Children's Academic Experiences during First Grade as Precursors of Later Academic Performance

by

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ABSTRACT

Children's academic experiences during first grade have substantial implications for their academic performance both concurrently and longitudinally. Using two complementary studies, this dissertation utilizing data from the National Institute of Child Development Study of Early Child Care and Youth Development helps create a better understanding of the importance of first-grade experiences for children's academic performance. The first study expands upon current literature by focusing on how children's academic experiences simultaneously influence children's academic performance through behavioral engagement. Specifically, study one examined the mediating role of first-grade behavioral engagement between first-grade academic experiences (i.e. parental involvement, positive peer interactions, student-teacher relationship, and instructional support) and second-grade academic performance. Using a panel model, results showed that behavioral engagement mediates relations between peer interactions and academic performance and relations between instructional support and academic performance. Implications for interventions focusing on children's positive peer interactions and teacher's high-quality instructional support in order to promote behavioral engagement during early elementary school are discussed.

The second study expands the current literature regarding instructional quality thresholds. Limited research has addressed the question of whether there is a minimum level of instructional quality that must be experienced in order to see significant changes in children's academic performance, and the limited research has focused primarily on preschoolers. The goal of study two was to determine if high-quality first-grade instructional support predicted children's first-, third-, and fifth-grade academic

performance. Using piecewise regression analyses, results did not show evidence of a relation between first-grade instructional support quality and children's academic performance at any grade. Possible reasons for inconsistencies in findings from this study and previous research are discussed, including differences in sample characteristics and measurement tools. Because instructional quality remains at the forefront of discussions by educators and policy makers, the inconsistencies in research findings argue for further research that may clarify thresholds of instructional support quality that must be met in order for various subgroups of children to gain the skills needed for long-term academic success.

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General Introduction

Recent political and educational shifts have resulted in more academic demands and formal structure within the early elementary grades (Ramey, Lanzi, Phillips, & Ramey, 2008). These large-scale changes to early classroom environments have the potential to impact children's classroom interactions and experiences, the type of instruction they receive, and ultimately, their academic outcomes. Typically, children undergo rapid cognitive development during first grade (Entwisle & Alexander, 1998). Accordingly, children's academic experiences during first grade can be extremely important for their cognitive development and for the instantiation of many specific academic skills (Entwisle & Alexander, 1998). Extant literature has shown that children's early schooling experiences are related to later academic outcomes (Alexander & Entwisle, 1988; Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002; Curby et al., 2009a; Mashburn et al., 2008). Furthermore, researchers have argued that children's academic performance during early elementary school is more indicative of future academic outcomes than performance during any other time (Entwisle & Alexander, 1998). If children have less than ideal academic experiences during first grade, they may be less likely to connect with their role as a student, which could be detrimental for their later academic outcomes.

Because first grade academic experiences appear to be so consequential for children's long-term academic outcomes, better characterizing the exact nature of those relations is important for improving teaching practice, structuring of curriculum, and increasing attention regarding classroom experiences. There are two areas of research that could be expanded upon to create a better understanding of the important role of first

grade. First, very little is known regarding how children's first-grade academic experiences simultaneously influence academic outcomes. Although researchers have investigated the influence of academic experiences during early elementary school on children's academic outcomes in isolation, which prevents researchers from accounting for their coexistence in the classroom, few studies have examined these academic experiences simultaneously. Understanding the simultaneous influence of first-grade academic experiences on children's academic outcomes may have long-term implications for children's academic careers (Alexander, Entwisle, & Dauber, 1993). Second, despite the increased emphasis on instructional quality following recent changes in educational standards, few researchers have examined the possibility that there may be instructional quality thresholds that must be met in order to benefit children's academic performance (Burchinal, Vandergrift, Pianta, & Mashburn, 2010; Zaslow et al., 2010). In addition, both of the aforementioned areas of research have yet to be examined longitudinally. Using two complementary studies, I begin to address gaps in the literature regarding the first-grade experience by (1) examining the simultaneous relation between first-grade experiences and academic outcomes, and (2) examining how instructional quality thresholds during first grade are related to academic performance across elementary school.

In the first study, I investigated if first-grade academic experiences are related to students' first-grade behavioral engagement, and if first-grade behavioral engagement is related to second-grade academic performance. In addition, I examined if behavioral engagement mediated the relation between first-grade academic experiences and second-grade academic performance. The academic experiences of interest included parental

school involvement, positive peer interactions, the student-teacher relationship, and teacher's instructional support. Previous research has shown that parental school involvement, peer interactions, the student-teacher relationship, and teacher's instructional support are directly related to children's academic performance (Hamre & Pianta, 2001; Jeynes, 2005; Ladd & Burgess, 2001; Pianta, La Paro, Payne, Cox, & Bradley, 2002); however, it is possible that these academic experiences may be indirectly related to academic performance through children's behavioral engagement, an aspect of academic motivation (Fredricks, Blumenfeld, & Paris, 2004). Promoting engagement in school during first grade is extremely important as early engagement is typically a forerunner of how well children engage in learning activities throughout their academic careers (Entwisle & Alexander, 1998). Unfortunately, most research is focused on only one or a very limited array of early academic experiences within the classroom and considers their impact in isolation from other simultaneously occurring experiences. This approach is limited in that studying individual experiences in isolation does not account for the simultaneous occurrence of these varied academic experiences within a child's life, and researchers have suggested that isolated investigations may be misleading when examining academic outcomes (Rimm-Kaufman & Pianta, 2000). The goal of Study 1 was to examine the simultaneous relation among first-grade academic experiences (i.e., parental involvement, positive peer interactions, student-teacher relationship, and instructional support) and behavioral engagement and second-grade academic performance. Additionally, the mediating role of first-grade behavioral engagement between first-grade academic experiences and second-grade reading and math performance was examined. This study provides a comprehensive view of the process

through which children's academic experiences are related to behavioral engagement and later academic performance. In addition, this study emphasizes the importance of accounting for the simultaneous influence of academic experiences when examining children's early elementary school outcomes.

In the second study, I examined if first-grade instructional support quality thresholds predict children's academic performance across elementary school. The quality of instructional support that children receive within the classroom is extremely important for children's academic performance (Hamre & Pianta, 2007; Pianta et al., 2002; Ponitz, Rimm-Kaufman, Grimm, & Curby, 2009), especially during first grade (Palardy & Rumberger, 2008); yet the quality of instructional support in first-grade classrooms is typically low (Curby, Rimm-Kaufman, & Ponitz, 2009). In addition, recent research has suggested that significant changes in children's academic performance may only occur if a minimum instructional quality threshold is met (Burchinal et al., 2010; Zaslow et al., 2010). Limited previous research has examined the notion of instructional support quality thresholds, and the findings have been inconsistent (Burchinal et al., 2009; Burchinal et al., 2010; Burchinal, Vernon-Feagans, Vitiello, & Greenberg, 2014). To my knowledge, the relation between first-grade instructional support quality thresholds and academic performance across the elementary years has yet to be examined. Thus, the goal of this study was to examine if first-grade instructional support quality predicted children's first-, third-, and fifth-grade academic performance and to determine if there is a threshold of quality in first grade that needs to be met before any positive impacts on achievement are observable. This study provides useful information for researchers, educators, and policymakers alike regarding the use of thresholds to

identify instructional quality and how instructional quality during early elementary school are related later academic outcomes.

Study 1: The Relation between First Grade Academic Experiences, Behavioral Engagement, and Second Grade Academic Performance

Major political and educational shifts over the past two decades have resulted in considerable formal structure as well as elevated academic and social demands during the early grades of school (Ramey et al., 2008). As a consequence, school can be very challenging for young children, especially those who came as kindergartners with relatively little formal educational experience. Research suggests that the early years of schooling are critical precursors to children's later cognitive development, and interactions and experiences during first grade are proposed to have a cumulative impact on development (Burchinal et al., 2002). Specifically, positive, successful experiences during the first years of school provide a crucial baseline for the remainder of children's academic careers, especially given that academic patterns are being formed during this time (Alexander & Entwisle, 1988). Thus, in order for educators to facilitate children's successful engagement in learning during the early grades, it is important to more fully document how particular academic experiences are related to children's engagement in school and later academic performance.

Academic experiences during first grade can include parent's involvement in learning, peer interactions, the student-teacher relationship, and teacher's instructional support, all of which help shape children's later academic performance (Burchinal et al., 2002; Rimm-Kaufman & Pianta, 2000). Specifically, research has shown direct relations during the early elementary years between these four types of academic experiences and student academic performance (Jeynes, 2005; Ladd & Burgess 2001; Hamre & Pianta, 2001; Pianta et al., 2002). Although extant research has documented that relations

between such experiences and academic performance exist, the pathways through which each type of experience exerts influence on academic performance remain incompletely determined. To be of high practical value for educators, it is important that researchers further investigate potential mediators of these relations (Hughes & Kwok, 2007; Marks, 2000). Motivational processes, such as behavioral engagement, would seem likely candidates for exploration. Specifically, behavioral engagement is a measurable manifestation of young children's motivation, which is formed through the simultaneous influence of multiple academic experiences (Skinner, Kindermann, Connell, & Wellborn, 2009). In turn, children's behavioral engagement is related to academic performance (Fredricks et al., 2004). At present, there is limited research that examines possible indirect relations between academic experiences and academic performance through behavioral engagement (Buhs & Ladd, 2001; Hughes & Kwok, 2007; Iyer, Kochenderfer-Ladd, Eisenberg, & Thompson, 2010). Furthermore, previous research has primarily examined particular academic experiences (e.g., student-teacher relationships) in isolation, an approach that does not take into account the interconnected nature of the many factors in a child's educational context. Given the complex interplay of children's academic experiences and outcomes, it is important that children's academic experiences are studied in conjunction with one another to illustrate a more comprehensive model of academic development during early childhood (Ladd, 1996). Significant advances to educational practice are more likely when the full context of learning is considered.

Research is necessary to create a better understanding regarding how multiple academic experiences, including parental involvement and aspects of the classroom environment (i.e., positive peer interactions, student-teacher relationship, and teacher's

instructional support) are related to behavioral engagement while accounting for their simultaneous occurrence (Marks, 2000). By understanding the complex interplay, teachers and parents can alter their behavior and promote behavioral engagement among children during early childhood in order to facilitate better academic performance. The present study aims to examine relations between four key academic experiences at first grade (parental involvement, positive peer interactions, the student-teacher relationship, and instructional support provided by teachers), children's behavioral engagement during first grade, and their second-grade academic performance. The second aim of the study is to test whether behavioral engagement during first grade mediates the relations between first-grade academic experiences and second-grade academic performance.

