HOW GENDER, ACADEMIC AND BEHAVIORAL SKILLS, AND COGNITIVE STIMULATION RELATE TO SUMMER LEARNING AND TO EACH OTHER

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Using a subsample of the Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K:2011; n = 4880), the current study examined summer learning in reading and math between the end of kindergarten and the beginning of first-grade. Utilizing a multilevel regressor variable approach, gender differences in summer learning were examined as well as whether behavior, baseline academic skills, and/or cognitive stimulation helped explain gender differences in summer learning. Further, this study investigated whether parents provided different types and levels of cognitive stimulation based on their child's gender or as a function of their child's behavioral (self-control and impulsivity) and/or academic skills. Contrary to the well-established finding that children lose skills over summer break, this study found that children gain in reading and math. Results also suggest that girls tend to gain more than boys in reading over summer break, even when they start the summer with equivalent reading skills. On the other hand, children who begin summer break with equivalent math skills gain similarly regardless of gender. Additionally, baseline academic skills and cognitive stimulation (but not behavior) helped explain some of the relation between gender and summer learning. Children with better self-control did, however, gain somewhat more in reading while those with lower impulsivity gained more in math compared to children with similar academic scores at the end of kindergarten but lower self- and impulse-control. With regards to cognitive stimulation, parents tended to provide girls with more stimulation and more academically-oriented activities compared to boys, some of which could be attributed to girls’ better self- and impulse-control. This study adds to a growing literature base acknowledging that children are active agents in their development, eliciting certain parenting strategies and thus driving their development. Findings from this study have implications for teachers, parents, and policy-makers, highlighting that both well-developed behavioral and academic skills can promote summer learning. Results also suggest that the recent media attention devoted to summer learning may partially explain the summer growth rather than summer slide in this sample of children.

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1.0 INTRODUCTION

Summer vacation could represent an opportunity for students to strengthen their existing skills or acquire new knowledge to bring into the next school year. Unfortunately, research suggests that the potential for academic maintenance or skill growth over the summer months is not generally realized—in fact, the average student scores one month lower on academic achievement tests in the fall than on the same test prior to summer vacation (e.g., Cooper, Nye, Charlton, & Greathouse, 1996). Previous research suggests that certain students are especially likely to lose ground over the summer months including those from lower socioeconomic backgrounds (e.g., Burkam, Ready, Lee, & LoGerfo, 2004; Cooper et al., 1996; Entwisle & Alexander, 1992) and those with a weaker grasp on the material prior to summer vacation (e.g., Arthur, Bennett, Stanush, & McNelly, 1998; Carroll, 1963). Less research, however, has been directed towards another group of students who may be more likely to experience summer learning loss: boys.

Girls generally have an academic and behavioral advantage over boys even before entering the kindergarten classroom (Chatterji, 2006; Gilliam, 2005; West, Denton, & Reaney, 2001). These initial advantages persist into the start of formal education, when girls start the school year with more basic academic and social skills than boys and, largely due to these initial advantages, learn somewhat more over the school year relative to boys (Ready, LoGerfo, Burkam, & Lee, 2005). It follows, then, that girls may be in a better position than boys to build skills over the summer months because they have a more solid foundation upon which to lay more complex skills (e.g., Heckman, 2008; Shonkoff & Phillips, 2000). Further, social and behavioral skills have long been linked to academic achievement (e.g., Alexander, Entwisle, & Dauber, 2003; Raver, 2005), and girls' more advanced behavioral skills (e.g., self-control) (Cunha & Heckman, 2007) may support better learning for girls over the summer, although this has not been empirically investigated.

Boys and girls may also learn differently over the summer because they are differentially exposed to academically-focused activities in the home. Research suggests that parents tend to provide and encourage different activities for sons versus daughters, which may help explain some of the academic advantage girls possess, especially in reading (Bussey & Bandura, 2004). For example, mothers of first-born daughters are significantly more likely to read, tell stories, and sing to their children compared to mothers of first-born sons, all of which may promote language and vocabulary skills (Baker & Milligan, 2013). Furthermore, girls are generally provided with dolls and domestic items that encourage collaborative and imaginative play (e.g., Alexander, Wilcox, & Woods, 2009). Because girls are more likely to be exposed to activities that are either inherently more "academic" (e.g., book reading) or simply exposed to more language through activities such as collaborative sociodramatic play or singing, they may be more likely to strengthen verbal skills over the summer. Boys, on the other hand, are more often encouraged to pursue active endeavors such as sports (Leaper, 2005) and tend to be provided with toys such as trucks, blocks, and bicycles. Because boys are more likely to be exposed to activities that encourage visual-spatial and gross motor skills and are less likely to be exposed to academic-focused activities such as reading, they may be more likely to strengthen basic math skills but lose basic reading skills over summer vacation.

Another possibility is that boys and girls are encouraged to pursue different activities over the summer but for reasons that are less tied to their gender and more to their academic and behavioral functioning. Research suggests that parents (as well as teachers) provide more academic instruction to children with more advanced academic and behavioral skills (e.g., Raikes et al., 2006). Thus, gender differences in summer learning may relate to the behavioral and academic skillsets children have at the start of summer vacation, the cognitive stimulation to which they are exposed, and the interplay between these factors.

The current project documents the relation between gender and summer learning and considers whether gender differences in summer learning are associated with differences in behavioral skills, namely self-control and impulsivity, as well as their academic skills at kindergarten entry. This study also investigates the types and levels of cognitive stimulation to which children are exposed over the summer and whether gender differences in summer learning are related to differences in summer activities between girls and boys. Finally, the current study considers whether the cognitive stimulation parents provide is related to their child's behavioral and academic skills.

The current dissertation enhances the prior literature in several ways. First, the project examines summer learning using the most current, nationally representative data available; the majority of the summer learning literature was generated using smaller, non-representative samples several years to several decades ago (e.g., Alexander, Entwisle, & Olson, 2007; Cooper et al., 1996; Entwisle & Alexander, 1992; Entwisle & Alexander, 1993; Heyns, 1978). Next, the study directly documents the unadjusted relation between gender and summer learning rather than simply including gender among several covariates in a regression model. Additionally, the study investigates whether gender differences in summer learning can be attributed to a child's behavioral and academic skills, which has not previously been investigated. This is especially important because research suggests that girls' better performance on standardized and teacher-rated academic measures can be partially attributed to better developed social and behavior skills (e.g., DiPrete & Jennings, 2012), although little is known about how behavioral skills relate to learning over summer break. Are girls, for instance, provided more academically-focused cognitive stimulation from parents because of better developed self- and impulse control? Or do boys learn less over the summer because they have more difficulty sitting still and controlling themselves? By considering both characteristics of the child, the types and levels of cognitive stimulation children receive, and whether parents provide different types and levels of cognitive stimulation as a function of their child's characteristics, this study provides the potential for a more in-depth understanding of the factors that relate to gender differences in summer learning.

1.1 DEFINING SUMMER LEARNING AND ITS IMPORTANCE

Summer vacation exists in the American collective conscious as a time of respite from school. Contrary to popular belief, closing schools over the summer was unrelated to the need for child labor on family farms (Gold, 2002). In fact, it was more often the case in 19th century America that children planted and harvested with their families during the fall and spring and attended school over the summer. The decision to close schools over the summer began in the mid-to-late 1800s, a decision initially driven by the aristocracy to allow time for family vacations and a break from the classroom (Gold, 2002). Recently, however, the idea of summer as a time to practice skills learned during the previous school year and develop new skills for the upcoming year is gaining momentum (e.g., McLaughlin & Smink, 2009). This shift in focus was at least partially prompted by evidence suggesting that all students lose academic skills over summer vacation, with some children especially vulnerable to academic decline (e.g., Alexander et al., 2007; Cooper et al., 1996).

In the most extensive review of the effects of summer vacation to date, Cooper et al. (1996) synthesized 39 studies comparing academic achievement at the end of the school year with performance levels in the fall of the next school year; on average, children's test scores were at least one month lower after summer vacation. With regard to math, loss was even more pronounced; the typical student lost approximately two months of grade level equivalency in computation, which is nearly 25% of math learned over a typical nine-month school year. Importantly, Cooper and colleagues (1996) also found that summer learning loss was not equitable across all students. On the contrary, academic skill loss was especially pronounced for students of lower-SES backgrounds and students who earned lower achievement scores prior to summer vacation.

Alexander and colleagues (2007) also established that summer vacation could be differentially beneficial or detrimental depending upon student characteristics. They examined academic achievement from first through ninth-grade using data from the Beginning School Study (BSS), which tracked a random sample of Baltimore public school students starting in 1982. Alexander et al. (2007) found that children of different socioeconomic (SES) levels tended to learn similar amounts during the school year but vastly dissimilar amounts over summer vacation, which contributed to a widening of the academic achievement gap across socioeconomic lines. Specifically, the difference in test scores between children of lower versus higher SES backgrounds approximately tripled from first through ninth-grade, with nearly half of the increase attributed to differences in summer learning. Furthermore, differences in summer learning also were associated with differences in high school dropout and college enrollment rates across SES lines (Alexander et al., 2007). Thus, research suggests that some students are more likely to lose skills over the summer than others, and that this loss accumulates over time, predicting both worse academic and longer-term outcomes such as future occupations and wages. Less research, however, has been directed towards understanding how summer learning may differ by gender.

1.2 GENDER AND SUMMER LEARNING

There are decades of research examining gender differences on academic outcomes, such as standardized achievement tests or classroom grades, much of which has been summarized in various meta-analyses (e.g., Else-Quest, Hyde, & Linn, 2010; Voyer & Voyer, 2014). On the whole, research suggests that females display small but consistent advantages over males on standardized measures of achievement, especially reading and language, and tend to earn better grades than males in every school subject (e.g., Voyer & Voyer, 2014). Even prior to kindergarten, girls know nearly a month more vocabulary than boys (Fenson, Dale, Reznick, Bates, Thai, & Pethick, 1994), a difference that may help explain why girls are nearly 25% more likely than boys to enter kindergarten academically ready to succeed (Isaacs & Magnuson, 2011).

Even when children enter kindergarten, gender differences favoring girls on standardized measures of reading and math are generally small but significant. Specifically, using nationally representative data from The Early Childhood Longitudinal Study, Birth Cohort (ECLS-B), Koury and Votruba-Drzal (2013) found that girls outscored boys in reading (*ES* = .13) and math (*ES* =

.05) in the fall of kindergarten, even after controlling for a host of family (e.g., household income, marital status, maternal depression) and child characteristics (e.g., race/ethnicity, birth weight, age at assessment). Similarly, a study using another nationally representative dataset, The Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K), found that girls entered kindergarten ahead of boys in reading (*ES* = .14) and learned somewhat more over the school year than boys, a difference that was largely related to their initial advantage (*ES* = .07 after inclusion of covariates) (Ready et al., 2005). Thus, although differences are small in terms of effect size, the finding that girls outperform boys on standardized measures of achievement and in the classroom is present early on and appears to remain consistent at least in the early years of education.

Despite research suggesting gender differences in overall academic achievement or learning rates, little is known about how a child's gender relates to learning specifically when school is not in session. Nguyen (2010) examined summer learning using the ECLS-K and reported small but significant gender differences in reading favoring girls (β= .03). Using data from the Beginning School Study (BSS) (see above for a description of the BSS), Slates and colleagues (2012) focused on summer learning among those they categorized as exceptional summer learners (ESLs). ESLs were children from low-SES backgrounds who gained as much or more than the median scores of children from high-SES backgrounds during at least three of the four elementary school summers included in the study. Results showed that girls were twice as likely as boys to be categorized as ESLs in both reading and math. Moreover, girls who were ELS in reading gained significantly more over the four summers in reading than boys who were considered ESLs (94 point median gain vs. 78 point median gain); similar gains were registered in math between genders.

It is also important to consider the studies that did not report significant gender differences (e.g., Alexander et al., 2007; Burkam et al., 2004; Cooper et al., 1996; Entwisle & Alexander, 1992, 1993; Heyns, 1978). Of these studies, none conducted formal moderation analyses or separate analyses by gender. Burkam and colleagues (2004), for example, were among the first researchers to examine summer learning loss in a nationally representative dataset. Burkam et al. (2004) provided information on how children of different social class backgrounds learned over the summer as well as examined which activities appeared to promote learning. In this study, however, gender was added to the regression model with a number of other covariates including race, age, marital status of parents, English language proficiency, and most notably, socioeconomic status, which has previously been established as one of the strongest predictors of both learning over the summer and throughout the school year. Given the number of covariates included simultaneously with gender, it is difficult to ascertain the unadjusted relation between gender and summer learning. This is concerning because unadjusted estimates provide at least a partial portrait of academic differences between girls and boys as they are in the classroom—that is, without adjustments for the characteristics they bring with them to school.

Thus, on average boys enter school with weaker academic skills and may, therefore, be more likely to experience summer learning loss than girls. Given the lack of research documenting the link between gender and summer learning and the small, but consistent, finding that girls tend to outscore boys on academic tests, it is necessary to determine whether girls and boys learn differently over the summer and the mechanisms driving the differences.

1.3 PATHWAYS THROUGH WHICH GENDER INFLUENCES SUMMER LEARNING

The current study draws upon a bioecological framework (Bronfenbrenner & Morris, 1998, 2006), the model of skill formation proposed by Cunha and Heckman (2007), and the dynamic systems theory (Thelen & Smith, 2006; Thelen, 2005). These perspectives are complementary in that they emphasize that 1) children are active agents in their own development, 2) caregivers play a prominent role in their child's development, and 3) development is dynamic, and as such, the characteristics of the child and parent interact with one another as well as with the contexts under which they exist to drive development.

As noted by Owen Blakemore, Berenbaum, and Liben (2009), few studies have attempted to use bioecological theory to understand gender differences in child development. The bioecological model, however, is useful for framing development as a process that is driven by individual characteristics as well as the multiple contexts under which these characteristics operate. Children are born with innate characteristics that relate to how they perceive and interact with their environments and how they are, in turn, perceived and interacted with by their environments. Gender represents a particularly important innate characteristic, because it has direct and indirect consequences on a child's life even before birth.

