en la investigación, firme una copia y devuélvala al investigador y conserve la otra copia para su registro. Si asiste a una sesión de información, puede devolverle su formulario de consentimiento firmado directamente al investigador. De lo contrario, puede enviar el formulario de consentimiento firmado a la escuela en el planificador de su hijo para que el maestro lo recoja y entregue al investigador o puede traer su consentimiento firmado a la oficina principal de la escuela de su hijo para que el personal lo recoja y lo entregue al investigador .

### **¿Por qué mi hijo está siendo invitado a participar en un estudio de investigación?**

Se está invitando a su hijo a participar en un estudio de investigación porque es un alumno de kínder en Wadsworth Elementary, una escuela primaria de Título I en las escuelas de Flagler que ha aceptado participar en este estudio.

### **¿Qué debo saber acerca de un estudio de investigación?**

Alguien te explicará este estudio de investigación.

Que tu hijo participe o no depende de ti.

Usted puede optar por no permitir que su hijo participe.

Puede acceder a que su hijo tome parte y más tarde cambia de opinión.

Su decisión no se tomará en contra de usted o su hijo .

Puede hacer todas las preguntas que desee antes de decidir.

### **¿Con quién puedo hablar?**

Si tiene preguntas, preocupaciones o quejas, o piensa que la investigación ha hecho daño a usted o a su hijo, hable con el investigador de investigación primaria, Karyn Allee-Herndon, por lo [Karyn.Alee-Herndon@ucf.edu](mailto:Karyn.Alee-Herndon@ucf.edu) o 407-739-4613. También puede contactar al Dr. Sherron Roberts, asesor de esta investigación, en [Sherron.Roberts@ucf.edu](mailto:Sherron.Roberts@ucf.edu) .

Esta investigación ha sido revisada y aprobada por una Junta de Revisión Institucional ("IRB"). Puede hablar con ellos al 407-823-2901 o [irb@ucf.edu](mailto:irb@ucf.edu) si :  
Que r preguntas, inquietudes o quejas no están siendo respondidas por el equipo de investigación.

No puedes contactar al equipo de investigación.

Quieres hablar con alguien además del equipo de investigación.

Usted tiene preguntas sobre los derechos de su hijo como sujeto de investigación .

Desea obtener información o proporcionar información sobre esta investigación.

### **¿Por qué se está haciendo esta investigación?**

El jardín de infantes puede ser un momento emocionante de aprendizaje y crecimiento para muchos niños, y queremos que sus primeras experiencias en la educación formal sean atractivas y significativas. Esta investigación se está haciendo para explorar cómo los niños aprenden mejor en el jardín de infantes, incluyendo cómo usar el juego como una estrategia de aprendizaje podría ayudar a los niños a mejorar en la escuela. Este estudio explorará el papel del juego en el uso del lenguaje de los niños, su función ejecutiva y su aprendizaje y rendimiento académico.

## **¿Cuánto tiempo durará la investigación?**

Esperamos que su hijo participe periódicamente en este estudio de investigación durante su tiempo en el jardín de infantes durante el año escolar 2018-2019. La participación incluiría niños tomando una breve evaluación de vocabulario (10-15 minutos) al comienzo y al final del año escolar, una encuesta para padres (10 minutos) sobre su aprendizaje dos veces durante el año escolar (una vez al principio y otra vez en el fin de kindergarten), y las observaciones en el aula del maestro y el entorno de aprendizaje tres veces al año durante aproximadamente 30 minutos cada una. Su hijo también puede ser seleccionado al azar para usar un dispositivo de seguimiento de movimiento similar a un FitBit por un período de 7 días. Si se selecciona, su hijo puede usar este dispositivo durante el comienzo del año escolar, a mediados del año escolar o hacia el final del año escolar. La participación de tiempo total para usted y su hijo durante este estudio sería de entre aproximadamente 45 minutos a una semana, dependiendo de si se ha seleccionado a su hijo a llevar el seguimiento del movimiento.

## **¿Cuántas personas serán estudiadas?**

Se invitará a todos los niños de kindergarten de las dos aulas seleccionadas que participan en el estudio a unirse al proyecto. Esperamos que aproximadamente 40 niños participen en este estudio de investigación.