The present study is guided by Self-Determination Theory (SDT; Ryan & Deci, 2000), which proposes that children's intrinsic motivation for school is promoted by three types of needs that are met through academic experiences. According to this framework, children's need for competence, relatedness, and autonomy must be met in order for children to feel intrinsically motivated at school. The need for competence refers to a child's need to perceive his or her actions as effective (Deci & Ryan, 2012). Relatedness refers to a child's need to be close to and cared for by others through positive, nurturing relationships (Deci & Ryan, 2012). Lastly, the need for autonomy is supported when children's goals and preferences are accounted for by providing choices and allowing children to take initiative and explore (Reeve & Halusic, 2009). These three needs are met and fostered through interactions and experiences; however, children's motivation, such as engagement to pursue academic goals, is strongest when these needs are met by multiple sources of support (Deci & Ryan, 2012; Deci, Vallerand, Pelletier, & Ryan,

1991). When these needs are met, children's academic motivation is higher, which can be measured observationally by examining their behavioral engagement. Further examination of the process through which children's academic experiences are related to academic performance, through behavioral engagement, will providing a better understanding of the importance of these simultaneously occurring academic experiences for later academic outcomes.

The Role of Behavioral Engagement in Academic Performance

An important element of children's academic performance concerns their adaptation to formal schooling via engagement (Fredricks et al., 2004). Behavioral engagement involves attending to and interacting with aspects of the school environment connected with learning academic material (Fredricks et al., 2004; Skinner et al., 2009). When they are behaviorally engaged in classroom work, students act in accordance with teachers' expectations, pay attention, exhibit cooperative classroom behavior, and demonstrate compliance (Buhs & Ladd, 2001; Ladd, Birch, & Buhs, 1999). They also demonstrate independent participation, which involves intrinsic motivation, a sense of autonomy, and initiative within the classroom (see Finn, 1989; Ford, 1985; Wentzel, 1991). Children's school engagement tends to persist over time and contributes to later learning and academic success (Fredricks et al., 2004; Ladd, Buhs, & Seid, 2000; Ladd & Dinella, 2009), with evidence showing that first-grade engagement is positively related to academic performance through fourth grade (Alexander et al., 1993). These findings emphasize the importance of the early grades as a sensitive period for behavioral engagement, a time before children's academic behaviors and trajectories become more stable (Alexander et al., 1993).

During early childhood, experiences in a new setting tend to have substantial impact on children's perceptions of what it is required to function well in the setting and of how they might act to derive benefit or avoid problems in the setting. Each child's interpretation of his or her academic experiences becomes instrumental in determining the child's motivations as they pertain to functioning as an actor in such settings (Grolnick, Ryan, & Deci, 1991), whether to actively engage in the activities present or to resist or demure. In turn, the child's behavioral engagement affects his or her performance in the setting. Researchers have suggested the importance of examining this process and the potential role of engagement as a mediator between children's academic experiences and academic performance, so as to not overestimate the direct relation between these academic experiences and academic performance (Pianta, Hamre, & Allen, 2012). In the following sections, attention will be given to how parental involvement, positive peer interactions, student-teacher relationships, and instructional support, all of which are important experiences during first grade, are implicated in children's academic performance and engagement.

Parental Involvement

Parental involvement in school can take many forms. Those include direct involvement within the classroom and providing educational experiences at home (Taylor, Clayton, & Rowley, 2004). One aspect of parental involvement is direct involvement with teachers and school activities, including volunteering in the classroom (Kohl, Lengua, & McMahon, 2000). Direct involvement provides parents with a better understanding of classroom expectations and promotes the parent-teacher relationship (Taylor et al., 2004). In turn, a positive, working parent-teacher relationship helps ensure

both parties feel comfortable to speak freely (Kohl et al., 2000) and promotes encounters and experiences that are aligned with the needs of the child, thus increasing the likelihood that the child's motivational needs are better met. Within the home, parents demonstrate involvement in education by promoting and supporting children's academic endeavors, emphasizing the importance of learning, and sharing positive feelings and expectations about school (Fantuzzo, Tighe, McWayne, Davis, & Childs, 2003; Neitzal, 2009). Children's need for competence is supported through parents' encouragement of the child's effort and work in school and offering praise for good effort (Guay, Ratelle, & Chanal, 2008). In turn, when a child's need for competence is met, the child may be more motivated to demonstrate behavioral engagement within the classroom.

Parental involvement has been linked to numerous child outcomes from the time of school entry to the end of formal schooling. A recent review and meta-analysis showed that parent involvement was positively related to academic performance (Jeynes, 2005) and engagement (Gonzalez-DeHauss, Willems, & Doan Holbein, 2005). When parents demonstrate interest in children's academic success through involvement, children are more likely to demonstrate appropriate classroom behaviors (e.g., higher behavioral engagement) and have better academic performance. However, few researchers have examined engagement as a specific mediating mechanism between parental involvement and children's academic performance. Hughes and Kwok (2007) found that behavioral engagement on the part of students mediated the relation between parental involvement in learning during first grade, measured using a latent variable, and second-grade academic performance. It is important to note that the parent involvement latent variable included a measure of the teacher's perceived home-school connection, an affective measure of trust

and support, and teacher's perceived parental involvement. The inclusion of the aforementioned measures as a single latent variable prevents researchers from understanding the independent influence of the home-school connection and parent involvement within this mediating process. In addition, the study relied solely on teacher reports, and the questionnaire included items that primarily focused on communication between the teacher and parent and did not include other aspects of parent involvement. Importantly, school involvement is complex; and parents and teachers often have different views regarding what parents do and what it means for children (Hill & Taylor, 2004). Given the sole use of teacher reported parental involvement and the lack of parent report, the Hughes and Kwok (2007) study likely does not fully account for parent involvement that occurs at home, preventing a comprehensive overview of the parent's school involvement. For example, if a parent is unable to volunteer within the classroom but is extremely involved in his or her child's education at home, the teacher may rate the parent's school involvement as low because she is unaware of the activities that occur within the home. Although few studies have specifically examined engagement as a mediator between parental involvement and academic performance, researchers have shown that academic motivation, which is closely connected with engagement, mediates the relation between family factors (including parent involvement) and academic performance in fifth- and sixth-grade children (Marchant, Paulson, & Rothlisberg, 2001). In addition, among a sample of third- to sixth-graders, academic motivation mediated the relation between children's perceptions of parental involvement and academic performance (Grolnick et al., 1991). However, both of the aforementioned studies

examined this mediation process with older children, and the findings may not be fully generalizable to children in early elementary school.

Academic motivation may manifest differently among different age groups; thus, it is important to understand how this process appears during the early school years. Many studies rely on teachers to report parental involvement, but it is likely that teachers and parents have a different perspective regarding a parent's involvement. Inclusion of parent reported involvement, including involvement both within the classroom and at home, is important to create a more comprehensive understanding of parents' involvement in their child's education. Researchers have also suggested that future studies use of advanced statistical procedures when examining these relations to better understand the role of parental involvement while accounting for other academic experiences (Gonzalez-DeHauss et al., 2005; Marchant et al., 2001).

Positive Peer Interactions

As children enter a new grade, they often encounter a new peer group. In classroom settings, many peer interactions become academically focused as children begin working in pairs or groups on classroom assignments. Positive peer interactions occur when children demonstrate prosocial and socially appropriate behavior. Children feel more supported by peers with whom they have positive interactions, which can promote children's engagement within the classroom (Buhs & Ladd, 2001). The need for relatedness and competence are fulfilled through positive peer interactions by providing a nurturing experience where the child can receive feedback on the effectiveness of his or her actions, which promotes intrinsic motivation (Deci, et al., 1991), an underlying

component of children's behavioral engagement. Unfortunately, children sometimes have negative interactions with peers, which may decrease their behavioral engagement.

Children's negative interactions with peers consist of rejection, conflict, victimization, and/or exclusion (Parker & Asher, 1987; Perdue, Manzeske, & Estell, 2009). Children who have negative peer interactions are more likely to have lower academic performance (Erath, Flanagan, & Bierman, 2008; Ladd & Burgess, 2001) and be more disengaged at school (Buhs, Ladd, & Herald, 2006; Perdue et al., 2009) than children who have positive peer interactions. Such relations can be seen during early elementary school (Buhs & Ladd, 2001; Ladd, 1990; Ladd, Kochenderfer, & Coleman, 1997). Consistent negative peer interactions during kindergarten are related to little or no growth of children's behavioral engagement from kindergarten to sixth grade. However, this trajectory can change if children begin to have more positive peer interactions during the later school years, resulting in a positive growth of behavioral engagement (Ladd, Herald-Brown, & Reiser, 2008). The study by Ladd and colleagues (2008) illustrates how negative peer interactions may inhibit, whereas positive peer interactions can facilitate, children's behavioral engagement.

As stated above, extensive literature exists regarding the relation between peer interactions and academic performance, and peer interactions and behavioral engagement. Researchers have also shown that behavioral engagement mediates the relations between negative peer interactions and academic performance in kindergarten (Buhs & Ladd, 2001). A longitudinal study of first- to fourth-grade children showed that negative peer interactions during first grade were negatively related to engagement both concurrently and predictively, and first- grade engagement mediated the relation between

first-grade negative peer interactions and second-grade academic performance (Iyer et al., 2010). In addition, among a sample of third- to sixth-grade children, engagement mediated the relation between children's perceived connectedness with peers, teachers, and adults (as a single, aggregate variable) and academic performance (Furrer & Skinner, 2003). Although this study included multiple predictors, by creating a single aggregate variable the specific relation between the predictors and engagement are not easily extricated. Importantly, the studies failed to independently account for the many simultaneously occurring academic experiences that may also be related to engagement. As mentioned earlier, numerous academic experiences help support children's motivational needs and engagement. Because school circumstances that may be associated with more positive peer relations may also be associated with other positive experiences, research that focuses only on peer interactions and fails to include co-occurring experiences does not provide a comprehensive model of the early elementary experience as all of these factors contribute to children's behavioral engagement, and in turn, academic performance.