The dynamic systems theory (Thelen & Smith, 2006; Thelen, 2005) is useful for viewing development as occurring within an ever-evolving system, with a change in one component influencing every other component. Further, it underscores the importance of considering development as having cascading effects; that is, each prior skill, ability, and behavior sets the stage for the present and the present, in turn, sets the stage for the future. Finally, the dynamic systems theory highlights that development can only be understood by examining the multiple levels of a system, from cells to society. Each of these levels interacts with one another to push development forward (Thelen, 2005). This framework is especially useful for the current study for considering how children may evoke parenting based on the characteristics they bring into the parent-child dynamic, and that the parenting elicited is flexible, not fixed.

The model of skill formation (Cunha & Heckman, 2007) complements the bioecological and dynamic systems framework by emphasizing skill acquisition as a function of genes, environment, and the interplay between the two. According to the model, skill and ability formation is a lifelong process that starts in the womb and continues throughout life with families playing the most prominent role in their creation. As noted by Cunha and Heckman (2007), skills at one stage facilitate the attainment of skills at a later stage; thus, early skills and abilities are important precursors and promoters of future capabilities. For example, early self-control may promote basic cognitive skills by allowing children to listen to stories being read aloud and also promote basic social skills by helping children be able to wait their turn. Thus, children are born with certain skills and abilities that families help to hone and multiply, and these early skills are foundational for later learning.

1.3.1 Direct links between gender and summer learning: Biological explanations

From a dynamic systems perspective, gender may directly relate to summer learning because gender is influenced at the molecular level (see Figure 1). Prior to birth, the developing fetus is exposed to differing levels of prenatal testosterone (e.g., Baron-Cohen, Lutchmaya, & Knickmeyer, 2006; Ruble & Martin, 1998). The level of testosterone to which a fetus is exposed during a particularly sensitive period of prenatal development shapes the architecture of the brain in a way that relates to children's later skills, interests, and proclivities (Hines, Constantinescu, & Spencer, 2015). Specifically, several regions of the brain are structurally distinct or mature at different rates between males (who are typically exposed to higher levels of testosterone in utero) and females (who are typically exposed to lower levels of testosterone in utero) (see Hines, 2015; Gurian, 2011 for summary). For example, areas that facilitate language tend to mature faster and are more active in female brains (i.e., the front lobe, hippocampus, arcuate fasciculus), whereas areas that facilitate spatial functioning in the right hemisphere tend to be more developed in male brains. These differences may potentially explain why girls tend to acquire reading, vocabulary, and grammar earlier than boys, whereas some research suggests that boys, and in particular high-performing boys, experience a faster rate of growth in math than girls (Aunola et al., 2004; Leahey & Guo, 2001).

Thus, if male brains need more time to master verbal abilities, they may enter kindergarten with fewer of the basic reading skills needed to hit the ground running, which puts them at risk for ending the school year with weaker foundations. Because research suggests that children with weaker skills prior to summer vacation are among the most vulnerable to forgetting, it stands to reason that boys may be more susceptible to summer loss (e.g., Carroll, 1963; Cooper et al., 1996). On the other hand, if boys are somewhat better equipped for spatial learning (e.g., Hyde, 2005), boys may gain more math skills than girls.

1.3.2 Indirect links between gender and summer learning: Child elicitation effects

From a bioecological standpoint, a child's gender elicits gender-specific responses from the players in their *microsystem* (the context that contains the developing person and all the activities and relationships to which they are exposed), most notably, their primary caregivers. In turn, the parent-child relationship exists within the context of the larger *macrosystem*, or all of the societal beliefs, expectations, and values that delineate proper behavior for members of a certain context (Bronfenbrenner, 1999; Bronfenbrenner & Morris, 2006). More concretely, the *macrosystem* of the US communicates certain gender role expectations to members of society, which parents directly or indirectly translate to their children through their interactions. In essence, gender helps shape the environment as well as how the environment is experienced (see Figure 1).

There are three main reasons that parents may play a role in gender differences in summer learning, each of which is informed by both the bioecological model and dynamic systems theory. First, gender differences in summer learning may be associated with differences in the way that parents interact with male and female children. From a bioecological perspective (Bronfenbrenner & Morris, 2006), parents may interact differently with girls vs. boys based on the gender role stereotypes to which they are exposed in society (i.e., the *macrosystem*). In other words, parents know the "appropriate" gender roles ascribed by society for their children and may use this information in selecting activities and experiences for their children (e.g., Andrée, Daniel, Gérard, & Louise, 1990). Research suggests that parents are especially concerned with maintaining masculine behavior in boys (Kane, 2006). Thus, mothers may be inclined to provide more stereotypically masculine activities and experiences for their sons (e.g., board games, organized sports) and fewer stereotypically feminine activities (e.g., book reading), and these differences may relate to different academic skill development over time.

Second, parents may also provide different activities for reasons that have less to do directly with gender and more to do with their child's academic skills and interests. As noted by Ansari and Crosnoe (2015), the effect(s) of children on parenting is much less represented in the extant literature than the inverse. Evidence is emerging, however, suggesting that the academic skillsets of children play an important role in eliciting certain parenting behaviors, aptly referred to as "child capital" by Chin and Phillips (2004). This can be understood in light of a dynamic systems theory that points to the interplay between child characteristics and the parenting they can elicit (Thelen, 2005). To this point, Ansari and Crosnoe (2015) found that parents who were identified as "at-risk parents" (i.e., provided less cognitive stimulation and more spanking and television viewing) when their children were two-years-old were significantly more likely to transition to "high investor parents" (i.e., provided more cognitive stimulation, less spanking, and less television viewing by the time their children started kindergarten if their child had developed better reading abilities. Raikes and colleagues (2006) found that children with better vocabulary at 14 months were provided more joint book reading from mothers at 24 months which served to further reinforce their existing skills at 36 months. Furthermore, children who show a greater interest in books are more likely to be read to, and thus more likely to reap the benefits of more literacy activities (e.g., Lyytinen et al., 1998; Scarborough & Dobrich, 1994). Therefore, children who are more interested in reading are more likely to elicit book reading from their parents, and those who elicit more book reading further increase their skills and their likelihood of being read to. If girls are more skilled in vocabulary and show more interest in reading, this could explain why girls are read to more often than boys and thus may be more likely to gain over the summer in reading.

Third, parents may also decide the activities and interactions to provide for their child based on their child's level of self-control and impulsivity. In the Ansari and Crosnoe (2015) study mentioned above, parents were also more likely to transition from the "at risk parent" status to the "high investor parent" status when their children had fewer behavioral problems at kindergarten entry. In fact, parents were 66% less likely to make the transition to more optimal parenting behaviors when their children had difficulty controlling their behavior. This finding is in line with each theoretical framework, acknowledging the importance of the cognitive (e.g., IQ) and non-cognitive factors (e.g., self-control and temperament) children bring to their environments. Moreover, as dynamic system theory would suggest, parents responded to the characteristics of their child, and changes in their child related to changes in parenting. Research suggests that boys tend to be more impulsive and less regulated than girls (see below; Silverman, 2003). As such, if boys are less able to control themselves and pay attention, it stands to reason that they may be at risk of learning less over summer simply because they are engaging in fewer learning activities independently.

Furthermore, parents may be less likely to provide their sons with activities that require sitting still or paying attention for long periods of time than their daughters, given gender differences in behavioral skills. Instead, parents may respond by providing activities and experiences they believe are better suited for their child's current skill level. This may be especially important to learning over the summer when children are not within the structured learning atmosphere of the classroom; providing learning activities as well as ensuring active participation in learning activities may have to be more intentional over the summer when school is not in session. Investigating whether children's social skills relate to the activities provided to children over the summer represents one of the main goals of the current project.

1.4 BEHAVIORAL SKILLS AND SUMMER LEARNING

It is well-established that behavioral skills are important for both school readiness and academic achievement (see Raver, 2003, for a review). Research suggests that self-control and the ability to pay attention are significantly and positively related to both reading and math at preschool (e.g., Dobbs et al., 2006) and kindergarten entry (e.g., Duncan et al., 2007; Duncan & Magnuson, 2009). Moreover, entering formal education with these behavioral skills predicts reading and math outcomes even into 8th grade (Duncan et al., 2007). A recent study by Wanless et al. (2013) highlights the importance of behavioral regulation during a one-on-one interaction with an adult (specifically, the Head-Toes-Knees-Shoulders task, or HTKS). In this study, Wanless and colleagues (2013) found that individual behavioral regulation significantly predicted school readiness in reading, vocabulary, and math for both genders and was more strongly predictive than classroom behavioral regulation (i.e., how well students behaved in a classroom setting). Furthermore, findings from the Dunedin Multidisciplinary Health and Development Study, a 40-year study of over 1,000 children, underscore the long-lasting implications of strong social skills during childhood. Specifically, Moffitt et al. (2011) note that participants with low self-control as children grew into less wealthy and less healthy adults and were also more likely have been convicted of a crime and have substance abuse issues compared to those who had high self-control; this held even after controlling for IQ, social class, and gender.

Children who enter kindergarten better able to regulate their behavior, pay attention, and sit still are better able to gain the early math, vocabulary, and reading skills necessary for success (e.g., Blair & Razza, 2007; McClelland, Acock, & Morrison, 2006). This is partly because children who are more behaviorally regulated can spend more time paying attention and engaging in learning activities, which allows them to practice and learn new skills. Conversely, children who struggle with self-control or attention receive less instruction from teachers (and parents), both of which otherwise contribute to academic skill development (Duncan & Magnuson, 2009). The accompanying lack of academic guidance in the classroom may relate to children feeling further frustrated, unmotivated, and less efficacious, all of which may contribute to acting out in the classroom. In turn, acting out may cause further friction in the student-teacher relationship, potential removal from the classroom, and eventually dropping out of high school (Hammond, Linton, Smink & Drew, 2007; Wigfield & Eccles, 2000).

Behavioral skills also relate to academic achievement by influencing teacher perceptions of a student. Cornwell, Mustard, and Van Parys (2012) analyzed data from the ECLS-K and found that teacher assessments of students' reading, math, and science skills also took into account their classroom behavior; that is, students rated by teachers as higher in approaches to learning (a measured correlated with self-control and attention, e.g., Rimm-Kaufman & Wanless, 2012) were also rated as higher in academic skills. Therefore, better behavior facilitates more positive experiences in school (and at home) in ways that may set into motion either positive or negative feedback loops (Cunha, Heckman, Lochner, & Masterov, 2005; Duncan & Magnuson, 2009). Children who can regulate their behavior elicit more learning opportunities from teachers and parents, which further engage children in learning and positively reinforce their well-regulated behavior.

1.4.1 Behavioral Skills as a Mediator of Gender Differences in Summer Learning

Although recent research has focused on the importance of behavioral skills for bolstering academic skill development, less work has examined whether differences in behavior explain differences in achievement between girls and boys (DiPrete & Jennings, 2012). Gender differences in social and behavioral skills such as impulsivity and self-control are evident as early as toddlerhood, with boys less able to control impulses, pay attention, and sit still than girls (e.g., Gurian, 2011; Silverman, 2003). By preschool, girls surpass boys in several aspects of self-control including approaches to learning (ATL) (Li-Grining et al., 2010), behavioral regulation (Wanless et al., 2013), and inhibitory control (e.g., McClelland et al., 2000). In contrast, boys are overrepresented among children who are suspended in preschool (79%) and are retained in kindergarten (61%) (CRDC, 2014). Using the ECLS-K dataset, DiPrete and Jennings (2011) show that girls enter kindergarten roughly .40 standard deviation units ahead of boys on teacher ratings of social/behavioral skills and approaches to learning. Furthermore, the difference is maintained and exacerbated over time—by the spring of fifth grade, the magnitude favoring girls is .58 SD for approaches to learning and .53 SD for externalizing behavior problems.

It is especially important to consider recent research that suggests gender differences in behavioral skills may be important for explaining girls' academic advantage over boys. Using the ECLS-K dataset, DiPrete and Jennings (2011) found that social/behavior and approaches to learning explained gender differences favoring girls at the beginning of kindergarten and at different points between kindergarten and fifth grade. Specifically, the female advantage at the start of kindergarten explained nearly half of the reading advantage at the end of fifth grade. The social and behavior skills of girls also buffers them against worse performance in math; namely, boys outscore girls in math by fifth grade, but the gap would be nearly 30% higher were it not for the well-developed social/behavioral skills of girls.

Another study using the ECLS-K data, Cornwell, Mustard, and Van Parys (2012) examined gender differences in academic achievement using both objective (standardized tests) and subjective (teacher assessments) measures of academic performance. Cornwell and colleagues (2012) found that gender differences in approaches to learning explained the more favorable teacher assessments enjoyed by girls in reading, math, and science. Specifically, teachers tended to grade girls of every racial category more favorably in reading, math, and science than boys, even when standardized test scores were comparable between boys and girls. Even boys who scored as well on reading tests were rated as .15-.21 SDs lower in reading by their teachers. After controlling for differences in teacher-rated approaches to learning, this gender gap essentially vanished. When, however, boys exhibited test scores *and* behavior similar to their female peers, they were "over-compensated"—that is, girls may be held to higher standards with regards to approaches to learning than boys and thus boys who exceed their somewhat lower standards may earn special treatment from their teachers. Thus, behavioral skills may explain gender differences in both teacher-ratings of achievement and standardized tests.

Gender differences in behavioral skills are well-established, but it is also important to consider why these differences exist. Some evidence highlights a biological perspective, suggesting that some of the gender differences in self-control and hyperactivity can be linked to prenatal hormone exposure (e.g., Gurian, 2011; Sax, 2005). For example, boys have more testosterone but less serotonin and oxytocin than girls, hormones with well-established links to impulse control and tranquility (Sax, 2005). Other research suggests that some of these differences stem from the different activities in which children are encouraged to participate during early childhood (Stockard, 2006). Specifically, parents are important socializers of their children and encourage certain behaviors and activities. Girls, for instance, are encouraged to engage in more sociodramatic play than boys (e.g., Edwards, 2000), a type of play that requires children to be more regulated (Bodrova & Leong, 2006). Because this play allows girls to practice being in adult roles that require more regulated behavior, they may be honing their social and behavior skills as they play (Best, 2010; Elias & Berk, 2002). Thus, both biological and socialization factors may help explain the differences in behavioral skills between boys and girls.