## **¿Qué sucede si digo que sí, quiero que mi hijo participe en esta investigación ?**

Si le da permiso a su hijo para participar en esta investigación, puede esperar lo siguiente:

- Se le pedirá que complete una breve encuesta de 10 minutos sobre su hijo dos veces durante el año en que su hijo esté en el jardín de infantes: una vez al comienzo del año escolar y una vez más al final del año escolar. Para medir el crecimiento de su hijo en las áreas de funciones ejecutivas medido por el BRIEF2, recibirá la misma versión de la encuesta BRIEF2 al principio y al final del año. Esta encuesta se denomina Evaluación de Comportamiento de la Función Ejecutiva, 2<sup>nd</sup> Edición (BRIEF2), y mide las habilidades de la función ejecutiva de su hijo. Usted puede solicitar una copia del informe de su hijo si le gustaría. La encuesta llegará a casa desde la escuela en el planificador de su hijo en un sobre sellado con el nombre de su hijo en el exterior. Dentro del sobre, encontrará la encuesta y un sobre de devolución con el nombre de su hijo y el nombre del maestro de su hijo. Puede devolver la encuesta completa en el sobre de devolución del planificador de su hijo o traerla a la oficina principal de la escuela.
- A su hijo se le dará la Prueba de Vocabulario de Imágenes de Peabody, Cuarta Edición (PPVT-4) al principio y al final del año escolar. Esta identificación de imagenprueba el vocabulario de su hijo. No requiere preparación de su parte o la de su hijo, no tendrá un efecto adverso en las experiencias de aprendizaje de su hijo, y puede solicitar una copia del informe de su hijo si lo desea. A menos que el maestro especifique lo contrario, ocurriría en cualquier momento durante el día escolar. Su hijo será escoltado por el investigador de su salón de clases a un área tranquila de exámenes en la escuela en pequeños grupos de dos niños. El investigador administrará la prueba individualmente a cada niño. Un niño trabajará en el PPVT-4 con el investigador mientras que el otro lee libros en voz baja. Cuando ambos niños hayan completado su evaluación, el investigador los acompañará nuevamente a su salón de clases. Este proceso

se repetirá hasta que todos los niños de kindergarten participantes hayan completado la evaluación.

- El investigador de vez en cuando visitará la clase de su hijo durante unos 30 minutos por visita para observar al maestro de su niño y el aprendizaje en el aula. El investigador visitará cada aula tres veces durante el año escolar.
- Se puede seleccionar a su hijo para que use un rastreador de actividad llamado ActiGraph GT9X para medir su movimiento en una pequeña parte del estudio de investigación al principio, en el medio o al final del año escolar. Este dispositivo es similar a un dispositivo de rastreo de actividad física y es útil para medir la frecuencia con que los niños se mueven en el aula en lugar de quedarse quietos. El Actigraph es similar a un FitBit en que es un rastreador de actividad. La única diferencia es que FitBit está disponible comercialmente y los usuarios pueden ver sus datos de actividad, mientras que estos acelerómetros son para fines de investigación y solo los investigadores pueden ver la actividad del participante.
- El tiempo total para que los investigadores expliquen y administren los rastreadores de actividad no tomará más de 10 a 15 minutos. Se establecerá el asentimiento infantil antes de la administración de los rastreadores de actividad. Si no devolvió su formulario de consentimiento durante la primera visita, puede devolver su formulario antes de que se lleve a cabo cualquiera de los procedimientos del estudio. Luego ajustaremos a su hijo con el rastreador de actividad, llamado ActiGraph GT9X (similar a un FitBit), que usará en su muñeca no dominante (es decir, si su hijo es diestro, él / ella usará el dispositivo en la muñeca izquierda).
- Si se selecciona, se le pedirá a su hijo que use el rastreador de actividad durante los próximos 7 días y noches, solo quitándolo para actividades acuáticas (por ejemplo, ducharse, nadar)
- A usted y a su hijo se les proporcionarán instrucciones para usar los rastreadores de actividad (p. Ej., No los retire a menos que se duermen, se bañen o naden).
- El investigador volverá al sitio de la escuela o la organización después del período de 7 días para recopilar los rastreadores de actividades. Durante la recolección, le haremos tres preguntas breves sobre su experiencia con el uso del dispositivo: 1) ¿Pudiste usar tu rastreador de actividad todo el tiempo? 2) Si se lo quitó, ¿cuándo se lo quitó o por qué? 3) ¿Era cómodo de llevar? ¿Tiene alguna idea para hacer que el rastreador de actividad sea más divertido o cómodo? El investigador repetirá o reformulará las preguntas según sea necesario para ayudar a su hijo. El tiempo total para esta parte de la visita no tomará más de 15 minutos.
- Los padres serán contactados con un recordatorio para devolver el rastreador de actividad si no se ha devuelto a la escuela a la hora designada. Ni los padres ni las escuelas serán responsables ni tendrán ninguna responsabilidad financiera si los rastreadores de actividad se pierden o se dañan, pero instamos a los padres y maestros a alentar y ayudar a los niños a cuidar a los rastreadores mientras los usan.
- Cada año, las Escuelas Flagler (FS) administran las pruebas de diagnóstico adaptativo basadas en la web de i-Ready en lectura y matemática para todos los estudiantes de kindergarten al comienzo, en el medio y al final del año escolar. Debido a que estas evaluaciones se administran a lo largo del año académico, son una buena medida del rendimiento en kindergarten. El investigador desea utilizar los puntajes de i-Ready junto con los puntajes PPVT-4 y BRIEF2 y otros datos recopilados durante este estudio para explorar los efectos de diferentes tipos de instrucción de jardín de infantes sobre el rendimiento de los niños. Los puntajes de Lectura y Matemáticas para cada estudiante se usarán para