Student-Teacher Relationship

As children enter each new grade, they form new relationships with non-familial adults. The student-teacher relationship is a context in which children's needs for relatedness are engaged (Niemiec & Ryan, 2009). Thus, the relationship has the potential to be important for children's academic outcomes, especially a relationship formed during the early grades when children are in the early stages of autonomy development (Birch & Ladd, 1997; Pianta, Steinberg, & Rollins, 1995). Research indicates that student-teacher relationships are related to academic performance throughout elementary

school (Burchinal et al., 2002; Cadima, Leal, & Burchinal, 2010; Hamre & Pianta, 2001; Maldonado-Carreno &Votruba-Drzal, 2011). Positive student-teacher relationships are characterized by closeness, warmth, supportiveness, and affection. This contrasts to negative relationships, which are characterized by conflict and/or emotional distance between student and teacher (Pianta et al., 1995; Pianta & Stuhlman, 2004). The general quality of student-teacher relationships remains relatively stable between kindergarten and second grade, even though the child is forming a new relationship with a different teacher each year (Birch & Ladd, 1997; Pianta et al., 1995).

A high quality student-teacher relationship provides a child with support and encouragement for learning and is positively related to engagement (Connell, Spencer, & Aber, 1994; Fredricks et al., 2004; Howes, Phillipsen, & Peisner-Feinberg, 2000). By nature, a warm, positive student-teacher relationship promotes children's feelings of belonging and is characterized by supportive interactions, especially regarding a child's actions and/or performance, all of which are important to support children's needs for relatedness and competence (Deci et al.,1991; Niemic & Ryan, 2009). A recent meta-analysis, which examined both cross-sectional and longitudinal studies, showed that positive student-teacher relationships were significantly related to higher levels of engagement and academic performance and emphasized the importance of examining this relationship in conjunction with additional academic experiences (Roorda, Koomen, Spilt, & Oort, 2011). Engagement also mediates the relation between the student-teacher relationship and academic performance longitudinally (Furrer & Skinner, 2003; Hughes, Luo, Kwok, & Loyd, 2008). Specifically, first-grade engagement has been shown to mediate the relation between the student-teacher relationship at first grade and second-

grade academic performance while accounting for teacher's perceived parental involvement (Hughes & Kwok, 2007); however, the aforementioned study used teacher reported measures among a sample of low achieving children and did not account for different types of parent involvement. Further research that employs a multi-reporter design among an academically diverse population is stronger for examining the mediating role of engagement between the student-teacher relationship and later academic performance.

Instructional Support

Teachers provide varying types and quality of instructional support within the classroom. Instructional support refers to the methods used to implement curriculum, and it is important that these methods be structured so that they promote children's learning (Pianta & Hamre, 2009). Characteristics of instructional support include linking concepts to previous work and the real world, emphasizing critical thinking skills, and providing supportive feedback. Teachers who demonstrate high-quality instructional support promote higher-order thinking, encourage students to use varied language (Curby et al., 2009a), use evaluative feedback, and have instructional conversations throughout the school day (Hamre & Pianta, 2005). High levels of instructional support are positively related to children's academic performance (Curby et al., 2009a; Hamre & Pianta 2005; Mashburn et al. 2008; Pianta et al., 2002). In addition, aspects of instructional support, including evaluative feedback from the teacher and encouraging children to express their own thoughts, are important for promoting children's motivational needs for autonomy and competence (Deci & Ryan, 2012; Reeve & Halusic, 2009). Specifically children who are able to take initiative in their learning and feel as though their actions within the

classroom are effective are likely to feel intrinsically motivated and demonstrate behavioral engagement within the classroom.

Overall, instructional support is positively related to children's engagement in school (Dotterer & Lowe, 2010). Both quantitative and qualitative research has shown that children are more engaged when teachers link previous knowledge to new concepts and learning, focus on learning rather than performance, use critical thinking strategies, allow autonomy during assignments, and scaffold learning (Dolezal, Welsh, Pressley, & Vincent, 2003; Guthrie & Davis, 2003). Limited research has examined the indirect relation between instructional support and academic performance through engagement. Specifically, there is an indirect effect through behavioral engagement between classroom quality (teacher's emotional support, instructional support, and classroom management) and academic performance in kindergarten (Ponitz et al., 2009) and late elementary school (Dotterer & Lowe, 2010); however, in these studies, classroom quality was examined as a latent variable and included multiple aspects of the classroom structure.

Studies that aggregate multiple aspects of the classroom into a single variable are unable to extricate how each aspect of the classroom is independently related to children's engagement. For example, emotional support from teachers can take the form of appropriate reactions to a child's distress, providing a generally warm and encouraging environment to all children, and positive responses to student actions (Pianta, La Paro, & Hamre, 2008). This type of support can vary significantly from the same teacher's use of instructional support; thus, simply aggregating these types of support does not provide an accurate depiction of how each one independently promotes children's engagement.

Separately examining the types of supports provided by teachers would provide a more precise understanding of the ways both emotional support (i.e. student-teacher relationships) and instructional support are related to children's behavioral engagement, and in turn how behavioral engagement is related to academic performance.

Present Study

Research shows that children's academic experiences, including parental school involvement, positive peer interactions, student-teacher relationships, and teacher's instructional support influence children's academic motivation (Kerssen-Griep, Hess, &Trees, 2003; Wentzel, 1999; Wigfield, Eccles, & Rodriguez, 1998); but details about these relations remain poorly characterized. To further illuminate these relations, behavioral engagement, a facet of motivation, is examined within the present study. Previous work has examined how children's academic experiences (i.e. parental involvement, positive peer interactions, student-teacher relationship, and instructional support) are both directly and indirectly related to academic performance through engagement. In addition, researchers have suggested that the interconnected and simultaneous influences of multiple factors during early elementary school should be accounted for when examining academic performance (Rimm-Kaufman & Pianta, 2000). Unfortunately, previous studies often fail to account for the multi-dimensional nature of first-grade classroom contexts by examining particular academic experiences in isolation. Models that consider only one (or perhaps two) factor at a time do not coincide with ideas from comprehensive theories of human motivation; that is, that many factors operate together to meet children's motivational needs. By examining factors in isolation,

findings from previous studies fall short of accurately depicting the contribution of any of these factors to children's behavioral engagement and subsequent academic performance.

The purpose of the present study was to examine relations between four key first-grade academic experiences (i.e., parental involvement, positive peer interactions, student-teacher relationship, and instructional support; hereafter, *predictors*), behavioral engagement during first grade, and second-grade math and reading performance. Employing a multi-reporter, multi-method design, I examined the relation between the predictors and behavioral engagement, and behavioral engagement and later academic performance in a single panel model. I hypothesized first-grade parental involvement, positive peer interactions, student-teacher relationship, and instructional support would each be positively related to first-grade behavioral engagement. In turn, I expected that first-grade behavioral engagement would be positively related to second-grade math and reading performance. I also expected that behavioral engagement would mediate the relations between the first-grade predictors and second-grade academic performance. In the analysis I controlled for first-grade academic performance because academic performance in the early grades tends to be predictive of subsequent academic performance (La Paro & Pianta, 2000).

Method

Participants

Parents were recruited in hospitals upon the birth of their child from 10 geographic sites across the United States as part of the National Institute of Child Health and Human Department Study of Early Child Care and Youth Development (NICHD-SECCYD) longitudinal national study beginning in 1990. The consent rate at recruitment

was 89% (N = 1,364 out of 1,526). Mothers who did not speak English and children with diagnosed disabilities were excluded from the study. Participating families represent demographic diversity of the sites from which they were recruited. Unlike some other longitudinal datasets, sampling weights are not used in the NICHD-SECCYD dataset.

As part of the NICHD-SECCYD study, children were followed longitudinally from birth to ninth grade; however, the present study focuses on first and second grade. Families were sent birthday cards, newsletters, and other forms of communication throughout the study duration in attempt to minimize attrition. Children who had completely missing data at first grade and children who were not in the focal grade (based on teacher report) were not included in the analytic sample, resulting in the omission of 446 children. The final sample in the present study consisted of 918 children (50% male). In terms of missing data, 709 children had complete data at both first and second grade. Approximately 23% of children in the present study had some missing data (i.e., 114 were missing only some first-grade data, 66 were missing only second-grade data, and 29 were missing some data at both first and second grade).

Children's ages ranged from 6.35 to 8.16 years (M = 7.03, SD = 0.29) at first grade. The majority of the sample was Caucasian (79%). Approximately 10% of children were African American, 6% were Hispanic, and 5% were identified as other. A little over half (55%) of children attended center-based preschool prior to formal school entry. During first grade, the majority of children attended public school (81%). The average total family income of participants, based on mothers' reports, was $68,111 ($SD$ = $51,427, $\underline{Mdn}$ = $55,000). The majority of parents were married and living together (77%). Approximately 11% of parents were divorced, 5% were living with their partner,

and 7% identified their arrangement as “other.” Mothers' highest level of education ranged from some high school to obtaining an advanced degree. Approximately 34% of mothers completed some college, 24% obtained a bachelor’s degree, 20% graduated high school, 13% completed graduate work, 7% did not complete high school, and 2% had an advanced degree (e.g., law or doctoral degree). Children were dispersed across 824 first-grade classrooms, in which 96% of teachers were female. Teachers' experience teaching first grade ranged from 0 to 40 years (M = 9.06, SD = 8.14). The majority of first-grade teachers identified as Caucasian (93%). Approximately 4% identified as African American, 1% identified as Asian, 1% identified as Hispanic, and 1% identified as other. Approximately 39% of first-grade teachers had completed some graduate work, 38% obtained a Master's degree, 20% obtained a Bachelor's degree, and 3% indicated other.

Procedure

During a laboratory visit, mothers completed a parent packet that included questions about child and home demographics and parental involvement in school. Mothers also reported on family income-to-needs, which was computed by dividing the reported family income by the national poverty level while accounting for household size. The child's teacher also completed a questionnaire each study year that included questions about the child's engagement, positive peer interactions, the student-teacher relationship, and academic performance. All participants were compensated for their time and participation.

In addition to interviews and questionnaires, both the teacher and child were observed in the classroom during first grade. Typically, the observations occurred during the morning and spanned a two-hour period. On occasions that morning observations

were not possible, the classroom was observed during the afternoon. Each study child's behavioral engagement within the classroom and the teacher's instructional support was observed by trained research personnel. Different research personnel completed the laboratory visits and the observations. If multiple study children were in the same classroom, separate observations were made for each child. The observations were conducted on different days and were performed by different research personnel. Of the classrooms that had multiple study children, only 6% of children were in a classroom with one other study child, and less than 1% of the children were in classrooms with more than two study children. Detailed information is publicly available regarding participant selection, procedures, and instruments (NICHD ECCRN, 1993).