As evidenced by the research above, gender differences in behavioral skills are well-established and important for predicting both standardized test scores and teacher ratings of academic achievement. Yet, little is known about how these behavioral skills relate to summer learning. If differences in behavioral skills explain gender differences in summer learning, the results of this study could help inform potentially useful interventions that promote social skills.

1.5 COGNITIVE STIMULATION AND SUMMER LEARNING

Brains are built over time and the ways in which they are constructed is highly dependent on the experiences to which they are exposed. From birth to three years of age, children's brains are particularly sensitive to environmental stimuli. In fact, during this three-year time span, synapse formation is at its peak, with 700 to 1,000 new neural connections being formed each second (Center on the Developing Child, 2015). As such, early childhood represents a particularly rich time for learning to occur. In line with the guiding theoretical frameworks of this paper (Bronfenbrenner & Morris, 2006; Cunha & Heckman, 2007; Thelen, 2005), parents play a key role in providing stimulating learning environments for their children. During early childhood, learning experiences in and outside of the home environment, such as reading books, playing board games, and taking trips to the library, are important for shaping early reading and math skills (Case & Griffin, 1990; Siegler & Ramani, 2009; Snow, Burns, & Griffin, 1998). These early experiences with cognitive stimulation during the infant and toddler years are positively related to school readiness and subsequent academic achievement (Crosnoe et al., 2010; Duncan, Brooks-Gunn, & Klebanov, 1994; Raikes et al., 2006; Senechal et al., 1996).

Unfortunately, much of what is known regarding the role of home environments in shaping academic skills does not isolate the effect of the home environment over the school year from that which is experienced over the summer; as noted by Heyns (1978), summer is when the home environment becomes the proximal context for child development. Of the existing literature, one of the most consistent predictors of reading growth over the summer is the number of books a child reads or has read to them (e.g., Heyns, 1978; Kim, 2004). Burkam and colleagues (2004) found that summer activities in general did little to explain differences in summer learning including summer school attendance. Of the many summer activities included in Burkam et al.'s (2004) study, only literacy-specific activities related to summer learning in reading. With respect to math, math-specific activities were not related to learning; however, having access to a computer for educational purposes and the number of summer trips (e.g., trips to museum, zoo, parks, play/concerts) were significantly and positively related to small math gains in the summer. This is consistent with other literature suggesting that children can learn math skills from informal activities involving numbers (e.g., LeFevre, Skwarchuk, Smith-Chant, Fast, Kamawar, & Bisanz, 2009) The general conclusions that can be drawn from the summer learning research are that the mechanisms driving summer learning, aside from reading activities, are still widely unknown;

further, activities that may be expected to relate to learning over the summer may, in fact, have a nonsignificant or unexpected association with learning over the summer.

1.5.1 Cognitive Stimulation as a Mediator of Gender Differences in Summer Learning

Some gender differences in summer learning may be attributed to differences in the ways parents interact with and the activities they provide to daughters compared to sons (Bussey & Bandura, 2004). For example, mothers of first-born daughters are significantly more likely to read, tell stories, and sing to their child compared to mothers of first-born sons; daughters are also more frequently taken to the library and provided with more books and music than sons (Baker & Milligan, 2013). Furthermore, girls are generally provided with dolls and domestic items that encourage collaborative and imaginative play (e.g., Alexander, 2009). Because girls are more likely to be exposed to activities that are either inherently more academic (e.g., book reading) or simply exposed to more language through activities such as collaborative sociodramatic play or singing, they are likely to strengthen verbal skills over the summer. Boys, on the other hand, are more often encouraged to pursue more active activities (Leaper, 2005) and provided with toys that encourage visual-spatial and gross motor skills such as trucks, blocks, and bicycles.

Work by Baker and Milligan (2013) is especially illustrative of the differences in home environments experienced by girls and boys; mothers of fraternal twins spent less time reading to and teaching letters and numbers to their sons compared to their daughters. Because boys tend to be provided with less formal academic activities and are encouraged to pursue activities with a spatial component, they may be more likely to gain math skills over the summer compared to girls.

Likewise, boys may be more likely to lose reading skills over the summer compared to girls, again, given the differences in activities provided and encouraged between the genders.

Again, it is useful to consider the reasons parents may provide their daughters with different activities over the summer than their sons. As discussed above, parents exist within the larger societal and cultural contexts, and thus may use knowledge of “gender-appropriate” activities and experiences in creating environments for their children (e.g., Andrée, Daniel, Gérard, & Louise, 1990). Alternatively or in conjunction, parents may also provide different activities for their daughters vs. sons for reasons related to their child’s interests and academic and behavioral skills (e.g., Ansari & Crosnoe, 2015; Raikes et al., 2006).

1.6 SIGNIFICANCE

Children who maintain or build skills over the summer return to school better able to take on the challenges of their new grade. On the other hand, students who return to school with weaker skills after summer may be left behind and unable to catch up to their peers. This sets in motion a cascading effect of low achievement and failure rather than high achievement and success; a cascade that often ends with high school dropout (Rumberger, 2007). Thus, it is important to understand whether boys and girls are equally likely to experience summer growth or if either gender is at a heightened risk of summer learning loss. Moreover, research suggests that differences in social and behavioral functioning are even larger by gender than by socioeconomic background (e.g., DiPrete & Jennings, 2012); as such, determining whether mean differences in behavioral skills explain any advantage girls may have over boys in terms of summer learning could offer teachers, policy makers, and parents a practical strategy for promoting summer learning. Because social and behavioral skills are malleable and can be taught, improving behavioral functioning may represent a potentially cost-effective mechanism to support learning over both the summer and the school year.

It is especially important to examine how learning that takes place over the school year is distinct from that which takes place over the summer and how gender may play a role. As noted by Entwisle et al. (1997), it is important to separate out summer learning from school year learning; without this distinction, policy makers could overlook the significance that schools have on learning. As previously noted, research suggests that students of all backgrounds tend to learn similarly across the school year but that student characteristics become important over the summer in predicting learning loss or gain (e.g., Alexander et al., 2001; Burkam et al., 2004). Although most research in this domain has focused on socioeconomic differences in summer learning, child gender also ought to be considered. If girls and boys learn similarly over the school year but girls learn or maintain more skill over the summer than boys, then girls may be in a better position than boys to keep growing over the next school year. Understanding the contributing factors to summer learning may be fruitful in improving learning outcomes for all students, but especially those who may be more vulnerable to skill loss, including boys.

1.7 RESEARCH AIMS AND HYPOTHESES

1.7.1 Aim 1

Using nationally representative data from the ECLS-K:2011 project, this study aims to examine whether boys and girls learn differently in reading and math over the summer between kindergarten and first-grade. Although this question has been considered before (e.g., Entwisle & Alexander, 1992; Heyns, 1978), it has not been examined using a current dataset. Previous analyses have considered summer learning using older data and/or data that are not nationally representative, both of which are addressed using the ECLS-K:2011. Further, summer learning has not been studied using gender as an independent variable and not simply a covariate, thereby offering an unadjusted estimate of the relation between gender and summer learning. It is expected that girls will gain significantly more reading skills over the summer compared to boys who start the summer with the same reading score. The opposite pattern is expected for math.

1.7.2 Aim 2

This study also extends prior summer learning research by considering whether a child's behavior, namely their level of self-control and impulsivity, relates to summer learning. To date, no study has investigated whether learning over the summer is associated with children's behavior. It is expected that self-control will be positively associated with summer gains whereas impulsivity will be negatively associated with summer gains in both reading and math. It is further hypothesized that girls will be rated as having higher self-control and lower impulsivity, and these factors are expected to mediate differences between girls and boys in summer learning.

1.7.3 Aim 3

This study also examines whether parents provide different types and levels of cognitive stimulation to children based on their children's gender, and if differences in cognitive stimulation, in turn, mediate summer learning differences by gender. The current study includes a composite measure of cognitive stimulation that takes into account both academic-focused (e.g., reading to child) and informal learning opportunities (e.g., trips to the museum). It is expected that parents will provide more overall cognitive stimulation and more academically-focused activities to girls compared to boys based partially on the gender role stereotypes parents hold. Differences in the types and levels of stimulation parents provide are expected to mediate the relation between gender and summer learning.

1.7.4 Aim 4

An important contribution of this study is that it extends past research on summer learning and academic achievement more generally by examining whether parents provide their child with different cognitively stimulating activities over the summer based on their child's behavior and academic skills. This is informed by both research and theory suggesting that children's individual characteristics elicit behavior from parents. It is expected that children with higher levels of self-control and academic functioning and lower levels of impulsivity will be provided with more academically-focused cognitive stimulation. Because girls are expected to be higher on self-control and baseline skills and lower on impulsivity compared to boys, parents are expected to provide more cognitive stimulation and academically-focused activities to girls; this is expected to mediate the relation between gender and summer learning.

2.0 METHOD

2.1 PARTICIPANTS

The current study utilized data from the Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K:2011), a nationally representative, longitudinal study of children in the United States who were in kindergarten during the 2010-2011 school year (~*N* = 18,000[1]). The ECLS-K:2011 is a multi-source, multi-method study designed to characterize the early educational experiences of children from beginning of kindergarten to the end of fifth grade (Tourangeau et al., 2013). It documents child and family sociodemographic backgrounds; early home, school, and childcare environments; as well as the cognitive, academic, and social development of children as they progress through school. The base year sample was selected in three stages. First, the U.S. was divided into primary sampling units (PSUs), which were geographic areas composed of counties or contiguous counties; 90 PSUs were sampled in total. Next, public and private schools with kindergarten programs or that educated kindergarten-age children within the PSUs were sampled. The ECLS-K:2011 also specifically oversampled Asians, Native Hawaiians, and other Pacific Islanders. Finally, children in kindergarten and other five-year-olds were selected within each sampled school or setting (Tourangeau et al., 2013). During the base year, roughly 18,000 children from 970 schools were included in data collection.

[1] Rounded to the nearest 50 to be in compliance with NCES

2.2 PROCEDURE

The ECLS-K:2011 collected data in waves starting in the fall of 2010. The current study utilizes data from the fall and spring of kindergarten (waves 1 and 2) and the fall of 1st grade (wave 3). Importantly, data were collected on the full sample of children during waves 1 and 2 but only one-third of the total sample were included in wave 3 data collection, when nearly all children from the base year were in first-grade (29.2% of the 30% subsample). Children were selected for the fall of first-grade subsample using a three-step procedure. First, one-third of the 90 PSUs used during the base year were selected. Then, students who were sampled in the base year from the eligible schools within the sample PSUs were included in the fall of first-grade sample. Finally, students in the subsample schools who participated in the base year and had not moved out of the country were included. Response rates for children from waves 1 through 3 are 87%, 85.2%, and 88.7%, respectively.

At each wave, the primary caregivers were interviewed and children's academic and social skills were assessed. Response rates for parents from waves 1 through 3 are 74.2%, 67.1%, and 86.7%, respectively. Mothers were generally the primary caregiver interviewed at each wave of data collection. Nearly all of the parent interviews were conducted in English during the fall and spring of kindergarten and the fall of first-grade assessments, with a small percentage conducted in Spanish. A sampling weight (variable name: w3cf3p_30) was utilized for all analyses presented in this study. The use of this sampling weight compensated for differential probabilities of being selected at each of the three sampling stages as well as adjusted for nonresponse associated with child assessment data from spring of kindergarten and fall of first-grade, parent interview data from fall or spring of kindergarten, and parent data from fall of first-grade.

2.2.1 Analytic Sample

Two analytic samples were created for data analysis, one of which was used for analyses on reading outcomes and the other for math outcomes. Children were included in the analytic sample if they (1) were in the fall of first-grade subsample; (2) had a nonmissing sampling weight; (3) had valid assessment scores at spring of kindergarten (wave 2) and fall of first-grade (wave 3) (reading or math scores for the respective analytic samples); (4) had a nonzero value for days summer vacation, and (5) were in first-grade during wave 3 (i.e., were not repeating kindergarten at wave 3). Of the children sampled during the base year (18,150), 5,500 were sampled for the fall of first-grade subsample and had a nonmissing sample weight. Of these children, roughly 92% had either valid reading scores at wave 2 and 3 or valid math scores. About 90% of children in the fall of first-grade subsample had a nonzero value for days of summer vacation. Finally, 88% were in first-grade during wave 3. Thus, the final analytic reading and math samples captured data from roughly 4,800 participants. It should be noted that models including baseline reading or math has a smaller sample due to missing data on fall of kindergarten academic assessments (N = 4,200).

Patterns of missing data revealed some significant differences between children in the analytic samples and those who were excluded, all of which corresponded to small effect sizes according to Cohen's *d* (Cohen, 1992). Overall, children in the analytic samples were somewhat older and earned somewhat higher baseline reading and math scores. Additionally, children in our analytic samples were more economically advantaged and had slightly more educated and stably married parents compared to children who were dropped due to the exclusionary criteria.

2.2.2 Measures

Child Academic Outcomes

Summer Learning. Reading and math skills were directly assessed in the fall and spring of kindergarten and again in the fall of first-grade using assessments taken or adapted from well-validated standardized instruments, such as the Peabody Individual Achievement Test-Revised (PIAT-R) (Pearson Education, Inc.), Peabody Picture Vocabulary Test-Third Edition (PPVT-III) (Pearson Education, Inc.), Test of Early Mathematics Ability—Third Edition (TEMA-3) (PRO-ED, Inc.), and Test of Early Reading Ability—Third Edition (TERA-3) (PRO-ED, Inc.). All children were administered a language screener comprised of two tasks from the Preschool Language Assessment Scale (preLas 2000). These tasks were designed to determine whether children could follow basic directions and understood basic vocabulary given in English. If children did not achieve a minimum score on the English basic reading skills section (EBRS) but spoke Spanish, assessments were completed in Spanish. For children who were neither English nor Spanish-proficient, the cognitive assessments ended.