este estudio. Debido a que FS ya administra esta evaluación a todos los estudiantes de kínder, no se requiere tiempo o esfuerzo adicional de su parte o la de su hijo. Seminole County Public Schools (SCPS) reúne y mantiene los siguientes datos demográficos de todos los estudiantes matriculados en el distrito: edad del estudiante, sexo, origen étnico, almuerzo gratis o a precio reducido, estado excepcional de educación del estudiante y estado del aprendizaje del idioma inglés. El investigador utilizará estos datos en el análisis para el estudio.

Flagler Schools (FS) reúne y mantiene los siguientes datos demográficos de todos los estudiantes matriculados en el distrito: edad del estudiante, sexo, origen étnico, almuerzo gratis o a precio reducido, estado excepcional de educación del estudiante y estado del aprendizaje del idioma inglés. El investigador utilizará estos datos en el análisis para el estudio.

De lo contrario, la experiencia de kínder de su hijo será exactamente la misma que la de las experiencias de kínder de los niños de la escuela de su hijo que no participan en este estudio. Todos los niños de kínder en esta escuela completarán las mismas evaluaciones académicas y usarán los mismos estándares de currículos sin importar su participación en este estudio .

### **¿Cuáles son mis responsabilidades si participo en esta investigación?**

Si usted o su hijo tomar parte en esta investigación, se será responsable de completar la encuesta BRIEF2 de 10 minutos sobre la función ejecutiva de su hijo dos veces: una vez al comienzo del año escolar y la siguiente al final del año escolar.

A su hijo también se le dará el PPVT-4 al comienzo y al final del año escolar. Esta prueba solo toma de 10 a 15 minutos administrarla, y se usa para medir el vocabulario de su hijo. No se necesita preparación de su parte o la de su hijo. Esta evaluación de identificación con niños es utilizada solo para explorar el vocabulario que su hijo conoce. No habrá efectos adversos en las experiencias de kínder de su hijo como resultado de su participación en Peabody.

### **¿Qué sucede si no quiero que mi hijo participe en esta investigación?**

La participación en la investigación es completamente voluntaria. Puede decidir permitir que su hijo participe o no. Si no desea que su hijo participe en esta investigación, aún participará en todas las experiencias de aprendizaje como un niño que sí participa. También puede indicar si no desea que su hijo use el rastreador de actividad. Si acepta que su hijo use el rastreador, pueden o no ser seleccionados al azar para esta parte del estudio. La única diferencia para los estudiantes participantes y no participantes será que no completarán el PPVT-4 con el investigador, no completarán la encuesta BREVE2 de su hijo al principio y al final del kínder, y los estudiantes pueden o no estar incluidos usar el rastreador de actividad.