Measures

All attempts were made to obtain complete item-level data within a given scale; however some item-level data were missing. Study administrators used proportional weighting imputation to account for missing item-level data if (a) no more than 20% of the items for a given scale were missing, (b) the Cronbach's alpha was larger than .75, and (c) items were unit-weighted (Appelbaum, 1993). Data available for public use include pre-populated composite variables.

Engagement.

First-grade behavioral engagement. All study children were observed using the Classroom Observation System (COS-1; NICHD ECCRN, 2002) during first grade. Children's behavioral engagement on assigned activities was the observed behavior of interest in the present study. Behavioral engagement occurred when the study child demonstrated involvement in learning and activities that were provided by the teacher.

Examples of behavioral engagement included reading aloud, working on a worksheet, listening to directions, and talking to peers/teachers about the assigned activity. The study child's behavioral engagement was observed and recorded as either present or absent for each 30-second interval, resulting in an engagement score between 0 and 60.

Trained research personnel observed a study child for two uninterrupted 30-minute cycles. Each cycle consisted of thirty 1-minute segments. During each segment, researchers observed the child's behavior for 30 seconds, and then recorded their observation for 30 seconds. This process was repeated 30 times (i.e., cycle). Upon completion of the two observation cycles (60 minutes) raw data from the observations were summed across observation segments per cycle (2 observation cycles, 30 segments per observation cycle). Finally, the total number of particular classes of behavior observed during both observation cycles was summed to create a composite score for that variable class (range from 0 to 60).

In order to assess whether observers coded children's behavior reliably, two observers simultaneously coded approximately 20% of cycles (live double-coding). All coders also independently coded a set of videos during two reliability test rounds. These videos had master keys, and the observer's scores were compared to the master key. A reliability estimate based on repeated measures analysis of variance on the total engagement score was computed for both the live double-coded segments (alpha = .81) and master key segments (alpha = .89).

Kindergarten engagement. Kindergarten teachers completed the 10-item cooperation subscale of the Social Skills Rating System Teacher Form (SSRS; Gresham & Elliot, 1990) using a 3-point scale (0=*never*, 1 = *sometimes*, and 2 = *very often*). The

cooperation subscale focuses on children's cooperative behavior (e.g., paying attention to directions and use of classroom time) within the classroom. The creators of the scale reported good internal reliability for kindergarten teachers (alpha = .92; Gresham & Elliot, 1990). Within the present study, a mean composite cooperation score was created (alpha = .92). Higher scores on the cooperation subscale represent more favorable performance. This measure was used as a proxy for engagement during kindergarten and was included as a covariate in study analyses.

Parental involvement. Parents completed the Parent-Teacher Involvement Questionnaire (PTIQ-P; Miller-Johnson & Maumary-Gremaud, 1995). The frequency of parent-teacher contact/involvement subscale consisted of 10-items answered on a 5-point scale (1 = *never* to 5 = *more than once per week*). Questions on this subscale focused on the frequency of parents' school involvement (ex. "In this school year, you have called your child's teacher."). This subscale had moderate internal reliability within the present study (alpha = .70). The parent encouragement and attitudes about school subscale consisted of 15-items that measured parents' self-reported encouragement and positive attitudes about school (alpha = .89). Within this subscale, 11-items focused on parents' interest in and encouragement of children's academic endeavors (ex. "You feel your child's teacher cares about your child." and "You read to your child.") and were rated using a 5-point scale (1 = *not at all* to 5 = *a great deal*). In addition, parents answered 4-items that focused on parents feelings about their child's school ("Your child's school is a good place for your child to be") using a 5-point scale (1 = *strongly disagree* to 5 = *strongly agree*). The PTIQ-P has been shown to have good internal consistency (alphas range from .69 to .91; Miller-Johnson & Maumary-Gremaud, 1995). A mean composite

was created using all 26 items (alpha = .87) with higher scores indicating more parental involvement.

Positive peer interactions. First-grade teachers completed the SSRS Teacher Form (Gresham & Elliot, 1990) using a 3-point scale (0 = *never*, 1 = *sometimes*, and 2 = *very often*). From this questionnaire, an *a priori* peer competence scale was derived. Ten questions that focused on children's positive interactions with peers (ex. cooperates with peers without prompting, gives compliments to peers, and accepts peers' ideas for group activities) were included in the subscale**.** Within the present study, the scale had good internal reliability (alpha = .85). A mean composite was created in which higher scores indicated more positive interactions with peers.

Student-teacher relationship. First-grade teachers completed the 15-item Student-Teacher Relationship Scale: Short Form (STRS; Pianta, 2001). This measure assesses a teacher's perception of his or her relationship with the study child. Teachers reported on their perceived closeness and conflict with the study child using a five-point Likert-type scale (1 = *definitely does not apply* to 5 = *definitely applies*). The 8-item closeness subscale is a measure of positive relationships between the student and teacher (e.g., "I share an affectionate, warm relationships with this child.") and had high internal reliability (Cronbach's alpha=.85) in the present sample. The 7-item conflict subscale is a measure of negative relationships between the student and teacher ("This child easily becomes angry at me") and also had high internal reliability (Cronbach's alpha = .88) in the current sample. Previous research has shown this scale as both a reliable and valid measure of the student-teacher relationship (Pianta & Steinberg, 1992; Pianta & Stuhlman, 2004). A mean composite score using all 15 items was created to reflect the

teacher's overall positive relationship with the child. All items from the conflict subscale were reverse-coded prior to inclusion in the composite score. Higher scores on this composite variable indicate a more positive overall relationship. The composite score had high internal reliability (alpha = .86).

Instructional support. First-grade teachers were observed using the First-Grade Classroom Observation System (COS-1; NICHD ECCRN, 2002). Research personnel were trained to observe and record specific behaviors using the COS-1. This measure allows trained observers to record and rate aspects of the instructional quality of the classroom climate using a 7-point scale (1 = *uncharacteristic*, 3 = *minimally characteristic*, 5 = *very characteristic*, 7 = *extremely characteristic*) during a 15-minute observation. Higher scores reflect a teacher who demonstrates that aspect exceptionally well.

The four aspects of instructional support assessed were literacy instruction, evaluative feedback, instructional conversation, and child responsibility. Classrooms that have high quality literacy instruction are characterized by the use of phonics and comprehension skills. In these high scoring classrooms, children are encouraged to make predictions about and relate their own experiences to stories and have exposure to books and written language. Evaluative feedback focuses on the quality of teacher's evaluation of student's work and comments. Classrooms score high on evaluative feedback when the teacher employs feedback that focuses on learning, developing understanding, effort, persistence, and personal improvement. This feedback encourages students to continue toward their goals by praising their process and providing information about solving problems. Instructional conversations focus on the concepts discussed and quality of

cognitive skills during conversations between the teacher and students. Classrooms that have high instructional conversation scores are characterized by conversations that encourage children to express original ideas and thoughts and prompt children to elaborate on ideas, explain reasoning, and process concepts more deeply. Lastly, child responsibility is characterized by the extent to which the classroom process allows students to take responsibility and be autonomous. Classrooms high in child responsibility are characterized by opportunities for leadership through classroom jobs and interactions with peers, teachers who elicit suggestions from students for solutions to problems in the classroom, and expectations that children will put away materials after finishing an activity.

In addition to receiving extensive training (see NICHD ECCRN, 2002, for training details), all observers completed reliability testing where they observed and coded 12 videotapes, over two sessions, which had a master key. Reliability for the 12 videotapes was computed using a reliability estimate based on repeated measures analysis of variance (Winer, 1971). The reliability rating for each subscale is an unbiased estimate of the reliability after accounting for differences in raters. All observers obtained moderate to good reliability on their reliability videotapes (literacy instruction = .81, evaluative feedback = .66, instructional conversations = .76, and child responsibility = .84). In addition, the correlations among the observed scores within 63 classrooms that had multiple study participants were examined; on average, the correlation between raters was greater than .70, indicating aspects of the classroom remained relatively stable across observations (NICHD ECCRN, 2004). A mean composite of instructional quality score

was created using all four subscales (alpha = .70), with higher scores indicating higher quality instructional support.

Academic performance. First- and second-grade teachers rated the study child's grade appropriate academic skills and knowledge using the Academic Rating Scale (ARS; Nicholson, Atkins-Burnett, & Meisels, 2002). Teachers completed both the Language and Literacy subscale (15 and 10 items at first and second grade, respectively) and Mathematical Thinking subscale (10 and 11 items at first and second grade, respectively) using a 5-point scale (1 = *not yet demonstrated* to 5 = *proficient*) with a separate "not applicable" choice for skills that had not been taught within the classroom. The Language and Literacy subscale consisted of questions about children's listening, reading, and writing behaviors and had good internal consistency at both first and second grade (alphas =.95 and .94, respectively). The Mathematical Thinking subscale addressed children's ability to understand and utilize mathematical skills when solving problems and had good internal consistency and both first- and second grade (alphas = .92 and .91, respectively). This scale has been shown to have good internal consistency in the early grades in longitudinal studies (alphas range from .91 to .94; Tourangeau et al., 2002). At first grade, children's academic performance was measured using both the ARS and the Woodcock- Johnson Psycho-Educational Battery-Revised (WJ-R; Woodcock & Johnson, 1989). Children's scores on the ARS were highly correlated with their scores on the WJ-R. Within the present study, scores on the ARS Mathematical Thinking subscale and the WJ-R Applied Problems subscale were positively correlated, r (851) = .51, $p < .01$. Scores on the ARS Language and Literacy subscale and the WJ-R Letter-Word subscale were also positively correlated, r (854) = .58, $p < .01$. Children were not administered the

WJ-R at second grade, thus the ARS was used as the measure of academic performance in the present study.

Prior to creation of each subscale mean composite score, responses of "not applicable" were recoded to "not yet demonstrated" if at least 60% of the questions were scored between 1 and 5. If less than 60% of the responses were scored from 1 to 5, the "not applicable" response was recoded as missing. A mean composite of both the Mathematical Thinking and Language and Literacy Subscale were created for both first and second grade with higher scores indicated higher ability.