The reading assessments captured basic language and literacy skills, such as letter recognition, print familiarity, letter sounds, rhyming words, and reading comprehension. The math component assessed skills such as problem solving and procedural knowledge (e.g., naming one-digit numbers, solving simple addition and subtraction problems). During the math assessment, text was generally read to children so that math performance was not contingent on reading ability. The assessments used during fall of first-grade were similar to those used in the kindergarten waves of data collection, with the exception that newer, more challenging items were included and easier, less age-appropriate items were omitted. The ECLS-K provided item-response theory (IRT)-

adjusted scores for reading and math at each wave of data collection. IRT scores estimate a child's score had they been administered the entire battery (Tourangeau et al., 2014). Reading values ranged from 0 to 100. Math values ranged from 0 to 96. Reliability estimates for reading and math assessments for fall and spring of kindergarten and fall of first-grade are as follows: reading: α = .95 across each wave; math: α = .92, .94, and .93, respectively.

Behavior

Self-control. Parents were asked to rate their children at the spring of kindergarten on various measures of social and behavioral functioning based on items from the Social Skills Rating System (SSRS) (Gresham and Elliott, 1990). A self-control subscale was created from parental ratings of five items relating to their child's level of self-control on a scale from 1 to 4, with higher numbers indicating better self-control. The spring of kindergarten self-control rating was utilized (α = .78). The specific items used to create the subscale are not provided by the ECLS-K as the SSRS is a copyrighted instrument.

Impulsive/Overactive. Parents were also asked to rate their children at the fall and spring of kindergarten on impulsive/overactive behavior using items from the SSRS (Gresham & Elliot, 1990). An impulsive/hyperactive subscale was created from parental ratings from two items on a scale of 1 to 4, with higher numbers indicating better ability to control impulses and activity level. The spring of kindergarten impulsive/overactive rating was used.

Cognitive Stimulation

Parents were asked to report on the summer activities of their children during the fall of first-grade wave of data collection using items from the well-validated Short Form of the Home Observation for Measurement of the Environment (HOME) Inventory (Caldwell & Bradley, 1979, 2001), the National Household Education Survey (NHES), and several questions constructed by the ECLS-

K. Primary caregivers were asked how often during a typical week they or someone else in the family engaged the child in certain activities on a scale of 1 (never) to 4 (every day). Items assess the frequency with which parents engaged in a variety of both more formally academic activities and informal learning experiences with their children. Sample items include how often children read books alone and attended story times at the library. The current study examined cognitive stimulation by creating both an aggregated measure that collapses across academic and more informal learning activities and an academically-focused measure that specifies that number of more formally academic activities (e.g., book reading). These items were aggregated to create an overall measure of cognitive stimulation (12 items, $\alpha = .68$). Items that could be characterized as more academically-focused were summed to form an index of the academic cognitive stimulation children experienced over the summer ($n = 7$). See Appendix B for complete list of items included in both measures.

Demographic Characteristics

Child, family, and background characteristics that are confounded with academic achievement were statistically controlled in data analyses. The child's age at the time of the fall of first-grade assessment was included in the models as a continuous measure of age in months. Child's race/ethnicity was statistically controlled using dummy variables, with race/ethnicity defined categorically as non-Hispanic White (reference), non-Hispanic African American, Hispanic, Asian/Native Hawaiian/Other Pacific Islander, American Indian/Alaskan Native, and Multiracial. In terms of family and background covariates, household income at wave 2 was assessed categorically but transformed into a continuous indicator by assigning the midpoint value of each range. Marital status was defined as either stably married across waves 1 and 2 or not stably married across waves 1 and 2, including those who were separated, divorced, widowed, or in a domestic partnership. The number of siblings in the home was averaged across wave 1 and 2. A dummy variable was created to indicate whether a child was in a non-English speaking home during wave 1 or wave 2. The highest level of parental education was also statistically controlled, with education categorically defined as 1) below a high school degree (reference), 2) high school degree/equivalent or vocational training, 3) some college but no degree, and 4) Bachelors degree or higher. An indicator for whether the primary caregiver was born in or outside of the United States was also included to control for parental immigrant status.

Following the lead of other researchers (e.g., Burkam et al., 2004), length of summer vacation as well as the amount of time between assessments (i.e., spring of kindergarten to fall of 1st grade) were added to the models as covariates. To calculate the time between wave 2 and wave 3 assessments, a child's age at the fall of first-grade assessment was subtracted from their age at the spring of the kindergarten assessment. It is necessary to control for the length of summer vacation exposure because children in this sample were especially heterogeneous in terms of the length of summer break.

2.3 DATA ANALYSIS

Recent research on summer learning highlights the importance of the modeling strategy used to estimate summer learning gaps (e.g., Bond & Lang, 2013; Quinn, 2014). Quinn (2014) examined the sensitivity of Black-White summer gap estimates to changes in modeling strategies and assumptions regarding measurement error; he reported that estimates differed considerably by modeling techniques, ranging from a significant disadvantage for Black students to a significant advantage for Black students over White students in summer math learning. Even studies that have used the same dataset (i.e., ECLS-K:1998-1999) to study summer learning gaps have reported different findings (see Burkam, Ready, Lee, & LoGerfo, 2004; Downey, von Hippel, & Broh, 2004). Given the importance of modeling strategy, great care was taken in choosing the appropriate method for the questions.

The current study utilized multilevel regressor variable models, also referred to as lagged dependent variable models. In doing so, fall of first-grade math and reading scores were predicted with spring of kindergarten scores. Because of the clustered nature of the data at the school-level, a cluster adjustment was made that took into account these differences. Without this adjustment, standard errors of the estimates will be inflated. Thus, models can be considered two-level regression models with children at level 1 and schools at level 2.

Models using the regressor variable method address whether girls and boys earn different reading and math scores in the fall if they started summer break with equivalent reading and math skills. This strategy provides different answers compared to a strategy that employs change score models, for instance. Change score models address whether girls and boys, on average, gain or lose differently over the summer. In these models, scores at fall of first-grade are subtracted from scores at spring of kindergarten. The advantage of using a regressor variable model over a change score model is that regressor variables take into account the skill level children have at the beginning of summer break; change score models, on the other hand, do not consider where children fall on the continuum of skill level. Consider a case with two children: one child leaves kindergarten with a score of 75 on an 80-point reading assessment, and the other leaves kindergarten with a score of 25 of 80 possible points. If both children gain five points over the summer, a five-point gain for the child at the top of the distribution is not the same as a five-point gain for a child at the bottom of the distribution but is treated as such in change score models. Therefore, regressor variable models were used because they most adequately address the questions of interest in this study.

Aim 1: In addressing whether there is a gender difference in reading and math learning over the summer between the kindergarten and first-grade, ordinary least squares (OLS) hierarchical regression modeling was used. In the first model, unadjusted mean differences in reading and math summer learning based on gender were estimated. These unadjusted differences describe whether, on average, girls and boys who began the summer with equivalent reading and math skills start the next school year having gained different amounts. This initial step *describes* the raw test score gap whereas subsequent models help *explain* the mechanisms behind any gap. In the second model, child and family characteristics were introduced to consider adjusted gender differences in reading and math summer learning. These include time-varying and time-invariant child and family characteristics, such as race, age at assessment, family income, and marital status (Equation 1). Controlling for these factors allows for an understanding of the unique associations between gender and summer learning because it takes into account the host of other child and family factors that may be correlated with both gender and learning, and thus may give rise to a spurious association. For example, if girls were older than boys and if age was positively related to summer learning, then failing to take into account age when examining differences in summer learning between girls and boys may lead to overstating differences related to gender.

(Eq. 1) $\text{Fall1st}_{3i} = B_0 + B_1\text{SpringKG}_{2i} + B_2\text{Gender}_i + B_3\text{Child}_{1\text{-}2i} + B_4\text{Family}_{1\text{-}2i} + B_5\text{Child}_i + B_6\text{Family}_i + \varepsilon_t$

Aim 2: To determine whether gender differences in summer learning can be explained by differences in a child's level of self-control, impulsivity, or baseline achievement, two sets of OLS regression models are necessary each potential mediator. The first model (see Equation 2 for example) is essentially Equation 1 from above with the addition of parent-reported self-control and impulsivity (both behavior measures was added to the model simultaneously) or baseline achievement introduced to the model. This model estimates the association between child behavior or baseline achievement and fall of first-grade reading and math scores, adjusting for child and family characteristics; thus, this is the adjusted effect of self-control and impulsivity or baseline achievement on summer learning. In the second model (see Equation 3 for example), self-control, impulsivity, or baseline achievement were regressed on gender as well as the full set of child and family covariates.

(Eq. 2) $Fall1st_{3i} = B_0 + B_1SpringKG_{2i} + B_2Gender_i + B_3Child_{1\text{-}2i} + B_4Family_{1\text{-}2i} + B_5Child_i + B_6Family_i + B_7SelfControl_{2i} + B_8Impulsivity_{2i} + \varepsilon_t$

(Eq.3) $Self\text{-}Control_{2i} = B_0 + B_1Gender_i + B_2SpringKG_{2i} + B_3Child_{1\text{-}2i} + B_4Family_{1\text{-}2i} + B_5Child_i + B_6Family_i + \varepsilon_t$

After generating these estimates, Sobel tests of mediation were performed (Sobel, 1982) to determine whether indirect effects of gender were operating through any of the potential mediator. It is important to note that gender need not be significantly related to differences in summer learning for there to be indirect effects of gender operating through self-control, impulsivity, and baseline achievement (Kenny & Judd, 2014; Zhao, Lynch, & Chen, 2010). The actual mathematics of the calculations are explained below in the Results section (also see Figure 2).

Aim 3: The third aim was to determine whether parents provide different types and levels of cognitive stimulation based on their child's gender, and if differences in cognitive stimulation, in turn, mediate summer learning differences by gender. To accomplish this, independent samples t-tests were run to consider whether parents provided different types and levels of cognitive stimulation to their daughters vs. sons. T-tests were run to consider whether levels of overall cognitive stimulation (aggregated across all learning experiences) as well as formally academic activities differed by gender. More nuanced examinations of the specific activities and experiences were also examined across gender using t-tests. To examine whether gender differences in summer learning in reading and math could be attributed to differences in cognitive stimulation, the two sets of OLS regression models from above were run once again, replacing self-control/impulsivity/baseline achievement with cognitive stimulation (see Equations 4-5). After generating these estimates, Sobel tests of mediation were once again calculated (Sobel, 1982).

(Eq. 4) $Fall1st_{3i} = B_0 + B_1SpringKG_{2i} + B_2Gender_i + B_3Child_{1\text{-}2i} + B_4Family_{1\text{-}2i} + B_5Child_i + B_6Family_i + B_7CogStim_{3i} + \varepsilon_t$

(Eq. 5) $CogStim_{3i} = B_0 + B_1Gender_i + B_2SpringKG_{2i} + B_3Child_{1\text{-}2i} + B_4Family_{1\text{-}2i} + B_5Child_i + B_6Family_i + \varepsilon_t$

Aim 4: To consider whether parents provide different types or levels of cognitive stimulation to their daughters and sons based on their child's level of self-control, impulsivity, or achievement, a final set of OLS regression models and Sobel tests were run. In these models, self-control, impulsivity, and baseline achievement were regressed on gender and the full set of child and family covariates (Equation 3). Then, cognitive stimulation was predicted using self-control, impulsivity, or baseline achievement scores. These models were fully adjusted for child and family characteristics (Equation 6). Sobel tests of mediation were run to determine whether there were indirect effects of gender on cognitive stimulation were operating through self-control, impulsivity, or baseline achievement skills.

(Eq. 6) $CogStim_{3i} = B_0 + B_1Self\text{-}Control_{2i} + B_2Gender_i + B_3SpringKG_{2i} + B_4Child_{1\text{-}2i} + B_5Family_{1\text{-}2i} + B_6Child_i + B_7Family_i + \varepsilon_t$

3.0 RESULTS

3.1 DESCRIPTIVE STATISTICS

Table 1 presents descriptive statistics for children in the full analytic sample as a whole as well as by gender. As can be seen in Table 1, the children and families comprising the sample represented a range of sociodemographic backgrounds. In terms of race/ethnicity, the sample was diverse with approximately 55% of children identified as White, roughly 35% identified as African American or Hispanic, and 10% identified as either Asian/Native Hawaiian/Other Pacific Islander, American Indian/Alaskan Native, or multiracial. Roughly two-thirds of children had stably married parents across the kindergarten school year. The average household income at wave 2 was approximately $66,400. As can be seen from Table 1, boys tended to be in slightly wealthier homes than girls (*ES* = 0.22). Approximately 11% of children had parents who had not completed high school. The remaining 89% of children were nearly equally divided into those whose parents had completed high school/vocational training, those who had completed some college but did not hold a degree, or those who had attained a Bachelors degree or higher. Whereas the vast majority of children had a primary caregiver who was born in the United States (~81%) and lived in homes where English was the primary language, there were still over 900 children of immigrants in the sample.

Children entered kindergarten with an average reading score of 38.16 (of 100) (*SD* = 9 .42), gaining an average of 12.26 points over the school year. Over the summer, children gained roughly over six points in reading (.81 SD). Girls started and ended the kindergarten year with higher reading scores as well as gained more over the summer; however, effect size estimates show that these differences are small (roughly one-tenth of a SD for each). Given that these estimates capture the "average" experience, estimates were also calculated to determine whether there were gender differences in those who gained the most and least over the summer. In these estimates, roughly 5% more boys fell into the bottom 25th percentile in summer reading gains compared to girls; roughly 1% more girls were among the top 25th percentile in summer reading gains compared to boys. Both of the latter findings were significant.

Children entered kindergarten with an average math score of 31.44 (of 96) (SD = 10.54) in math, gaining an average of 12.68 points over the school year. Over the summer, children gained nearly eight points in math (.83 SD). As can be seen in Table 1, on average, girls and boys started and ended kindergarten with nearly identical math skills as well as gained equal amounts over summer vacation. When considering the top and bottom 25th percentiles, roughly 1% more boys fell into the bottom 25th percentile of summer math gains compared to girls; both genders were equally represented in the top 25th percentile.

Gender differences were larger in magnitude for behavioral functioning than for academic skills. Specifically, parents rated girls significantly higher on self-control (*ES* = .18) and lower on impulsivity (*ES* = .25) than boys during the spring of kindergarten.