### **¿Qué sucede si digo que sí, pero cambio de opinión más adelante?**

Puedes tener a tu hijo poder abandonar la investigación en cualquier momento. No será retenido en contra de usted o su hijo. Si decide que su hijo abandone la investigación, comuníquese con el investigador para que el investigador pueda sacar a su hijo de los archivos relacionados con el estudio y de cualquier evaluación futura. Se eliminarán todos los datos ya recopilados sobre su hijo hasta el momento del retiro.

### **¿Hay alguna manera de estar en este estudio podría ser malo para mi hijo?**

Hay poco o ningún riesgo para usted o su hijo involucrados en este estudio. Existe una pequeña posibilidad de que su hijo, si es seleccionado, se sienta incómodo usando el rastreador de actividad, sin embargo, los investigadores del estudio harán todo lo posible para que la correa del reloj sea lo más cómoda posible.

### **¿Estará en este estudio ayudando a mi hijo de alguna manera?**

No podemos prometerle ningún beneficio a su hijo u otras personas por participar en esta investigación. Sin embargo, los posibles beneficios incluyen obtener un informe detallado sobre el vocabulario receptivo de su hijo y las habilidades de la función ejecutiva al comienzo y al final del año escolar. Los posibles beneficios para otros investigadores y educadores de docentes incluyen obtener más información sobre las estrategias de enseñanza y los enfoques que ayudan a desarrollar habilidades críticas del cerebro para mejorar los logros académicos en los niños. Los hallazgos de este estudio de investigación se difundirán dentro de la comunidad académica para ayudar a informar las mejores prácticas educativas.

### **¿Qué sucede con la información recopilada para la investigación?**

Se realizarán esfuerzos para limitar el uso y la divulgación de la información personal de su hijo , incluidos los registros del estudio de investigación, a las personas que tienen la necesidad de revisar esta información . No podemos prometer el secreto completo. Cualquier información que se reciba con información de identificación se mantendrá en un archivo protegido por contraseña en una computadora protegida por contraseña en una oficina cerrada en la Universidad de Florida Central. Una vez que todos los archivos de datos se combinan en un solo archivo, se eliminará la información de identificación. Organizaciones que pueden inspeccionar y copiar el contenido de su hijo la información incluye el IRB y otros representantes de esta organización.

### **¿Qué más necesito saber?**

Si está interesado en recibir una copia de los resultados BRIEF2 y PPVT-4 de su hijo , comuníquelo con el maestro de su hijo o póngase en contacto con el investigador principal, Karyn Allee-Herndon, en [Karyn.Alee-Herndon@ucf.edu](mailto:Karyn.Alee-Herndon@ucf.edu) o 407-739-4613. También puede contactar al asesor de investigación, Dr. Sherron Roberts, en [Sherron.Roberts@ucf.edu](mailto:Sherron.Roberts@ucf.edu).

**Bloque de firma para niños**

Su firma documenta su permiso para que el niño nombrado participe en esta investigación .

\_\_\_\_\_  
Letra impresa de niño

\_\_\_\_\_  
Firma del padre

\_\_\_\_\_  
Nombre impreso del padre

\_\_\_\_\_  
Fecha  
 Padre  
 Individuo legalmente  
autorizado para dar su consentimiento  
a laparticipación del niño en el  
estudio

Correo electrónico de los padres: \_\_\_\_\_

Número de teléfono principal: \_\_\_\_\_

**Nota: Los** investigadores deben asegurarse de que las personas que no son padres demuestren su autoridad legal para consentir la participación del niño . Póngase en contacto con un abogado si surge alguna pregunta.

**APPENDIX G: INFORMED CHILD ASSENT – ENGLISH**



UNIVERSITY OF CENTRAL FLORIDA

**School of Teacher Education**  
**College of Community Innovation and Education**  
P.O. Box 161250  
Orlando, FL 32816

**Protocol Title:** Elementary Education PhD Dissertation  
**Principal Investigator:** Karyn Allee-Herndon, EdS  
**Child Assent Script**

I am a teacher and researcher who teaches people how to be teachers! I also used to teach kindergarten just like your teacher. I am trying to learn about how children learn in school. I think that children learn when they play and do other activities to help grow their brains. Does your teacher ever have you sing or dance or play games?