Analytic Plan

First, preliminary analyses were conducted. Specifically, using SPSS 22, I computed descriptive statistics and zero-order correlations. I also tested for differences on study variables for children with complete and incomplete data. Then, I estimated the hypothesized path model using a full information maximum likelihood estimator to accommodate missing data, along with empirical bias-corrected bootstrapping to examine mediated effects, using Mplus 7.11 (Muthén & Muthén, 1998-2014). Empirical bias-corrected bootstrapping involves obtaining 1,000 artificial samples drawn with replacement from the existing dataset, treating each sample as a replication of the original sample. This approach was used as a means of estimating the direct relations between the first-grade predictors (parental involvement, peer interactions, student-teacher relationship, and instructional support) and first-grade behavioral engagement, and the relations between first-grade behavioral engagement and second-grade math and reading performance. In addition, I estimated indirect effects in order to determine whether behavioral engagement mediated the relation between the predictors and academic

performance. The 95% bias-corrected bootstrap confidence intervals (CI) were examined to determine if mediation was evident for the specified indirect effects. Bias-corrected bootstrapping yields more accurate CIs and lower Type-1 error rates by using resampling methods rather than other methods used to test indirect effects (e.g., normal theory of testing mediation; Mackinnon, Lockwood, & Williams, 2004). Mediation is supported if the 95% CI does not contain zero.

Results

Preliminary Analyses

As Table 1 shows, all variables were within the recommended range for normal distribution (i.e., skewness < 2 and kurtosis < 7; Tabachnick & Fidell, 2012). Pearson product moment correlations between predictors, mediator, and outcome variables were computed. Zero-order correlations between the study variables, child age and mother-reported income-to-needs were also computed (see Table 2). Given that age was related to the student-teacher relationship and instructional support (*rs* = -.10 and -.09, *ps* < .01, respectively) and income-to-needs was related to almost all study variables (see Table 2), both age and income-to-needs were included as control variables in the final model. As expected, all predictors were positively related to behavioral engagement (see Table 2). Behavioral engagement was positively related to math and reading performance.

Differences in study variables and covariates for children with complete data on the primary study variables and children with incomplete data were examined using independent samples *t*-tests. There were significant differences between children with incomplete data and children with complete data on three study variables and two covariates. Children with incomplete data ($M = 2.20$, $SD = 0.42$) had significantly lower

ratings of parental school involvement than children with complete data (M = 2.31, SD = .41), t (244.07) = 3.12, p < .01. In terms of positive peer interactions, children with incomplete data (M = 1.48, SD = 0.37) had significantly lower ratings than children with complete data (M = 1.55, SD = .35), t (232.41) = 2.42, p = .02. Children with incomplete data (M = 4.25, SD = .59) had significantly lower student-teacher relationship scores than children with complete data (M = 4.38, SD = .52), t (220) = 2.62, p < .01. In terms of covariates, there were significant differences between children with incomplete data and those with complete data on kindergarten engagement and family income-to-needs. Children with incomplete data (M = 1.56, SD = .41) had significantly lower kindergarten engagement scores than children with complete data (M = 1.64, SD = .38), t (241) = 2.12, p = .04. Lastly, children with incomplete data (M = 3.57, SD = 2.75) had significantly lower family income-to-needs than children with complete data (M = 4.17, SD = 3.12), t (284.70) = 2.31, p = .01. Given there were differences among children with complete and incomplete data, a full information maximum likelihood estimator was used to accommodate missing data.

Hypothesized Path Model

The hypothesized relations were examined using a path model. In terms of covariates, both first-grade math and reading performance were included in the final model. Specifically, second-grade math performance was regressed on first-grade math performance, and second-grade reading performance was regressed on first-grade reading performance. All first-grade predictors were regressed on age and income-to-needs as these covariates were reported during first grade. Given that the predictors of interest and first-grade behavioral school engagement were collected during the same school year,

kindergarten engagement was included as a covariate in an attempt to account for alternative causal processes (i.e. previous levels of engagement predicting first-grade parental involvement, positive peer interactions, student-teacher relationship, and instructional support). In effect, first-grade predictors were regressed on kindergarten engagement in an attempt to clarify the casual ordering of the predictors and mediator (Cole & Maxwell, 2003).

The original model fit was adequate, χ^2 (29) = 123.68, $p < .01$, Comparative Fit Index (CFI) = .91; root mean square error of approximation (RMSEA) = .08, 90% CI [.07, .09]; standardized root mean square residual (SRMR) = .08. Upon examination of the modification indices, covariances between the first-grade variables and first-grade math and reading performance were added. As all of these measures were obtained during the same semester, the addition of the covariances among the measures could be supported theoretically, as well as empirically (see Table 3 for covariance-residual variance table). Once the covariances were added, the model fit the data well, as indicated by the fit indices (CFI = .95; RMSEA = .08, 90% CI [.07, .09]; SRMR = .05; Figure 1). The chi-square test of model fit was significant, χ^2 (9) = 123.68, $p < .01$; however the chi-square test is sensitive to large sample sizes and can be statistically significant even for very small model-data discrepancy (Browne, MacCallum, Kim, Anderson, & Glaser, 2002). Both unstandardized and standardized parameter estimates for the paths from the covariates (i.e., age, income-to-needs, and kindergarten engagement) to first-grade parental involvement, positive peer interactions, student-teacher relationship, and instructional support are presented in Table 4 to ease interpretation of the model figure.

Two statistically significant paths emerged from academic experiences to behavioral engagement. First-grade positive peer interactions was positively related to behavioral engagement, B = 1.41 (p = .02), β = .11, and first-grade instructional support was positively related to behavioral engagement, B = .44 (p < .01), β = .10. First-grade parental involvement was not significantly related to first-grade behavioral engagement, B = .41 (p = .30), β = .04. In addition, the relation between the first-grade student-teacher relationship and behavioral engagement was not significant, B = .72 (p = .07), β = .08. As expected, first-grade behavioral engagement was significantly related to second-grade academic performance. Specifically, behavioral engagement was positively related to second-grade math, B = .02 (p = .02), β = .08, and second-grade reading, B = .02 (p = .03), β = .08.

To test if behavioral engagement mediated the relations between the first-grade predictors and second-grade math and reading performance, the results from the bias-corrected bootstrap CIs for the hypothesized indirect effects were examined (Table 5). The hypothesized indirect effect is supported if CIs do not contain zero. All hypothesized indirect effects from peer interactions and instructional support to both math and reading performance through behavioral engagement were supported and positive. Conversely, none of the indirect effects from parental involvement and the student-teacher relationship to math and reading through behavioral engagement were supported.

Discussion

Research indicates that children's first-grade academic experiences are important precursors for later academic performance (Alexander et al., 1993). According to SDT academic experiences, like the four examined in this study, are critical factors necessary

to encourage children's behavioral engagement, which is an overt manifestation of academic motivation. It is through behavioral engagement that children's academic experiences are related to academic performance. The present study sought to examine the indirect relation between children's first-grade academic experiences and their second-grade academic outcomes through first-grade behavioral engagement. This approach expands on current literature by including multiple academic experiences in a single mediation model. By doing so, the present study attempts to provide a more accurate portrayal of the multi-dimensional nature of first-grade academic experiences than previous work in that most of the studies that have examined similar experiences have examined them in isolation.

I hypothesized that all four first-grade academic experiences would show positive relations with behavioral engagement. Accordingly, it was not surprising to find small but significant bivariate relations between each of the four academic experiences and behavioral engagement. However, when the full model containing all four was tested, only two (positive peer interactions and instructional support) were significantly related to behavioral engagement. As expected, first-grade behavioral engagement was positively related to both second-grade math and second-grade reading performance. Results showed that the relation between first-grade positive peer interactions and second-grade academic performance was mediated by first-grade behavioral engagement. In addition, first-grade behavioral engagement mediated the relation between first-grade instructional support and second-grade academic performance.

Supported Mediating Processes

Positive peer interactions. Consistent with previous research, peer interactions were positively related to school engagement (Buhs & Ladd 2001; Ladd & Burgess, 2001), and in turn, school engagement was positively related to children's academic performance (Ladd, 1990; Ladd et al., 1999). As expected the relation between peer interactions and academic performance (both math and reading) was mediated by behavioral engagement. Previous work has examined the same basic mediating process using concurrent measures only and has focused exclusively on negative peer interactions during kindergarten (Buhs & Ladd, 2001; Ladd et al., 1999). This mediational process has also been examined using school engagement as a composite that included both emotional and behavioral engagement during first grade (Iyer et al., 2010) making it difficult to disentangle children's overt behavior from their intrinsic feelings, which are two very distinct types of engagement that children experience. Thus, current findings would seem to give more precise information on how classroom experiences are implicated in children's behavioral engagement in learning tasks. In effect, interactions with peers may have more impact on what children do with respect to task assignments than how they feel about classroom assignments themselves.

A more precise understanding of the processes through which children's peer interactions are related to their academic outcomes should allow researchers to develop better targeted peer interventions for use with students in the early years of school. Such interventions may help improve children's behavioral engagement. While interventions exist that focus on negative peer interactions (see Leff, Power, Manz, Costigan, & Nabors, 2001), findings from this study suggest that promoting positive peer interactions

may have benefits for academic outcomes. Children who experience more socially appropriate interactions with peers are more likely to demonstrate appropriate behavior within the classroom and, specifically, engage more productively in learning tasks. Such findings comport with principles of SDT which says that productive autonomous actions are promoted by having one's relationship needs fulfilled. Thus, by implementing interventions that focus on promoting positive peer interactions, educators are allowing for children's motivational needs to be fulfilled by their peers, which will positively impact children's behavioral engagement and subsequently their academic performance.

Instructional support. Consistent with previous work, findings from this study showed that instructional support was positively related to behavioral engagement, and that behavioral engagement positively mediated the relation between instructional support and academic performance (Dotterer & Lowe, 2010; Ponitz et al., 2009). The present study extends current knowledge by examining this process over time during the early elementary grades and by examining instructional support simultaneously with teacher's emotional and social support (i.e. student-teacher relationship). This approach provides useful information into the types of instruction, examined independent of the student-teacher relationship, that promote children's behavioral engagement in school. In accordance with SDT, children's motivational needs are met when teachers use more instructionally supportive practices to promote responsibility and self-initiative for learning, ultimately allowing children to feel both autonomous and competent. Consistent with arguments made concerning the value of teachers' use of organizing questions, structured feedback, and positive appraisals of student performance, the findings show

that instructional support leads to productive engagement with school tasks (Dolezal et al., 2003; Guthrie & Davis, 2003).