Cognitive stimulation also differed significantly by gender with parents providing significantly higher levels of cognitive stimulation overall (*ES* = .22) and a greater number of academic activities to girls relative to boys (*ES* = .13). Gender differences were also examined within specific activities constituting cognitive stimulation, the results of which are discussed below in section 3.5 (also see Appendix C).

3.2 ARE THERE GENDER DIFFERENCES IN SUMMER LEARNING IN READING AND MATH DURING THE SUMMER BETWEEN KINDERGARTEN AND FIRST-GRADE?

Reading. Before testing for gender differences in summer learning, it is essential to establish whether there is learning or loss occurring over the summer. In the first step of the hierarchical regression analysis, fall of first-grade reading scores were regressed on spring of kindergarten reading scores. Model 1 of Tables 2-3 suggest that, on average, children gain over the summer in reading and that the literacy skills children have before starting summer break are significantly and positively related to the skills they bring into the next school year. In the second step of the regression model, unadjusted differences in summer learning between girls and boys were examined (see Tables 2-3). As can be seen in these tables, there was a small but significant difference in reading over the summer by gender. That is, girls tend to gain more in reading compared to boys, even when girls and boys end kindergarten with similar reading scores. The effect is small in magnitude but suggests that some of the reason girls start first-grade with somewhat better reading skills can be attributed to learning that occurred over summer break. Importantly, this model (and the upcoming models) were adjusted for the time between the spring of kindergarten and fall of first-grade assessments as well as for the length of summer vacation children experienced. As can be seen in Table 2, length of time between assessments was positively and significantly related to reading learning, suggesting that students who experienced a longer delay between the spring and fall reading assessments performed better on the fall of 1^{st} grade assessment (likely from any review teachers provided at the start of the school year).

After examining unadjusted gender differences in reading gains over the summer, child and family covariates were entered into the regression equation. This allowed for the determination of whether any child and family factors helped explain the relation between skills at the end of kindergarten and skills at the beginning of first-grade. As shown in Model 3 of Table 2, the introduction of these variables did not attenuate the relation between reading at the end of kindergarten and at the beginning of first-grade; this is useful information given that child and family factors are often incredibly powerful predictors of academic achievement (e.g., income). These characteristics did help explain some of the link between gender and summer learning, in particular parental educational attainment and immigrant status of the child's primary caregiver. Specifically, when children leave kindergarten with equivalent reading scores, children whose parents have a Bachelors degree or above learn significantly more in reading than children whose parents do not have a high school degree. Interestingly, when children leave kindergarten with similar reading scores, those with a primary caregiver born in the U.S. actually learn significantly *less* in reading than those whose primary caregiver was an immigrant.

Math. Again, in the first step of the hierarchical regression analysis, fall of first-grade math scores were regressed on spring of kindergarten math scores (see Model 1 of Tables 4-5). Similar to the reading models, the average child gains math skills over the summer, some of which can be attributed to their math skills prior to summer vacation. Unlike reading, there were no significant unadjusted differences in math learning over the summer by gender (see Model 2); thus, girls and boys who leave kindergarten with equivalent math skills tend to enter first-grade with equivalent math skills.

Again, child and family covariates were entered into the regression equation to examine whether these factors related to math skills a child brought to first-grade, controlling for their math skills at the end of kindergarten. As shown in Model 3 of Table 4, child and family background characteristics did not greatly attenuate the relation between math scores at the end of kindergarten and those at the start of first-grade. However, it is important to note that the previously nonsignificant gender difference becomes significant with the addition of child and family covariates; this is considered a suppression effect (i.e., rather than the coefficient being explained and thus reduced by covariates, it increases in magnitude). Essentially, after controlling for the higher likelihood of girls to have slightly more educated parents (which related to positive math gains) as well as their somewhat lower likelihood of being Hispanic (which was associated with significantly lower math gains), the gender difference in math learning is exacerbated.

Similar to reading models, certain child and family characteristics were significantly related to math skills at first-grade controlling for math skills at the end of kindergarten. Race of the child was significant in these models. That is, in the math models, African American, Hispanic, and Native American children learn significantly less math over the summer between kindergarten and first-grade than their White peers, even when starting summer vacation with similar math scores. Again, children whose parents have a college degree or higher learn significantly more math than children whose parents have less than a high school degree, even when these children start summer vacation with similar math scores.

Thus, gender was significantly related to summer learning in reading, and the gender difference grew to significance with the inclusion of covariates in math. Therefore, girls learn significantly more reading over the summer compared to boys, even when they leave kindergarten on equal footing. Boys and girls tend to learn similarly in math over the summer when they start the summer with equivalent math skills, although the models suggest that boys would score even higher in first grade math once child and family factors are taken into account. Importantly, having solid reading and math skills prior to summer vacation is significantly and positively associated with achievement scores at the start of the next school year.

3.3 DO SELF-CONTROL AND IMPULSIVITY OR BASELINE ACHIEVEMENT RELATE TO SUMMER LEARNING IN READING AND MATH?

Behavior. Parent-rated self-control and impulsivity in the spring of kindergarten were entered into the regression equation in Model 4 of Tables 2 and 4 (reading and math models, respectively). Child self-control was positively associated with summer learning in reading, although it only reached trend-level significance. Impulsivity, on the other hand, was not related to reading gains. Therefore, students who left kindergarten with equivalent reading scores but had lower levels of self-control learned somewhat less over the summer compared to their better regulated counterparts. In math models, the opposite is true. Parent rated impulsivity was significantly and negatively related to math learning over the summer. Specifically, children rated by their parents as more highly impulsive learned less math over the summer compared to children with similar math scores at the end of kindergarten but lower impulsivity. The difference in findings across math and reading suggests that behavioral functioning may play different roles in reading and math learning over the summer.

Baseline achievement. Baseline reading or math scores at the beginning of kindergarten were stepped into the final regression model (see Model 5 of Tables 2 and 4). Both reading and math skills at kindergarten entry were significantly and positively related to summer learning in each of these subjects. It is important to note that this regression model contains both fall and spring achievement score from the same school year, and both predictors are significant. This effectively means that the reading and math skills that children bring into the kindergarten classroom and the skills children end the kindergarten school year with have unique effects on first-grade achievement. Also worth noting is that baseline math skills appear to be a stronger predictor than baseline reading skills of the achievement scores earned at the fall of first-grade (*B* = 0.32 vs. *B* = 0.15).

3.4 DO SELF-CONTROL, IMPULSIVITY, AND BASELINE ACHIEVEMENT MEDIATE THE RELATIONSHIP BETWEEN GENDER AND SUMMER LEARNING IN READING AND MATH?

It is worth noting the direction of change in the gender coefficient across reading and math models with the addition of behavior and baseline achievement. In the reading models, the gender difference favoring girls was attenuated (decreased) by adding child and family covariates and stepping in self-control, impulsivity, or reading achievement at kindergarten entry to the regression models. In contrast, the gender difference in the math models favoring boys is exacerbated with the addition of the aforementioned variables. The change in the gender coefficient (either attenuation or exacerbation) suggests that some of the effect of gender on summer learning may be explained by child social and behavioral functioning and baseline academic skills.

Again, gender need not be directly related to summer learning according to the regression model (the “c” path in Figure 2), for there to be indirect effects of gender operating through self-control, impulsivity, and baseline achievement (Kenny & Judd, 2014; Zhao, Lynch, & Chen, 2010). To consider whether there are, in fact, indirect effects of gender operating through these characteristics, Sobel tests of mediation were performed (Sobel, 1982).

Indirect effects for characteristics of self-control were calculated by multiplying the a_1 path shown in Figure 2 by the b_1 path. Similarly, indirect effects for impulsivity were computed by multiplying the a_2 path by the b_2 path, and indirect effects for baseline achievement were calculated by multiplying the a_3 path by the *b3* path. The *b* paths are estimated for children's reading and math skills at first-grade by the coefficients on self-control/impulsivity, and baseline achievement take from Models 4 and 5 respectively in Table 2 (reading) and Table 4 (math). To generate estimates of the *a* paths in Figure 2, self-control, impulsivity, and baseline achievement was regressed on gender as well as the full set of child and family covariates. These models are displayed in Table 6. Indirect effects of gender operating through children's social and behavioral functioning and baseline achievement were then generated by multiplying the coefficient on the gender indicator from Table 6 by their corresponding coefficient in the model predicting children's academic skills with dimensions of self-control, impulsivity, and baseline achievement taken from Model 4-5 in Tables 2 and 4. For example, to calculate whether boys score significantly below girls in reading at fall of first-grade because they are rated as having lower levels of self-control, one would multiply the coefficient for "boy" in Table 6 predicting self-control (-0.07) by the coefficient for self-control predicting summer learning in reading in Model 4 of Table 2 (0.42). The statistical significance of the indirect effect is then tested by dividing the indirect effect by its standard error.

Self-control and impulsivity as mediators.

There were no statistically significant indirect effects of self-control or impulsivity that explained the association between gender and reading/math summer learning. There was a trend-level indirect effect of impulsivity on math learning, such that parents rated boys as significantly higher on impulsivity compared to girls, which in turn related to lower math skills at first-grade (Sobel z-statistic: -1.93, *p* = .05).

Baseline achievement as a mediator.

Gender was also associated with summer learning in reading via its association with baseline reading skills. Specifically, there was a significant indirect effect of gender on reading learning over the summer via the relation between gender and baseline reading skills at kindergarten entry. Girls tended to enter kindergarten with better-developed basic reading skills, and as such, tended to gain significantly more over the summer compared to boys (Sobel z-statistic: .92, p = .005). This however, was not the case for math learning.

3.5 IS COGNITIVE STIMULATION RELATED TO SUMMER LEARING IN READING OR MATH?

Tables 3 and 5 show the reading and math models with cognitive stimulation included in the regression equation. Model 1 includes the composite cognitive stimulation measure. Both reading and math models were also run using the number of academic activities as the measure of cognitive stimulation; because results were similar but smaller in magnitude, only the composite measure is shown in the tables (available upon request). As can be seen in Model 1 of Table 3, overall levels of cognitive stimulation relate to reading but not math learning over the summer.

A more nuanced examination of the specific activities parents reportedly provided for their children illustrated that only a few items significantly related to reading and/or math learning over the summer. A more nuanced examination of the specific activities parents reportedly provided for their children illustrated that only a few items significantly related to reading and/or math learning over the summer. Specifically, children who read books/looked at books by themselves gained significantly more in reading over the summer compared to children who did not engage in this activity but had the same level of reading skills at the beginning of summer vacation (B = .47, SE = .14). Being read to, however, was only related to reading growth at trend-level (p = .097). Additionally, the frequency of visits to libraries/bookstores (B = .55, SE = .14) and visiting art galleries/museum/historical sites (B = .27, SE = .14) was significantly and positively to reading growth over the summer. Children who left kindergarten with the same reading and math skills but played outside more often in the summer learned less reading and math. Of the activities parents reported engaging their child in over the summer, only one activity trended towards significance in the positive direction; visiting art galleries/museums/historical sites was somewhat related to better math gains (B = .26, SE = .14, p = .075). Interestingly, children who attended more story times at the library/bookstore, visited a large city outside of their hometown, or attended computer, academic, or music/performing arts camps learned less math over the summer than children with similar math skills who did not engage in those summer activities.

3.6 DO PARENTS PROVIDE DIFFERENT TYPES AND LEVELS OF COGNITIVE STIMULATION BASED ON THEIR CHILD'S GENDER?

As hypothesized in Aim 3 above, parents do provide different types and levels of cognitive stimulation to daughters compared to sons. Table 1 provides the average overall level of cognitive stimulation children experienced, aggregated across formal academic activities and informal learning experiences (e.g., trips to the zoo). There is also a measure of the average number of formal academic activities to which children were exposed. Results suggest that parents provide significantly more overall cognitive stimulation and more specifically academic activities to girls compared to boys (*ES* = .24 and *ES* = .13, respectively).

Gender differences were also examined in a more nuanced fashion by investigating the specific activities and experiences that fell under the "cognitive stimulation" construct (see Appendix C). As evident from Appendix C, there are more similarities than differences, especially when considering less academically-focused activities. In general, parents tend to provide similar amounts of reading time to children, encourage them to use the computer for educational purposes at the same rate, and take children to museums, galleries, zoos, parks, beaches, and other informal learning experiences at the same rate. Parents also provide children with similar camp experiences (e.g., similar rate of computer camp, art camp), tutoring in reading and math, and summer school. Parents were more likely to provide daughters with more academically-focused cognitive stimulation compared to boys. Specifically, girls were provided with more math (*ES* = .13, trend) and writing activities (*ES* = .32), were read to more often or looked at book on their own more often than boys. Girls were also taken on more trips to the library, plays/concerts, and enrolled in music/performing arts camps. Boys, on the other hand, were significantly more likely to engage in active outdoor play (e.g., running) than girls (*ES* = .14).

3.7 DO PARENTS PROVIDE DIFFERENT TYPES AND LEVELS OF COGNITIVE STIMULATION BASED ON THEIR CHILD'S BEHAVIOR AND ACADEMIC FUNCTIONING?

To address whether parents provided different types and levels of cognitive stimulation based on their child's self-control and impulsivity, regression analyses were run predicting cognitive stimulation with each of the potential mediators (see Table 7). Note that these models are fully adjusted for each of the child and family characteristics included in the previous tables. As can be seen from the table, children who exhibited more self-control and less impulsivity were provided with significantly more cognitive stimulation. Children who had higher baseline reading and math skills were also provided with somewhat more cognitive stimulation than children who had weaker reading and math skills at kindergarten entry.