I have some questions to ask you. If you decide to answer my questions, I will find out more about what you know using a special test. I may also sometimes watch you when you are learning in your classroom. I will ask your teachers and parents to tell me more about how you learn. I may also ask you some more questions later about the things you like about school. Would you like to hear more about my project?

[If yes, then:] Great! I will visit your classroom sometimes while you are in kindergarten this year. Most of the time I will just watch how you are learning in your class. In the next few weeks, I will give you a special test about the words you know. Don't worry if some of the questions are tricky! They are supposed to be to help me find out all the things you know! Just do your best, okay? I might also ask you a few questions every once in awhile about what you are learning, how you are learning, and how you feel about school.

While I am watching you learn or listening to your answers, I will write notes in my notebook to help me remember what happened later when I get back to my office. Is that okay?

I would like to understand how children like you learn so that teachers will be able to teach children the best way that they can.

You get to decide whether or not you want to do this, and no one will be upset with you if you decide not to. It will not make any difference to how you are treated in school. If you try it and decide that you want to stop, that's okay, too. Just tell me that you would like to quit.

What else would you like to know about answering my questions or letting me watch you learn? If you don't have questions right now, you can still ask me at any time, okay? Would you like to help me learn more about learning by letting me watch you learn and ask you some questions, or would you rather not?

**APPENDIX H: INFORMED CHILD ASSENT – SPANISH**



UNIVERSITY OF CENTRAL FLORIDA

## **Escuela de formación docente** **Colegio de Innovación y Educación Comunitaria**

P.O. Box 161250  
Orlando, FL 32816

**Título del Protocolo:** Disertación de Doctorado en Educación Primaria  
**Investigador principal:** Karyn Allee-Herndon, EdS  
**Script de asentimiento del niño**

¡Soy un profesor e investigador que enseña a las personas a ser maestros! También solía enseñar kindergarten como tu maestra. Estoy tratando de aprender sobre cómo los niños aprenden en la escuela. Creo que los niños aprenden cuando juegan y hacen otras actividades para ayudarles a crecer sus cerebros. ¿Alguna vez tu maestro te hizo cantar, bailar o jugar?

Tengo algunas preguntas para preguntarte. Si decides responder mis preguntas, descubriré más sobre lo que sabes con una prueba especial. A veces también te miro cuando estás aprendiendo en tu clase. Pediré a tus profesores y padres que me cuenten más sobre cómo aprendes. También puedo hacerte algunas preguntas más adelante sobre las cosas que te gustan de la escuela. ¿Te gustaría saber más sobre mi proyecto?

[Si es así, entonces:] ¡Genial! Voy a visitar tu salón de clases a veces mientras estés en kindergarten este año. La mayoría de las veces solo observaré cómo estás aprendiendo en tu clase. En las próximas semanas, te daré una prueba especial sobre las palabras que conoces. ¡No te preocupes si algunas de las preguntas son complicadas! ¡Se supone que son para ayudarme a descubrir todas las cosas que sabes! Solo haz tu mejor esfuerzo, ¿de acuerdo? También puedo hacerte algunas preguntas de vez en cuando sobre lo que estás aprendiendo, cómo estás aprendiendo y cómo te sientes con respecto a la escuela.

Mientras observo que aprendes o escuchas tus respuestas, escribiré notas en mi cuaderno para ayudarme a recordar lo que sucedió más tarde cuando regrese a mi oficina. ¿Está bien?

Me gustaría entender cómo aprenden los niños como usted para que los maestros puedan enseñar a los niños de la mejor manera posible.

Usted puede decidir si desea hacer esto o no, y nadie se molestará con usted si decide no hacerlo. No hará ninguna diferencia en la forma en que te tratan en la escuela. Si lo intentas y decides que quieres parar, está bien, también. Solo dime que te gustaría dejarlo.

¿Qué más te gustaría saber sobre responder mis preguntas o dejar que te vea aprender? Si no tiene preguntas ahora, todavía puede preguntarme en cualquier momento, ¿está bien? ¿Te gustaría ayudarme a aprender más sobre el aprendizaje dejándome ver cómo aprendes y hacerte algunas preguntas, o preferirías no hacerlo?