The findings pertaining to instructional support would seem to have implications for teacher training. Pre-service or in-service training experiences for teachers could focus on strategies that can help teachers create more instructionally supportive classrooms. Such training might include attention to identifying children who may be struggling to effectively engage in classroom activities with a view to increasing the use of key instructional support strategies with them in particular. Likewise, teachers might be mentored on how to incorporate such strategies more broadly into instructional activities when the classroom is composed of a high percentage of learners with more limited readiness skills. This approach may help children become more overtly engaged within the classroom and have lasting effects on their later academic performance. As it happens, in-service programs for preschool teachers have been developed that provide teachers with information regarding the types of interactions with students that are particularly effective in improving student engagement that could serve as models (Hamre et al., 2012). Although interventions that focus on teaching quality often emphasize academic performance, given the findings from the present study, improvement of instructional support within the classroom can also promote children's behavioral engagement, which has longitudinal implications for children's academic performance. Further research is necessary to examine if this type of in-service program can be utilized by teachers of different grades, followed by a replication of the current study among those participants.

Unsupported Mediating Processes

Parental involvement. Although a review article has outlined numerous associations between parental involvement and both school engagement and motivation (see Gonzalez-DeHauss et al., 2005), parental involvement was not related to behavioral engagement in the present study. Interestingly, many prior studies have utilized information on parental involvement based on teacher report (Izzo, Weissberg, Kasprow, & Fendrich, 1999). Teachers' perceptions of what is occurring with parents within the classroom may be different from those reported by parents about their own involvement (Hill & Taylor, 2004). It is, in fact, unlikely that teachers are fully aware of how most parents are involved in their own children's learning. In the present study, parents reported on their own involvement; but the focus was on the frequency of parents' involvement at school and their encouragement and attitudes about school. Including parents' report of encouragement and positive attitudes as a measure of parental involvement is consistent with the theoretical approach in the present study, as these behaviors support children's need for competence (Guay et al., 2008). However, it is not likely sufficiently inclusive of the many ways parents prepare and support children's learning and school engagement. In effect, the findings should not be interpreted as supporting the idea that parental involvement does not matter. Rather, they suggest that a more precise understanding of how parent involvement is implicated in children's academic performance likely requires a more comprehensive assessment of the many ways parents directly and indirectly support academic motivation and achievement.

The failure to find significant relations between parental involvement and engagement may also attest to the power of the classroom environment itself as a

determiner of children's academic performance during the early grades. Most prior studies have not controlled for instructional quality and peer interactions when examining relations between parent involvement and school engagement; thus, prior studies may have overestimated the independent influence of parent involvement. Indeed, many theoretical frameworks of learning and motivation emphasize the importance of accounting for coexisting academic experiences when conducting research about children's academic performance (Lee & Shute, 2010; Rimm-Kaufman & Pianta, 2000; Ryan & Deci, 2000) so as to not overestimate the influence of a single construct.

The relation between parental involvement and academic performance was not mediated by behavioral engagement in the present study, a finding that is inconsistent with previous research. To my knowledge, there is only one other study that found that first-grade behavioral engagement mediated the relation between a latent variable including parental involvement and second-grade academic performance (Hughes & Kwok, 2007). While this study examined a similar process as the present study, there are differences in sample characteristics between the two studies that may preclude our ability to generalize and compare findings. Children in the present study were from middle-income families and varying levels of achievement whereas, in the study conducted by Hughes and Kwok (2007), the sample was characterized by low income and low achievement. One possibility for the inconsistent results may be attributable to family income. By comparison to middle socioeconomic (SES) homes where supports for learning and academic motivation could be plentiful and diverse, children who are in low SES homes may face more academic risks (McLoyd, 1998). Although researchers have shown a positive relation between parental involvement and SES (Jeynes, 2005), there is

less understanding regarding the effects of parent involvement within different income groups (Desimone, 1999). Parental involvement may operate as a protective factor, or buffer, for children from low-SES families (Mcwayne, Hampton, Fantuzzo, Cohen, & Sekino, 2004). Further examination of the role of parental involvement within homogenous socioeconomic groups of children may provide useful information regarding how the patterns of parental involvement, as described by teachers and parents, are differentially related to children's academic performance. That is, children from low-income families may show more drastic benefits from parental involvement (Domina, 2005; Hughes & Kwok, 2007), whereas the benefits may be less noticeable among children from middle- to high-SES families.

Student-teacher relationship. Interestingly, the student-teacher relationship was not significantly related to children's behavioral engagement. This finding is contrary to numerous studies that have shown positive relations between close student-teacher relationships and engagement, as well as negative relations between conflictual student-teacher relationships and student engagement (see Roorda et al., 2011). However, it should be noted that Roorda and colleagues (2011) excluded studies that contained measures of instructional support and, when conducting the analyses, took the average effect size when both emotional and behavioral engagement were included in studies. Consequently, it may be that when other simultaneously occurring academic experiences are taken into account, relations between the quality of student-teacher relationships and school engagement are not significant – or at least weaker than has been estimated in studies where such controls were not used. Another possibility is that the findings from this study only pertain to one aspect of student engagement (i.e., behavioral engagement).

As school engagement is often broadly defined, encompassing emotional, behavioral, and cognitive engagement (Fredricks et al., 2004), it may be that the student-teacher relationship is more predictive of forms of school engagement not measured in the present study.

The relation between the first-grade student-teacher relationship and second-grade academic performance was not mediated by first-grade behavioral engagement, which is inconsistent with findings from both longitudinal (Dotterer & Lowe, 2010) and concurrent (Furrer & Skinner, 2003; Ponitz et al., 2009) studies. Apparent inconsistencies between findings from this study and prior studies that also used a longitudinal design are not easy to explain given other differences in the designs used. Previous research has examined and found support for such mediating process using aggregate measures of classroom quality depicted as latent variables including multiple aspects of the classroom such as the student-teacher relationship, instructional support, and peer interactions (Hughes & Kwok, 2007; Hughes et al., 2008; Dotterer & Lowe, 2010; Furrer & Skinner, 2003; Ponitz et al., 2009). In most prior studies, the focus was on capturing academic experiences as a context, preventing the extrication and examination of academic experiences independently. In effect, it may not be surprising that the findings from the present study are not fully consistent with prior studies, given the emphasis on examining each construct as an independent contributor within the hypothesized process in the present study. More closely related to the modeling approach used in the present study, through the inclusion of an independent measure of the student-teacher relationship, previous work has shown that second-grade behavioral engagement mediated the relation between the first-grade student-teacher relationship and third-grade academic

performance (Hughes et al., 2008). Similarly, in a model that also included a measure of parental involvement, the relation between the first-grade student-teacher relationship and second-grade academic performance was mediated by second-grade behavioral engagement (Hughes & Kwok, 2007). Importantly, however, the aforementioned studies only included children who were low achieving and primarily low income, preventing the generalization of findings to more academically and socioeconomically advantaged populations.

Within the present study, the unsupported hypothesized mediating processes included predictors that involved adults (i.e. parental involvement, student-teacher relationship); however, as outlined above, research has shown that adult interactions and involvement are critical for children's academic outcomes. Behavioral engagement did not mediate the relation between either type of interactions with adults and children's academic performance longitudinally in the present study. However, previous studies have shown that academic motivation mediated the relation between parent involvement and academic performance (Marchant et al., 2001; Grolnick et al., 1991), and a composite of school engagement that included both behavioral and emotional engagement mediated the relation between the student teacher relationship and academic performance (Furrer & Skinner, 2003). Given these findings, it may also be possible there is an unmeasured construct, namely intrinsic motivation that could be involved in this mediating process. According to SDT, positive, nurturing interactions between the teacher and student are critical to fulfill the student's need for close, nurturing relationships; similarly, parents who support children's learning through academic encouragement and academic support help children feel more confident in their abilities, and both types of adult interactions

promote children's intrinsic motivation (Deci & Ryan, 2012). The resulting intrinsic motivation from positive adult interactions may be better measured via emotional engagement, a measure of children's feelings about school (Fredricks et al., 2004). More research is necessary that examines the mediating role of both behavioral and emotional engagement between the adult interactions (i.e. parental involvement and student-teacher relationship) and academic performance. Furthermore, researchers have proposed a framework that suggests academic experiences that are external to the child work together to produce favorable levels of school engagement and academic outcomes (Lee & Shute, 2010), and more research is necessary utilizing this integrative framework to student learning. To be more specific, research that focuses on how all four predictors are related to academic performance through different forms of school engagement may provide novel evidence regarding how co-occurring academic experiences are important for different aspects of children's school engagement and how to best promote school engagement, a multidimensional construct.

It is also important to note that studies typically focus on school engagement at the population level, and often fail to examine school engagement using a person centered approach (Archambault, Janosz, Morizot, & Pagani, 2009). Future research could use latent profile analyses (LPA) to address this shortcoming. Specifically, LPA could be used to identify possible classes of engagement. For example, there may be three classes of engagement: a group of children who are high in both emotional and behavioral engagement, a group of children who have high emotional and low behavioral engagement, and a group of children who have both low emotional and low behavioral engagement. In turn, researchers could then examine how academic experiences differ

among engagement classes (i.e. the class with high emotional and behavioral engagement are in classrooms with high quality instructional support and student-teacher relationships). Overall, this approach could help researchers understand how similar or dissimilar academic experiences look among children with varying profiles of engagement.

Limitations and Conclusions

The present study provides a more detailed understanding of how first-grade academic experiences are indirectly related to later academic performance through behavioral engagement. Several limitations should be considered. Although the children in the sample were recruited as part of a longitudinal national survey, the demographics of the sample may prevent the findings from being generalized to the United States population as a whole. Specifically, the majority of the children were Caucasian and from middle-income households; thus, additional research would be required to investigate whether findings would hold for non-Caucasian children and those from low-income families. Broadly, research is necessary that replicates the current study among different ethnic groups and varying socio-economic statuses to better understand if the findings from the present study are generalizable to other populations. In addition, more specifically, future research should examine possible cumulative risk models among children from low-income families to determine if the processes in the present study can act as protective factors for children's academic outcomes. Research has shown that children from low-income families enter school at-risk compared to their higher income peers (McLoyd, 1998). Thus, among populations that enter school with more academic risk factors, the processes in the present study may manifest differently, as the child's

poverty history can infiltrate multiple aspects of the child, home, and school (Hill & Taylor, 2004; Seccombe, 2002).