Moreover, because girls were hypothesized to exercise more self-control and exhibit lower impulsivity than boys, parents were expected to provide more cognitive stimulation and academically-oriented activities to girls, which would in turn help mediate the relation between gender and cognitive stimulation. Again, Table 6 shows that boys were rated significantly lower than girls on self-control and significantly higher than girls on impulsivity. Moreover, Table 6 also shows that girls earned significantly higher baseline reading scores than boys, although there was not a significant difference in math. To consider whether there were indirect effects of gender on cognitive stimulation operating through self-control, impulsivity, or baseline academic skills, Sobel tests of mediation were once again performed (Sobel, 1982). The method for calculating the indirect effects is identical to the method used above to determine if self-control, impulsivity, and baseline achievement mediated the relation between gender and summer learning. Here, the goal is to determine whether parents provide their daughters vs. sons with different levels of cognitive stimulation based on the behavioral and academic functioning of their child. To generate estimates of the *a* paths in Figure 2, self-control, impulsivity, and baseline achievement were regressed on gender as well as the full set of child and family covariates (see Table 6). Indirect effects of gender operating through children's social and behavioral functioning and baseline achievement were then generated by multiplying the coefficient on the gender indicator from Table 6 by their corresponding coefficient in the model predicting cognitive stimulation with dimensions of self-control, impulsivity, and baseline achievement taken from Table 7. For example, to calculate whether boys receive less cognitive stimulation than girls because they are rated as having lower levels of self-control, one would multiply the coefficient for boy in Table 6 predicting self-control (-.08) by the coefficient for self-control predicting cognitive stimulation in reading in Table 7 (.10). The statistical significance of the indirect effect is then tested by dividing the indirect effect by its standard error.

Formal tests of mediation show that gender was associated with cognitive stimulation through its relation to self-control and impulsivity but not baseline achievement. Specifically, on average, parents provided daughters with more cognitive stimulation than sons because girls were significantly more regulated (Sobel test statistic = 3.30, p = .001) and less impulsive (Sobel test statistic = -2.79, p = .005).

4.0 DISCUSSION

The current study had several aims. First, it examined associations between gender and math and reading learning over the summer between kindergarten and first-grade. Second, it examined whether factors at different contextual layers explained summer learning differences. Specifically, behavioral and academic skills (individual-level) and cognitive stimulation over the summer (microsystem-level) were investigated as potential mediators of the relation between gender and summer learning. Lastly, the current study considered whether the cognitive stimulation parents provided over the summer was related to their child's behavioral and academic skills. The present study is the first to investigate whether behavioral skills relate to learning that takes place over the summer as well as whether any gender differences in summer learning can be attributed to a differences in behavioral functioning. Furthermore, it adds to the growing literature on how children's individual characteristics are associated with the parenting they receive, an area of study heretofore underdeveloped especially with regards to summertime learning.

4.1 KEY FINDINGS

The main findings of the current study can be organized into four conclusions.

4.1.1 Children, on average, gain in math and reading over the summer.

First, on average, children gained, not lost, ground in math and reading over the summer. Specifically, children gained roughly 54% of the reading gains and 60% of the math gains over summer vacation as they made over the entire kindergarten year. That is, children are essentially making over half of the gains made during a [typically] 180-day school year in roughly 78 days of summer.

This result appears to contradict previous research showing that children tend to lose skills over the summer, especially in math (e.g., Cooper et al., 1996; Downey et al., 2004; Entwisle & Alexander, 1992; Entwisle et al., 2007; Heyns, 1978). It is likely that the difference in findings is related to differences in the samples, methods, and time periods of the studies. More specifically, Entwisle and colleagues (2007) used data collected in 1982 on an exclusively economically disadvantaged sample of children from Baltimore. Heyns' (1978) classic study of summer learning loss focused on middle-school aged youth in Atlanta in the mid-1970s. Cooper et al. (1996) conducted a meta-analysis of 13 studies that revealed overall summer learning loss, especially for lower-SES children, but this study also included children across a range of ages and grade-levels. Moreover, Cooper et al. (1996) analyzed studies from 1975-1994, which brings into question the generalizability of their findings to this generation of young learners. Conversely, Burkam et al. (2004) used a more current dataset similar to the present study and found that children across social lines gained on average in literacy and math in summer, although how much they gained differed by SES. Based on the prior research, it appears that lower-income children tend to lose and middle to higher-income children are more likely to gain. Because the current study included up-to-date nationally representative data with a wide-range of income levels and one grade-level, it is perhaps unsurprising that findings differ.

It is also possible that parents and teachers have become more sensitive to the idea of using summer time to facilitate academic growth. Within the past decade, summer learning has gained momentum and media attention as a mechanism by which children can maintain the skills learned over the last school year and acquire new academic skills to bring into the next school year. In fact, summer learning was cited in President Obama's campaign booklet, "Blueprint for Change," as a way to reduce high school dropout and close the achievement gap (Obama, 2008, p. 23); and as of 2009, there is an established National Summer Learning Association that focuses on promoting summer learning and diminishing summer slide. With the media spotlight and studies suggesting that children slide backwards in the summer without enriching activities, parents and teachers may be making more attempts to keep students engaged during the summer.

4.1.2 Girls gain more in reading than boys, even when they begin summer vacation with similar reading scores, although this is not the case for math.

The second conclusion is that girls tend to gain more in reading over summer vacation compared to boys, even when they start the summer with similar reading skills. This was also true when examining overall average gains over the summer (unadjusted gain scores); girls, on average, gained more in reading compared to boys. Based on these unadjusted means, girls were also more likely to fall into the top 25th percentile of reading gains compared to boys who were more likely to fall into the lowest 25th percentile. Although gender differences in summer learning have been largely understudied, similar to the current study, Slates and colleagues' (2012) found that girls were twice as likely as boys to be categorized as exceptional summer learners (ESLs) in reading and to gain significantly more in reading over the four summers of the study. Several studies note that girls tend to start kindergarten ahead of their male peers and gain somewhat more over the course of the year, although the magnitude of the differences tends to be small. This study is no exception; it does appear that girls have a slight advantage in reading at kindergarten entry and learn slightly more over the school year and summer vacation.

Previous research also notes that gender differences in math tend to be small or nonsignificant in young children but grows as children enter higher grade levels (e.g., Hyde et al., 1990; Fryer & Levitt, 2009). For example, using the ECLS-K, Fryer and Levitt (2009) found that, despite there being no gender difference in math at kindergarten entry, boys outscore girls by more than 0.20 standard deviations in math by fifth-grade; this is the equivalent of 2.5 months of classroom learning. Again, there is little summer learning research to draw from, but Slates et al. (2012) (see above) found that girls and boys tended to gain similarly in math.

One potential reason girls and boys gained similarly in math but not reading is that parents tend to concentrate more on literacy development than math (e.g., Barbarin et al., 2008). This was evident in the present study as well; parents tended to provide more literacy-specific activities compared to math-specific activities (see Appendix C). Moreover, parents report nearly the same frequency of math-specific activities for girls and boys (on average, once or twice a week), lending support to the notion that girls and boys both experience low math exposure. Along this line, Tudge and Doucet (2004) found that, during 18 hours of observation in a variety of setting and over the course of several days, children were exposed to 1 of 180 math lessons or activities. If the findings from Tudge and Doucet (2004) can be generalized to the experiences of children in the present study, essentially less than 1% of children's time was spent on math over the summer. It may also be that the type of math exposure children experienced over the summer was not especially useful in math development. Siegler and Ramani (2009) found that informal number activities such as playing board games helped children learn new math problems more so than simple math task training. Thus, it may be that girls and boys were equally exposed to low levels of math activities, some of which may not have been especially useful.

4.1.3 Self-control is related to reading gains, impulse-control is related to math gains, and both of these relate to cognitive stimulation received.

Third, self-control and impulsivity related to summer learning, although somewhat differently than hypothesized. Specifically, children who leave kindergarten with better self-control learn somewhat more reading over the summer compared to those who leave kindergarten with equivalent reading skills but less self-control. Impulse-control, on the other hand, was significantly related to math gains over the summer. Neither self-control nor impulsivity were significant mediators of the relationship between gender and reading/math, although there was a suggestion that boys would have performed even better in math compared to girls if their higher levels of impulsivity were taken into account. This corroborates past findings that better regulated children generally learn more than those who struggle with self- and impulse-control (Clark, Pritchard, & Woodward, 2010) because they are better able to pay attention and keep themselves on track and engaged, which allows them to hone previously learned skills or acquire new skills (Vohs & Baumeister, 2004). These findings also support research suggesting that girls have the upper-hand in behavioral regulation from a young age (Gurian, 2011).

A logical question arises from the current study's findings; why was self-control not predictive of math gains and why was impulsivity not predictive of reading gains? These results, however, do align with past research. For example, Clark and colleagues (2012) found that three-year-old children who struggled with impulsivity and attention had weaker math skills at kindergarten. Similarly, Welsh and colleagues (2010) found that working memory and attention control related to gains in reading and math skills in children in Head Start the year before kindergarten. It is important to keep in mind that children made equivalent gains in both math and reading over the summer, and thus what seemed to boost reading growth did not seem to boost math growth and vice versa. Thus, it is possible that the behavioral skills that benefit reading may differ from those that benefit math skill development over the summer months. As Muraven and Baumeister (2000) note, solving math problems may not require self-control per se; that is, the ability to inhibit desires, emotions, or behaviors, unlike other tasks.

Another possibility is that summer math learning, especially at such a young age, relies more on prior math skill than behavioral functioning whereas summer reading learning relies more on behavioral functioning. The results of this study lend credence to this possibility. Self-control and impulsivity were stronger predictors of reading learning over the summer than was baseline reading skills at kindergarten entry, whereas baseline math skills were much more predictive of math gains compared to self-control and on par with the effect of impulsivity. In fact, kindergarten math skills were twice as predictive of first-grade math skills as kindergarten reading skills were of first-grade reading. This aligns with the findings of Duncan et al.'s (2008) study of longitudinal associations between early and later academic outcomes, namely that math skill at kindergarten entry was more strongly predictive of later achievement than early reading, attention, or socioemotional skills. These results highlight the importance of solid math skills at kindergarten entry, and aligns well with Cunha and Heckman's (2008) model of skill formation and dynamic systems theory (Thelen, 2005) that suggests prior skills form the foundation upon which more complex skills are built. Additionally, findings of the current study suggest that different strategies are likely necessary to boost math growth over the summer compared to reading.

4.1.3 Children's characteristics are associated with the cognitive stimulation parents provide over the summer

The current study found that children who exhibited more self-control and less impulsivity were provided with significantly more cognitive stimulation. Furthermore, children who had higher baseline reading and math skills were also provided with somewhat more cognitive stimulation than children who had weaker reading and math skills at kindergarten entry. These findings support past work that children's behavioral and academic skills are associated with the parenting they experience. That is, child characteristics are important evictors of parenting behaviors. For instance, in a recent study, Ansari and Crosnoe (2015) found that parents changed their parenting strategies in relation to their child's academic skills and behavioral skills. In their study, parents who were considered "at-risk" (i.e., high level of spanking, television watching, and low level of investment) when their children were two-years-old were much more likely to transition to the "high investor" category (i.e., the profile of parentings linked to school readiness) at kindergarten entry when their children had better reading skills and lower behavior problems. Parents were two-thirds less likely to transition to more optimal parenting if their child had high behavior problems compared to average behavior problems (Ansari & Crosnoe, 2015).

Results of the current study also suggest that parents provided different types and levels of cognitive stimulation to girls compared to boys. Specifically, parents provided girls with more cognitive stimulation and more academically-focused cognitive stimulation (e.g., more trips to library, plays/concerts, and writing activities) and encouraged more active outdoor play (e.g., running) for their sons. Results also suggest that children's behavioral skills at least partially explained differences in the activities parents provided to their daughters compared to their sons. Specifically, parents provided daughters with more cognitive stimulation overall and more academically-focused activities than sons because girls were significantly higher in self-control and less impulsive. These findings can be understood using dynamic systems theory (Thelen, 2005). Specifically, parents create environments and choose experiences for their children based in part on their child's characteristics, including their gender, behavior, and academic skills. To the author's knowledge, this is the first study of summer learning to consider how children's characteristics relate to the summer activities parents provide.

4.2 STRENGTHS AND LIMITATIONS

The current study had several strengths including the use of a nationally representative, large-scale, dataset with the most up-to-date data on summer learning. However, there were also limitations.

First, this study was only able to examine learning during the summer between kindergarten and first-grade, and thus it cannot offer insight into how summer learning changes or remains stable across individuals, time, or grade-level. However, capturing learning during the earliest years of formal education when children are laying down the foundation for future learning is a worthwhile endeavor. Understanding how behavior, academic skills, and activities relate to summer learning before a child enters a new grade is useful; the findings of this study suggest that behavioral functioning is one potential avenue for intervention in considering how to boost reading learning in future first-graders.

A second limitation is that this study focused on summer learning in a purely academic sense. However, children likely learn social and behavioral skills over the summer. Unfortunately, the ECLS-K:2011 did not measure self-control and impulsivity in the fall of first-grade, so changes in these social behaviors could not be examined. There is some evidence that summer learning program attendance can increase social and behavioral skills (cite), but this is still a relatively nascent area of research, especially as it pertains to this young age group.

A third limitation is that gender differences in summer learning may be especially pronounced for certain subgroups, which possibility was not explored in the current study. For example, it is possible that boys in lower-income homes may experience more summer learning loss than girls in similar homes. Further, this study suggests that African American children learn more in reading compared to White children who left kindergarten with roughly the same reading skills (after adjusting for covariates). An extension of the current study is planned to explore gender differences in children from different racial/ethnic groups and parental education levels.

4.3 CONCLUSIONS

The results of the current study contribute to the growing knowledge base of summer learning, but in a perhaps more positive direction compared to the losses described in previous research. It appears that generally children gain about half the amount of reading and math skills over the summer as they do during the school year. Nevertheless, there are still children who start the summer below their peers and learn less over the summer, and thus fall further behind. Moreover, children who are the most likely to gain in the summer are those who are higher in self-control and lower in impulsivity. There may be two reasons for this result. First, those children are likely to be able to gain more from learning interactions because they can attend to the information better. Second, parents provide more cognitive stimulation and academic learning experiences to children who are better controlled. Thus, children who are struggling behaviorally may also be at risk for experiencing fewer academic activities over the summer, which could put them behind during the next school year compared to children who were exposed to more academic enrichment.

Finally, this study adds to the growing literature base that emphasizes children as elicitors of parenting. Parents do, in fact, adjust their parenting in accord with their child's behavior. In fact, after controlling for self-control and impulsivity, parents actually provide girls and boys with similar learning experiences.