Although the present study used an observational measure of behavioral engagement, a measure of children's emotional school engagement was not included. Emotional engagement may be more closely related to intrinsic motivation as it involves a child's feelings about school. Researchers should examine both emotional and behavioral engagement as possible mediating variables. The predictors in the present study all occur concurrently and are critical components of children's early school experience. Although not all hypothesized mediating paths were significant, the predictors of interest may still play an integral role in children's school engagement and achievement. The examination of possible interactions among academic experiences was not within the scope of the present study. Future research should examine possible interactions among academic experiences within the hypothesized mediating process; it may be that adult centered interactions do not directly predict behavioral engagement, but that this path may be moderated by other academic experiences, such as peer interactions within the classroom.

Although established, reliable measures were included in the present study, only parents' report of parental involvement within the home and school was included. This approach adds to a literature that often focuses solely on teacher's report of parental involvement, but future research that includes both the teacher's and parent's perceptions of parental school involvement will provide a more accurate portrayal of parental involvement as a whole. In addition, the present study relied on teacher's report of academic performance. Our confidence in the model is bolstered by the fact that two

different teachers reported on children's academic experiences and academic performance, and teacher reported academic performance was significantly correlated with a standardized measure of academic performance. Teachers also reported on both the student-teacher relationship and children's peer interactions during first grade and the correlation between these two variables was high (r = .66); as such, it is important to note this may indicate common-reporter bias. Having teachers report on both the independent variables and outcomes is not the most ideal approach. To strengthen the findings of the present study, future research should include a standardized measure of academic performance, and independent reporters for the student-teacher relationship and peer interactions, which will help eliminate the potential for reporter bias.

Despite these limitations, the findings of this study add to the literature in several ways. Although research exists that has examined the mediating role of behavioral engagement between children's academic experiences and academic performance, previous work often focuses on one or two academic experiences at a time. The present study begins to fill this gap by including multiple, independently measured academic experiences within a single model, which provides important information regarding the aforementioned mediating processes that are occurring within the presence of other coexisting experiences. Furthermore, the findings suggest that some academic experiences may be more closely related to children's behavioral engagement during the early elementary years. Specifically, children's peer interactions and teachers' instructional support functioned as important predictors of children's behavioral engagement. Ultimately, the importance of having positive, supportive early academic

experiences has implications for children's behavioral engagement within the classroom, which is essential for children's subsequent academic performance.

Study 2: First grade Instructional Support Quality Thresholds and Academic Performance through Elementary School

Within the United States, most states have adopted the Common Core State Standards (CCSS), a set of universal curriculum standards that emphasize critical thinking skills to prepare students for college and careers after high school (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). The emphasis on reaching the goals outlined by the CCSS begins early in children's academic careers because the academic skills children are taught in the early grades set the foundation for their later learning (Entwisle, Alexander, & Olson, 2005). With the changes to educational standards, and a greater emphasis on critical thinking skills, education reform has begun to focus on the instructional practices that occur within the classroom (Hamre & Pianta 2007). Specifically, research indicates that the *quality* of instructional interactions children have with their teacher during first grade is vital for children's academic and cognitive development (Hamre & Pianta, 2007).

High-quality instructional interactions (i.e., instructional support) promote children's academic performance (Curby et al., 2009a; Mashburn et al., 2008; Palardy & Rumberger, 2008). Yet, low-quality instructional support is typically seen in first-grade classrooms (Curby et al., 2009b), a critical grade for cognitive growth (Entwisle & Alexander, 1989). Research that has examined instructional support quality and academic performance often assumes a linear relation; that is, an increase in instructional support will result in a comparable increase in academic performance. Recently, however, researchers have begun to emphasize the importance of examining possible quality thresholds that must be met in order to see significant, measureable changes in children's

academic performance (Burchinal et al., 2010; Zaslow et al., 2010). Although the emphasis on identifying potentially consequential classroom quality thresholds has increased, few studies have actually examined this empirically; thus, more research is needed that directly examines how instructional support thresholds during early elementary school predict children's academic performance. The aim of the present study is to examine if first-grade instructional support quality thresholds predict children's first-, third-, and fifth-grade academic performance.

Theoretical Framework

The present study was guided by sociocultural developmental theory (Vygotsky, 1978) and Self-Determination Theory (SDT; Ryan & Deci, 2000). The sociocultural theoretical framework highlights the importance of shared activities and experiences for children's development (John-Steiner & Mahn, 1996). Specifically, this framework emphasizes the zone of proximal development (ZPD) and importance of scaffolding for learning. The ZPD refers to the child's potential to learn through support from an adult (or competent other), given the child's existing knowledge and skill (Goldhaber, 2000). That is, within the ZPD, children are capable of advancing their learning beyond their current skill with the guidance and support of a more knowledgeable player, and within a school setting this player can be the teacher. High-quality instructional interactions that occur within the ZPD involve the teacher's recognition of a child's existing academic skills and then altering his or her teaching style so that there is a good fit between the child's level of competence and the instructional strategy used. This ensures the child is supported throughout the learning process which promotes the child's development of academic skills, and ultimately, helps the child move forward on the continuum of

learning. A key piece of this framework focuses on scaffolding that occurs within the ZPD. The guidance that a teacher provides to promote learning can occur through scaffolding. When teachers scaffold learning, they must be aware of the child's beginning ability and provide enough assistance to encourage, but not overwhelm, the child to complete the task. This encouragement occurs through the use of verbal strategies such as leading questions and prompting the child to explain his or her thought processes without dismissing or completing the task for the child (Carlton & Winsler, 1999). Instruction that incorporates scaffolding and is fitted to children's ZPD is a catalyst for learning and can be considered foundational elements of instructionally supportive interactions with students.

The sociocultural theoretical framework provides an important foundation for understanding how to promote the greatest gains in children's learning. This framework is complemented by SDT, which emphasizes the importance of instructionally supportive interactions to promote children's academic motivation needs (Ryan & Deci, 2000). Specifically, instruction that is consistent with the sociocultural theoretical framework can promote children's need for autonomy and competence. When instruction provides children with choice and the ability to take initiative, it supports children's need for autonomy (Reeve & Halusic, 2009). Similarly, children's need for competence is supported when they receive feedback that their actions are effective (Deci & Ryan, 2012). Ultimately, high-quality instruction not only promotes learning through the ZPD and scaffolding, but also promotes children's academic motivation. Both have positive implications for academic performance (Guay et al., 2008).

Instructional Support and Academic Performance

Defining instructional support. Within the first grade classroom, children are presented with concepts and curricula that are often predetermined by school officials, imposing the same standards for all children. However, the instructional behaviors teachers use to implement curricula may vary. Process-product research has shown that teacher's instructional behavior within the classroom, such as questioning to stimulate learning and creating interactive learning experiences, is related to children's academic performance (Brophy, 1999), and these instructional behaviors are often referred to as instructional support. Broadly, instructional support refers to the implementation of purposeful instruction that promotes children's higher-order thinking and language (Pianta & Hamre, 2009). Identifying first-grade instructional support quality is important given the knowledge that early schooling experiences are extremely important for children's later academic outcomes (Alexander & Entwisle, 1988). Classrooms that have high quality instructional supports in place can be identified observationally through the types of instruction, feedback, and conversations that occur within the classroom (Cash, Hamre, Pianta, & Myers, 2012).

In classrooms with high-quality instructional support, teachers encourage children to make predictions about assignments and relate activities to their own lives (Guthrie, 2001). The opportunity to make predictions allows children to take initiative in their learning and supports children's need to feel autonomous in their learning which promotes academic motivation (Reeve & Halusic, 2009). By encouraging children to make predictions, teachers are requiring the child to process and think critically about the information they are learning (Brophy, 1999), a skill that can be transferred to other

classroom assignments, as well as real world situations. Additionally, within these classrooms, productive conversations between the student and the teacher are characterized by feedback loops (Pianta et al., 2012), which occur when the teacher and student have sustained back and forth conversations that focus on the student's expression of original ideas, elaboration on comments, and explanation of reasoning (Pianta et al., 2008). Reciprocated conversations encourage students to think deeply about what they are learning, often through the use of open-ended questions, rather than just providing the correct answer, a theoretically important approach. By asking questions that are directly related to the child's initial comment, teachers help the child move forward to the next level of understanding, which occurs through scaffolding within the child's ZPD. Specifically, the teacher recognizes the child's ability, and prompts the child with open-ended questions to move forward in his or her learning and skill. This process helps students internalize learning, which allows them to independently apply their knowledge in the future. Evaluative feedback is another important aspect of instructional support that is demonstrated through teacher's comments and responses to students with a focus on enhancing children's learning and understanding (Meyer, Wardrop, Hastings, & Linn, 1993; Hamre & Pianta, 2005). Instruction that includes carefully directed feedback encourages students to reflect on their understanding of particular concepts and encourages higher academic performance within the classroom (NICHD ECCRN, 2002). In addition, this type of targeted feedback is more likely to encourage students' efforts and persistence towards goals, compared to general praise (i.e., "good job"), in that it directly reinforces their specific engagement with learning (Hamre & Pianta, 2005). Reinforcement of children's engagement with learning ultimately promotes their need for

competence, as children are likely to feel more competent regarding school when they perceive their actions as appropriate (Deci & Ryan, 2012). In turn, children's overall academic motivation is promoted, which is related to their academic performance (see Deci et al., 1991)

Research on instructional support quality. Taken together, the aspects of instructional support outlined in the above section have been shown to promote children's academic performance during elementary school (Pianta & Hamre, 2009). Examined linearly, instructional support quality is positively related to children's academic performance (Curby et al., 2009b; Hamre & Pianta 2005; Pianta et al., 2002). Recently, however, researchers have begun to examine possible thresholds for instructional support quality. This shift occurred to reflect policy initiatives that began to focus on quantifying the quality within classrooms (Tout, Zaslow, Halle, & Forrey, 2009) in order to share quality information with the public. These quality ratings are often tied to incentives and negative consequences for teachers; thus, researchers began to focus attention on how thresholds of instructional support quality were related to children's academic performance.

Researchers have used spline regression models to empirically determine an instructional support quality cut-score at which the slopes below and above the cut-scores differ (Burchinal et al., 2010). This cut-score is then deemed the empirical threshold and used for further analyses. When examined as a threshold, instructional support scores are labeled prior to analyses as either low- or high-quality using the empirically pre-defined cut-score. The use of thresholds allows researchers to examine if the linear association between instructional quality and academic outcomes differs for classrooms characterized

by low-quality and classrooms characterized by high-quality instructional support (Burchinal et al., 2014). Some research has shown that instructional support is meaningfully related to academic outcomes only when it is characterized as high quality. For example, when examined using a low- and high-quality threshold cut-scores during preschool, instructional support positively predicted math and reading performance in the high-quality classrooms, and there was no relation between instructional support and academic performance in the low-quality classrooms (Burchinal et al., 2010). However, the study by Burchinal and colleagues only included children from low-income backgrounds and utilized a cross-sectional design.