In conclusion, summer learning is a rich time for growth in both academic and behavioral domains. If improving behavioral skills over the summer can in turn improve academic skills, then interventions to target behavioral functioning may represent a cost-effective mechanism to support learning over the summer and the school year.

APPENDIX A

TABLES

Table 1: Weighted Descriptive Statistics for Full Reading Sample and by Gender

	Full ($N \approx 4,800$) M or % (SD)	Boys ($N \approx 2,500$) M or % (SD)	Girls ($N \approx 2,300$) M or % (SD)
Child gender: Boy	51.54%		
Academic skills			
Reading			
IRT scores—Fall KG (baseline)	38.16	37.74	38.60**
	(9.42)	(9.48)	(9.35)
IRT scores—Spring KG	50.42	49.78	51.09***
	(11.05)	(11.14)	(10.91)
IRT scores—Fall 1st	56.99	56.19	57.83***
	(13.22)	(13.27)	(13.13)
Gain score (standardized)	0.81	0.79	0.82*
	(0.40)	(0.41)	(0.38)
Bottom 25th percentile in summer gain	25.56%	28.08%**	22.92%
Top 25th percentile in summer gain	23.43%	22.75%	24.14%**
Math			
IRT scores—Fall KG (baseline)	31.44	31.58	31.29
	(10.54)	(10.77)	(10.28)
IRT scores—Spring KG	44.12	44.21	44.02
	(10.63)	(10.86)	(10.39)
IRT scores—Fall 1st	51.91	52.19	51.62
	(12.98)	(13.34)	12.59)
Gain score (standardized)	0.83	0.83	0.83
	(0.37)	(0.37)	(0.37)
Bottom 25th percentile in summer gain	25.06%	25.62%$^{+}$	24.48%
Top 25th percentile in summer gain	24.57%	24.42%	24.74%
Behavioral Functioning			
Parent-rated self-control	2.94	2.90	2.99***
	(0.50)	(0.50)	(0.49)
Parent-rated impulsivity	1.91	1.99***	1.82
	(0.67)	(0.69)	(0.64)
Covariates			
Time between assessments	5.76	5.74	5.77
	(0.81)	(0.80)	(0.82)
Length of summer vacation (days)	77.81	77.85	77.76
	(8.19)	(8.05)	(8.35)
Child covariates:			
Child race:			
White	55.57%	55.95%	55.17%

African American	12.15%	11.92%	12.39%
Hispanic	22.37%	22.91%	21.81%
Asian	3.75%	2.82%	4.74%**
Native American	1.87%	1.68%	2.08%
Multiracial	4.28%	4.72%	3.81%
Age at fall of 1st grade assessment	79.21	79.62***	78.78
	(4.30)	(4.40)	(4.15)
Family and household covariates			
Income at Spring of KG (continuous)	$66,411	$66,996***	$65,794
	($5,393)	($5,443)	($5,337)
Primary language of home non-English	13.60%	13.86%	13.32%
Mother born in the United States	80.71%	81.92%+	79.43%
Parental education:			
Below high school degree	11.41%	11.47%	11.35%
High school degree/vocational training	27.55%	28.03%	27.05%
Some college, no degree	28.95%	28.45%	29.49%
Bachelors degree or higher	29.86%	28.95%	30.80%
Number of siblings	1.51	1.54	1.48
	(1.13)	(1.20)	(1.06)
Stably married primary caregiver	63.98%	62.94%	65.09%
Cognitive stimulation over summer			
Cognitive stimulation composite	0.03	-0.02	0.08***
	(0.45)	(0.43)	(0.46)
Number of academic activities	5.56	5.49	5.63**
	(1.07)	(1.12)	(1.00)

Notes. Significant differences between boys and girls are indicated with superscripts. The superscript is placed in either column depending on the direction of the difference. *** $p < .001$. ** $p < .01$. * $p < .05$. + $p < .10$.

Table 2: Hierarchical Models Predicting Fall 1st Grade Reading with Gender, Child and Family Covariates, and Child Characteristics

	Model 1 B (SE)	Model 2 B (SE)	Model 3 B (SE)	Model 4 B (SE)	Model 5 B (SE)
Reading--Spring KG	1.00***	1.01***	1.00***	1.00***	0.92***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Boy		-0.41*	-0.35+	-0.24	-0.30
		(0.18)	(0.21)	(0.21)	(0.22)
Time between assessments		1.20***	1.81***	1.83***	1.98***
		(0.11)	(0.15)	(0.15)	(0.16)
Length of summer vacation		0.00	0.00	-0.01	0.00
		(0.02)	(0.02)	(0.02)	(0.02)
Covariates					
Age at fall 1st assessment			-0.03	-0.02	-0.08**
			(0.03)	(0.03)	(0.03)
Race: African American			0.81+	0.87*	0.87*
			(0.42)	(0.43)	(0.44)
Hispanic			-0.03	-0.13	-0.10
			(0.33)	(0.34)	(0.34)
Asian			0.59	0.55	0.95+
			(0.50)	(0.50)	(0.52)
Native American			0.68	0.76	0.74
			(0.79)	(0.80)	(0.84)
Multiracial			0.53	0.54	0.45
			(0.54)	(0.55)	(0.54)
Primary language non-English			-0.04	-0.03	-0.08
			(0.38)	(0.38)	(0.40)
Income			0.00	0.00	0.00
			(0.00)	(0.00)	(0.00)
Parental education:					
High school/vocational			0.24	0.19	-0.06
			(0.35)	(0.36)	(0.38)
Some college, no degree			0.31	0.25	0.02
			(0.39)	(0.40)	(0.42)
Bachelors degree or higher			0.97*	0.89*	0.31
			(0.42)	(0.43)	(0.45)
Number of siblings			-0.07	-0.05	-0.07
			(0.09)	(0.10)	(0.10)
Stably married			0.33	0.32	0.64*
			(0.24)	(0.25)	(0.26)
Mother born in US			-1.42***	-1.44***	-1.09**
			(0.34)	(0.35)	(0.36)
Child characteristics					

Parent-rated self-control				0.42+ (0.24)	
Parent-rated impulsivity				-0.22 (0.18)	
Reading--Fall KG (baseline)					0.15*** (.02)
Intercept	6.63*** (0.46)	0.14 (1.49)	-1.01 (2.44)	-1.84 (2.62)	0.75 (2.54)

Notes. *N range*= 4,800-3,250. *** $p < .001$. ** $p < .01$. * $p < .05$. + $p < .10$. Each racial/ethnic group is compared to the omitted category of White. Each parental education group is compared to the reference group of below high school.

Table 3: Hierarchical Models Predicting Fall 1st Grade Reading With Gender, Child and Family Covariates, Cognitive Stimulation, and Child Characteristics

	Model 1 B (SE)	Model 2 B (SE)	Model 3 B (SE)	Model 4 B (SE)
Reading--Spring KG	1.00***	1.00***	1.00***	0.91***
	(0.01)	(0.01)	(0.01)	(0.02)
Boy	-0.27	-0.21	-0.17	-0.25
	(0.21)	(0.22)	(0.22)	(0.22)
Time between assessments	1.78***	1.79***	1.79***	1.93***
	(0.16)	(0.16)	(0.16)	(0.16)
Length of summer vacation	0.00	-0.01	-0.01	0.00
	(0.02)	(0.02)	(0.02)	(0.02)
Covariates				
Age at fall 1st assessment	-0.02	-0.02	-0.02	-0.08**
	(0.03)	(0.03)	(0.03)	(0.03)
Race: African American	0.72+	0.72	0.78+	0.82+
	(0.43)	(0.44)	(0.44)	(0.45)
Hispanic	-0.02	-0.07	-0.09	-0.09
	(0.34)	(0.34)	(0.34)	(0.35)
Asian	0.41	0.37	0.41	0.75
	(0.51)	(0.51)	(0.52)	(0.54)
Native American	0.61	0.71	0.76	0.75
	(0.83)	(0.83)	(0.84)	(0.89)
Multiracial	0.59	0.59	0.59	0.52
	(0.55)	(0.57)	(0.56)	(0.55)
Primary language non-English	0.14	0.16	0.16	0.14
	(0.39)	(0.39)	(0.39)	(0.42)
Income	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Parental education:				
High school/vocational	0.13	0.13	0.11	-0.14
	(0.37)	(0.37)	(0.37)	(0.39)
Some college, no degree	0.16	0.15	0.15	-0.10
	(0.41)	(0.41)	(0.41)	(0.43)
Bachelors degree or higher	0.67	0.64	0.65	0.05
	(0.44)	(0.44)	(0.44)	(0.47)
Number of siblings	-0.05	-0.02	-0.03	-0.05
	(0.10)	(0.10)	(0.10)	(0.10)
Stably married	0.34	0.34	0.32	0.64*
	(0.25)	(0.25)	(0.25)	(0.26)
Mother born in US	-1.50***	-1.52***	-1.49***	-1.17**
	(0.35)	(0.35)	(0.35)	(0.37)
Cognitive stimulation (composite)[a]	1.15***	1.14***	1.16***	1.05***
	(0.25)	(0.25)	(0.25)	(0.26)

Child characteristics				
Parent-rated self-control		0.37^{+}		
		(0.22)		
Parent-rated impulsivity			-0.31^{+}	
			(0.16)	
Reading--Fall KG (baseline)				0.15^{***}
				(0.02)
Intercept	-0.89	-1.91	-0.25	0.93
	(2.51)	(2.61)	(2.55)	(2.60)

Notes. *N range*= 3,550-3,100 *** p < .001. **p < .01. * p < .05. $^{+}$ p < .10. Each racial/ethnic group is compared to the omitted category of White. Each parental education group is compared to the reference group of below high school.

[a] A model was also run using the number of academic cognitive stimulation activities rather than the composite of cognitive stimulation; the coefficient was also positive and significant but weaker in magnitude (*B* = 0.37, *SE* = 0.10).

Table 4: Hierarchical Models Predicting Fall 1st Grade Math With Gender, Child and Family Covariates, and Child Characteristics

	Model 1 B (SE)	Model 2 B (SE)	Model 3 B (SE)	Model 4 B (SE)	Model 5 B (SE)
Math--Spring KG	0.99***	1.00***	0.99***	0.99***	0.75***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Boy		0.30	0.53*	0.60**	0.49*
		(0.19)	(0.22)	(0.22)	(0.22)
Time between assessments		1.31***	2.50***	2.47***	2.55***
		(0.12)	(0.16)	(0.16)	(0.18)
Length of summer vacation		0.01	-0.01	-0.01	-0.02
		(0.02)	(0.02)	(0.02)	(0.02)
Covariates					
Age at fall 1st assessment			0.02	0.03	-0.04
			(0.03)	(0.03)	(0.03)
Race: African American			-0.98*	-1.08*	-1.31**
			(0.44)	(0.45)	(0.45)
Hispanic			-1.07**	-1.14**	-0.81*
			(0.35)	(0.35)	(0.36)
Asian			-0.44	-0.39	-1.08*
			(0.52)	(0.53)	(0.54)
Native American			-1.44+	-1.53+	-2.00*
			(0.82)	(0.83)	(0.86)
Multiracial			-0.02	-0.06	-0.22
			(0.57)	(0.57)	(0.55)
Primary language non-English			-0.41	-0.44	-0.58
			(0.39)	(0.40)	(0.41)
Income			0.00	0.00	0.00
			(0.00)	(0.00)	(0.00)
Parental education:					
High school/vocational			-0.20	-0.30	-0.89*
			(0.37)	(0.37)	(0.38)
Some college, no degree			0.07	-0.01	-0.52
			(0.41)	(0.41)	(0.42)
Bachelors degree or higher			1.15**	1.07*	0.20
			(0.44)	(0.44)	(0.45)
Number of siblings			-0.06	-0.07	0.00
			(0.10)	(0.10)	(0.10)
Stably married			-0.46+	-0.39	-0.42
			(0.25)	(0.26)	(0.26)
Mother born in US			-0.38	-0.35	-0.26
			(0.36)	(0.36)	(0.37)
Child characteristics					
Parent-rated self-control				0.03	

				(0.25)	
Parent-rated impulsivity				-0.38*	
				(0.19)	
Math--Fall KG (baseline)					0.32***
					(0.02)
Intercept	7.93***	-0.40	-6.49*	-5.70*	0.34
	(0.45)	(1.63)	(2.54)	(2.72)	(2.68)

Notes. *N range*= 4,850-3,250. *** $p < .001$. **$p < .01$. * $p < .05$. $^{+}$ $p < .10$. Each racial/ethnic group is compared to the omitted category of White. Each parental education group is compared to the reference group of below high school.

Table 5: Hierarchical Models Predicting Fall 1st Grade Math With Gender, Child and Family Covariates, Cognitive Stimulation, and Child Characteristics

	Model 1 B (SE)	Model 2 B (SE)	Model 3 B (SE)	Model 4 B (SE)
Math--Spring KG	0.99***	0.99***	0.99***	0.75***
	(0.01)	(0.01)	(0.01)	(0.02)
Boy	0.50*	0.52*	0.56*	0.46*
	(0.22)	(0.22)	(0.22)	(0.22)
Time between assessments	2.57***	2.55***	2.54***	2.62***
	(0.16)	(0.16)	(0.16)	(0.18)
Length of summer vacation	-0.02	-0.02	-0.02	-0.03
	(0.02)	(0.02)	(0.02)	(0.02)
Covariates				
Age at fall 1st assessment	0.02	0.02	0.02	-0.05+
	(0.03)	(0.03)	(0.03)	(0.03)
Race: African American	-1.17*	-1.31**	-1.24**	-1.51***
	(0.45)	(0.46)	(0.46)	(0.47)
Hispanic	-0.96**	-1.01**	-1.01**	-0.68+
	(0.35)	(0.36)	(0.36)	(0.36)
Asian	-0.34	-0.36	-0.31	-1.06+
	(0.53)	(0.53)	(0.54)	(0.55)
Native American	-1.70*	-1.90*	-1.80*	-2.38**
	(0.86)	(0.87)	(0.87)	(0.90)
Multiracial	-0.19	-0.25	-0.24	-0.41
	(0.58)	(0.58)	(0.58)	(0.56)
Primary language non-English	-0.36	-0.42	-0.39	-0.53
	(0.40)	(0.41)	(0.41)	(0.42)
Income	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Parental education:				
High school/vocational	-0.03	-0.11	-0.17	-0.74+
	(0.38)	(0.38)	(0.38)	(0.39)
Some college, no degree	0.21	0.11	0.08	-0.40
	(0.42)	(0.43)	(0.43)	(0.43)
Bachelors degree or higher	1.29**	1.19*	1.16*	0.35
	(0.46)	(0.46)	(0.46)	(0.47)
Number of siblings	-0.04	-0.04	-0.06	0.01
	(0.10)	(0.10)	(0.10)	(0.10)
Stably married	-0.45+	-0.41	-0.38	-0.42
	(0.26)	(0.26)	(0.26)	(0.26)
Mother born in US	-0.32	-0.35	-0.31	-0.21
	(0.37)	(0.37)	(0.37)	(0.37)
Cognitive stimulation (composite)[a]	0.21	0.23	0.24	0.17
	(0.26)	(0.26)	(0.26)	(0.26)

Child individual characteristics				
Parent-rated self-control		0.22		
		(0.23)		
Parent-rated impulsivity			-0.29^{+}	
			(0.17)	
Math--Fall KG (baseline)				0.32^{***}
				(0.02)
Intercept	-6.38^{*}	-6.77^{*}	-5.54^{*}	0.84
	(2.59)	(2.70)	(2.63)	(2.74)

Notes. *N range*= 4,350-3,900. *** p < .001. **p < .01. * p < .05. $^{+}$ p < .10. Each racial/ethnic group is compared to the omitted category of White. Each parental education group is compared to the reference group of below high school.

[a] A model was also run using the number of academic cognitive stimulation activities rather than the composite of cognitive stimulation; the coefficient was also nonsignificant (*B* = 0.00, *SE* = 0.11).

Table 6: Adjusted Differences in Self-control, Impulsivity, Baseline Achievement, and Cognitive Stimulation by Gender

	Self-control	Impulsivity	Baseline Reading	Baseline Math	Cog Stim.[a]
	B (SE)	B (SE)	B (SE)	B (SE)	B (SE)
Boy	-0.07***	0.15***	-0.92**	0.31	-0.10***
	(0.02)	(0.02)	(0.30)	(0.33)	(0.01)
Time between assessments	0.00	-0.02	-0.46+	-0.61*	0.00
	(0.01)	(0.01)	(0.24)	(0.25)	(0.01)
Length of summer vacation	0.00	0.00	0.00	0.02	0.00
	(0.00)	(0.00)	(0.03)	(0.03)	(0.00)
Covariates					
Age at fall 1st assessment	0.00	0.00	0.34***	0.49***	0.00
	(0.00)	(0.00)	(0.04)	(0.04)	(0.00)
Race: African American	0.03	0.06	-0.27	-2.72***	0.09**
	(0.03)	(0.04)	(0.62)	(0.67)	(0.03)
Hispanic	0.03	-0.06	-0.78	-2.49***	-0.01
	(0.02)	(0.03)	(0.49)	(0.53)	(0.02)
Asian	0.03	0.11*	3.31***	3.03***	0.12***
	(0.04)	(0.05)	(0.74)	(0.80)	(0.03)
Native American	0.05	0.10	-1.85	-1.23	0.11*
	(0.06)	(0.08)	(1.19)	(1.28)	(0.05)
Multiracial	-0.05	0.10+	0.95	-0.03	0.00
	(0.04)	(0.06)	(0.76)	(0.82)	(0.04)
Non-English home lang.	-0.02	0.06	-2.40***	-1.87**	-0.15***
	(0.03)	(0.04)	(0.56)	(0.61)	(0.03)
Income	0.00**	0.00***	0.00***	0.00***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Parental Education:					
High school/vocational	0.09**	-0.10**	1.58**	2.09***	0.14***
	(0.03)	(0.04)	(0.53)	(0.57)	(0.02)
Some college, no degree	0.13***	-0.06	2.57***	3.57***	0.20***
	(0.03)	(0.04)	(0.58)	(0.62)	(0.03)
Bachelors degree or higher	0.16***	-0.10*	5.64***	6.41***	0.30***
	(0.03)	(0.04)	(0.62)	(0.66)	(0.03)
Number of siblings	-0.03***	-0.03**	-0.63***	-0.50**	-0.02*
	(0.01)	(0.01)	(0.14)	(0.15)	(0.01)
Stably married	0.01	-0.05*	1.54***	1.76***	0.01
	(0.02)	(0.02)	(0.36)	(0.38)	(0.02)
Mother born in US	0.02	0.06+	-0.60	-0.33	0.02
	(0.03)	(0.04)	(0.51)	(0.55)	(0.02)
Intercept	2.88***	1.98***	10.90**	-9.29*	-0.19
	(0.18)	(0.24)	(3.67)	(3.91)	(0.16)

Notes. *N range*= 4,350-3,950. *** $p < .001$. **$p < .01$. * $p < .05$. $^{+}$ $p < .10$. This table depicts the fully adjusted relation between gender and self-control, impulsivity, baseline achievement, and cognitive stimulation. Each racial/ethnic group is compared to the omitted category of White. Each parental education group is compared to the reference group of below high school.

[a] A model was also run using the number of academic cognitive stimulation activities rather than the composite of cognitive stimulation; the coefficient was also negative, significant, and of similar magnitude (*B* = -0.13, *SE* = 0.04).

Table 7: Adjusted Differences in Cognitive Stimulation by Self-control, Impulsivity, and Baseline Achievement

	Cognitive Stimulation	
	B	(SE)
Parent-report self-control	0.10^{***}	(0.01)
Parent-report impulsivity	-0.03^{**}	(0.01)
Baseline reading	0.00^{***}	(0.00)
Baseline math	0.00^{***}	(0.00)

Notes. *N range* = 4,300-3,900. *** $p < .001$. **$p < .01$. * $p < .05$. $^{+}$ $p < .10$. This table depicts the fully adjusted relation between cognitive stimulation and self-control, impulsivity, and baseline achievement. These models are necessary to test for whether cognitive stimulation varies by child's behavioral and academic functioning.

APPENDIX B

FIGURES

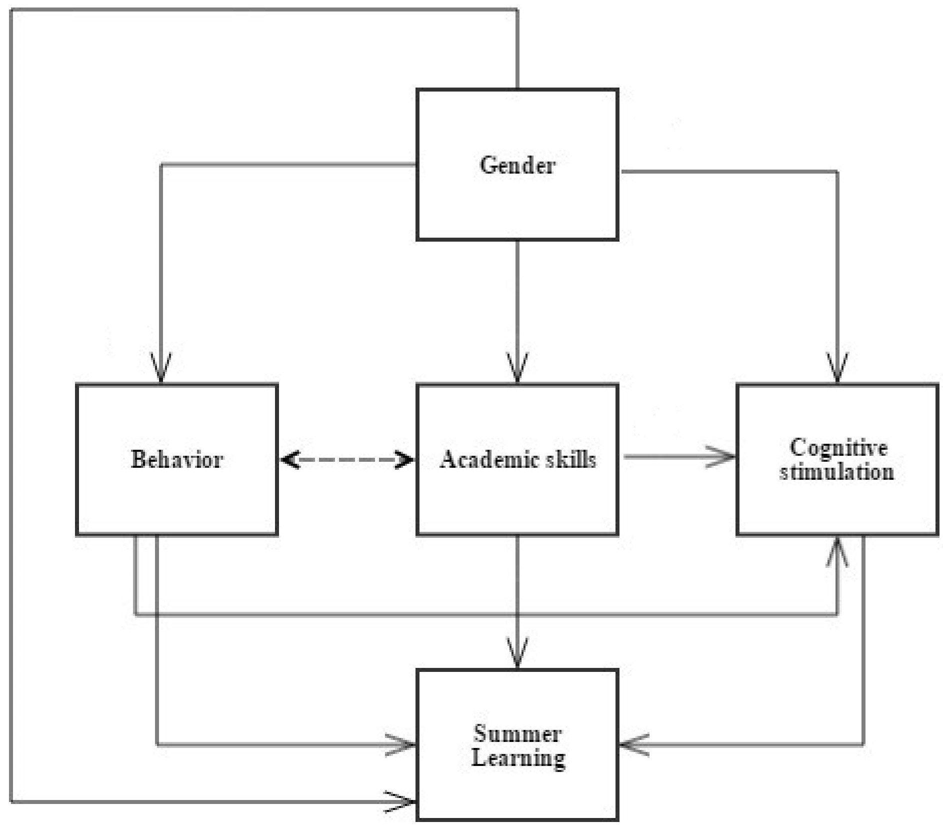

Figure 1: Conceptual map of gender's effects on summer learning in reading and math

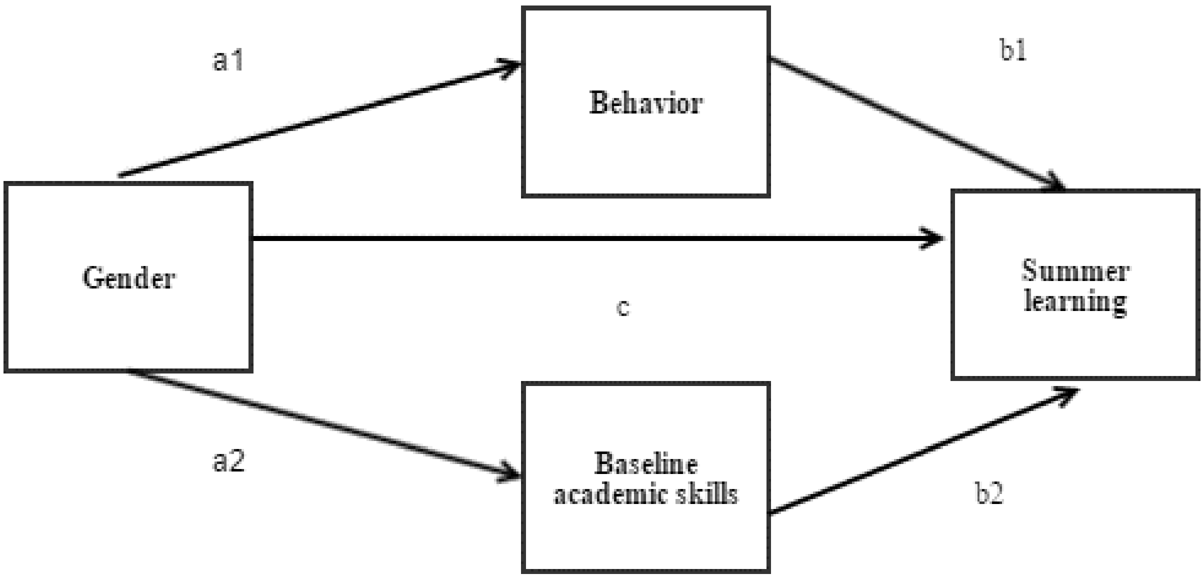

Figure 2: This figure depicts the theoretical model being tested.

The “c” pathway represents the first research question, whether gender has a direct relation with summer learning in reading and math. The “a” and “b” pathways represent the research questions, whether the relation between gender and summer learning can be partially explained by the relation between gender and behavioral and academic skills. In order for behavior and/or baseline academic skills to partially explain the association between region of origin and school readiness, the “a” and “b” pathways must be statistically significant (Baron & Kenny, 1986). Sobel tests (Sobel, 1982) were used to determine if behavior or baseline academic skills acted as partial mediators of the relation between gender and summer learning.

APPENDIX C

Table 8: Gender Differences in Parent-Reported Cognitively Stimulating Activities Over the Summer

	Full sample ($N \approx 4{,}800$) M or % (SD)	Boys ($N \approx 2{,}500$) M or % (SD)	Girls ($N \approx 2{,}300$) M or % (SD)
Frequency items[a]			
Math activities	2.46	2.41	2.51
	(0.79)	(0.77)	(0.80)
Writing activities	2.65	2.51	2.79
	(0.85)	(0.81)	(0.86)
Read books to child	3.22	3.16	3.28
	(0.83)	(0.84)	(0.82)
Child looks at/reads books on own	2.98	2.81	3.15
	(0.88)	(0.89)	(0.84)
Minutes of reading to child[b]	1.71	1.70	1.72
	(0.78)	(0.77)	(0.79)
Use computer for educational purposes	2.41	2.40	2.43
	(0.98)	(1.00)	(0.96)
Play outside actively (e.g., running)	3.72	3.76	3.68
	(0.56)	(0.52)	(0.60)
# of visits to library/bookstore over summer (0-2)	1.38	1.34	1.43
	(0.84)	(0.86)	(0.82)
Dichotomous items[c]			
Visited art gallery/museum, or historical site	50.66%	50.77%	50.55%
Visited zoo/aquarium	65.22%	63.92%	66.60%
Visited amusement parks	57.98%	59.04%	56.85%
Visited beach/lake/river/national parks	86.91%	88.06%	85.70%
Visited large city	58.89%	58.27%	59.56%
Attended plays/concerts	25.36%	21.67%	29.29%
Attend story time at library/bookstore	20.45%	20.34%	20.56%
Did child receive tutoring?			
Reading	3.41%	3.47%	3.35%
Math	2.73%	2.52%	2.97%
Did child attend camp?			
Sports	17.83%	17.60%	18.08%
Art	21.73%	20.11%	23.44%
Computer	5.31%	5.15%	5.48%
Academic	12.83%	12.61%	13.08%

Music/performing arts	13.48%	9.94%	17.23%
Summer school	8.75%	8.78%	8.73%

[a] During typical week during the summer, how often did you or any family member do the following activities? **1** = *never*; **2** = *once or twice*; **3** = *three to six times*; **4** = *everyday*
[b] When you or another family member read to child, how long was he/she generally read to each time? **1** = *15 min. or less*; **2** = *16-29 min.*; **3** = *30-45 min.;* **4** = *46 min. or more*
[c] Over the summer, did you or any family member take to the child to the following places?

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