It is important to note that results pertaining to quality thresholds are mixed; another study failed to replicate findings that instructional support quality thresholds were related to low-income, rural preschooler's reading, math, and working memory (Burchinal et al., 2014). The authors note that almost no classrooms scored higher than a four (on a scale of 1 to 7) on instructional support, indicating relatively low-quality instructional support for the entire sample. Although the findings of this study did not replicate previous work, the sample characteristics limit generalizability of the findings. Further research is necessary to help create a better understanding regarding possible quality thresholds for instructional support.

In overview, because instructional quality in the early grades appears instrumental in determining children's academic trajectories and because the few studies on quality thresholds leave uncertain whether there is a threshold of quality that must be attained in order to promote early learning, there is need for further research on the issue of quality thresholds. The present study aims to add to the emerging literature by examining

whether instructional support quality thresholds at first grade are related to academic performance throughout elementary school. Within the present study, the quality threshold cut-score for the low- and high-quality group were based on previous research (Burchinal et al., 2010).

Present Study

High-quality instructional support is important for children's academic outcomes throughout school (Pianta et al., 2002; Ponitz et al., 2009), and the quality of instruction a child receives in first grade is highly predictive of academic performance (Palardy & Rumberger, 2008). The linear relation between instructional support quality and children's academic performance has been examined in previous work. Recently, however, researchers have argued that relations between quality of instruction and academic performance may not be linear; and, specifically that there may be thresholds of quality below which there is little relation. To my knowledge, researchers have yet to examine how early elementary instructional support quality is related to children's academic performance through elementary school when accounting for quality thresholds.

The goal of the present study was to determine whether the relation between first-grade instructional support quality and children's first-, third-, and fifth-grade academic performance is non-linear; specifically, I sought to identify whether there is a threshold below which differences in quality do not predict academic performance. I hypothesized that high-quality first-grade instructional support would be significantly related to children's first-, third-, and fifth-grade math and reading performance. However, based on previous research (Burchinal et al., 2009; Burchinal et al., 2010), no significant relation

between low-quality first-grade instructional support and children's math and reading performance at any grade were hypothesized. Given that academic skills observed earlier in time tend to be predictive of future performance (La Paro & Pianta, 2000), children's academic performance from the prior academic year was included as a control variable (e.g. controlling for third-grade academic performance when examining the fifth-grade academic performance). In addition, research has shown that the student-teacher relationship, a type of emotional support in the classroom, is predictive of academic outcomes (Hughes & Kwok, 2007). Given that the early grades of school are critical for the creation of future academic patterns, and the importance of the student-teacher relationship as an emotional support during this time, the first grade student-teacher relationship was included as a control variable in all analyses.

Method

Participants

The present study utilizes data from the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development (NICHD-SECCYD). During 1990, parents from 10 geographic sites across the United States were recruited upon the birth of their child to participate in this longitudinal national study. Children who had received a disability diagnoses and mothers who did not speak English were not included in the study. At recruitment, the consent rate was 89% (N = 1,364 out of a possible 1,526). Participating families were demographically diverse in terms of the sites from which they were recruited. Sampling weights are not available for this dataset. Detailed information about the participant selection, procedures, and instruments are available publicly (NICHD ECCRN, 1993).

Participants were followed longitudinally from birth through ninth grade; the present study focuses on first, third, and fifth grades. In order to minimize attrition, families were mailed different forms of communication throughout the duration of the study. Any child who was not in the focal grade (reported by the teacher) for a given data collection (e.g., in first grade during the first grade focal year) was not included in the analytic sample. These criteria resulted in the omission of 100 students. In addition, children who had completely missing data on study variables were not included in the study (n = 234). The resulting analytic sample was 1,030 children (50% male, n = 512), of which 732 had complete data at all three grades.

At first grade, children's ages ranged from 6.35 to 8.07 years (M = 7.03, SD = .29). The majority of the sample, approximately 78%, was Caucasian. Approximately 11% of children were African American, 6% were Hispanic, and 5% were identified as other. In terms of preschool experiences, approximately half (55%) of children attended center-based preschool. During first grade, the majority of children attended public school (81%). In first grade, children were dispersed across 872 classrooms. Very few classrooms contained more than one study child. Specifically, 7% of classrooms had two study children, and less than 1% of classrooms had three or more study children. Approximately 40% of first-grade teachers had completed some graduate work, 38% obtained a Master's degree, 20% obtained a Bachelor's degree, and 2% indicated other. The amount of teaching experience for first-grade teachers ranged from .25 to 40 years (M = 9.16, SD = 8.13). The majority of first-grade teachers were female (96%) and identified as Caucasian (94%). Approximately 3% of teachers identified as African American, 1% identified as Asian, 1% identified as Hispanic, and 1% identified as other.

Mother's reported the average total family income of participants was $67,586 (*SD* = $51,531, *Mdn* = $55,000). The majority of parents were married and living together (77%). Approximately 12% of parents were divorced, 6% were living with their partner, and 5% identified as other. The majority of mothers (76%) were employed. The highest level of education for mothers ranged from some high school to an advanced degree. Approximately 33% of mothers completed some college, 24% obtained a bachelor's degree, 20% graduated high school, 14% completed graduate work, 7% did not complete high school, and 2% had an advanced degree.

Procedures

During the spring of first grade, instructional support quality was observed and coded in the study child's classroom. Typically, the observations occurred during the morning. If morning observations were not possible, the classroom was observed during the afternoon. On the rare occasion that multiple study children were in a single classroom, observations were made separately for each child. Observations were performed by different research personnel, and they were conducted on different days (one visit per study child). Given the longitudinal nature of this study, teachers completed a questionnaire with personal demographic and classroom information each year. In addition, mothers were interviewed by a trained research personal and children participated in laboratory visits during which they were administered academic performance tests. Questions on the mother's interview included child and home demographic information during first grade. All participants were compensated for their participation.

Measures

Despite efforts to obtain complete item-level data, some item-level data were missing. Proportional weighting imputation was used by the study administrators to account for missing item-level data if (a) no more than 20% of the items for a given scale were missing, (b) the Cronbach's alpha was larger than .75, and (c) items were unit-weighted (Appelbaum, 1993). Data available for analyses were composited by the study administrators.

Instructional support quality. The First Grade Classroom Observation System (COS-1; NICHD ECCRN, 2002) was used to observe the instructional support quality in the first-grade classroom. Using this measure, trained research personnel observe, record, and rate aspects of the instructional quality of the classroom climate using a 7-point scale (1 = *uncharacteristic*, 3 = *minimally characteristic*, 5 = *very characteristic*, 7 = *extremely characteristic*). Observations took place over the span of 15 minutes on a single day. Higher scores reflect higher quality instructional support, as characterized by a teacher who demonstrates aspect of instructional support extremely well.

The four aspects of instructional support include literacy instruction, evaluative feedback, instructional conversation, and child responsibility. Literacy instruction quality was characterized by the use of phonics and comprehension skills. Evaluative feedback refers to the teacher's evaluation of student's work and comments. Instructional conversations quality was characterized with respect to the kinds of concepts discussed and the cognitive skills elicited during teacher-student conversations. Child responsibility measures the opportunities available for students to take leadership and ownership over aspects of the classroom, in addition to their own learning. In the present study, a mean

composite instructional support quality score was created using all four subscales (alpha = .70) resulting in a possible score between 1 and 7, with higher scores indicating higher quality instructional support.

All observers completed intensive training and reliability testing (see NICHD ECCRN 2002 for training details). Observer's reliability was evaluated after observing and coding 12 videotapes, which had a master key. Reliability on the master coded videos was computed using a reliability estimate based on repeated measures analysis of variance (Winer, 1971). For each subscale, the reliability rating accounts for differences in raters and is an unbiased estimate of the reliability. All of the observers showed moderate to good levels of reliability (literacy instruction = .81, evaluative feedback = .66, instructional conversations = .76, and child responsibility = .84). The correlations among codes within the 63 classrooms that had multiple study participants were examined; according to high correlations between raters ($r > .70$), aspects of the classroom remained stable across observations (NICHD ECCRN, 2004). A detailed manual of this observational coding scheme is available (see http://secc.rti.org).

Academic performance. Children's math and reading performance was directly assessed by trained research personnel during the spring of first, third, and fifth grades using the Woodcock- Johnson Psycho-Educational Battery-Revised (WJ-R; Woodcock & Johnson, 1989), a reliable and valid measure of children's academic performance (McGrew, Werder, & Woodcock, 1991). This battery can be used to assess children's math and reading achievement as early as age two. Children were administered the Letter-Word Identification (57-items; e.g. naming letters and words) and Applied Problems (60 items; e.g. mathematic word problems) subscales. Children's raw scores on

each scale were converted to *W* scores, scoring unique to WJ tests that have equal interval units allowing researchers to compare children's scores across time and subscale. Within the present study, the subscales had high internal reliability for first, third, and fifth grade (Letter-word identification = .92, .90, .88, and Applied Problems alpha = .83, .81, .82, respectively).

Covariates. Child gender, ethnicity, and mother's reported income-to-needs at first grade were included in all analyses. Each income-to-needs ratio was computed by dividing the reported family income by the national poverty level, taking into account household size. Children's performance at 54 months on the Letter-Word Identification (alpha = .84) and Applied Problems (alpha = .84) subscales of the WJ-R were included as control variables for first-grade analyses.

Student-teacher relationship. First-grade teachers completed the Student-Teacher Relationship Scale: Short Form (STRS; Pianta, 2001). This 15-item measure assesses the teacher's perceptions of his or her relationship with the study child. Teachers reported on their closeness and conflict with the study child using a five-point scale (1 = *definitely does not apply* to 5 = *definitely applies*). The closeness scale (8-items) is a measure of the positive relationship between the study child and the teacher ("I share an affectionate, warm relationships with this child"; Cronbach's alpha = .85). The conflict scale (7-items) is a measure of the negative aspects of the relationship between the study child and teacher ("this child easily becomes angry at me"; Cronbach's alpha = .88). This measure has been shown to be a reliable and valid measure of the student-teacher relationship (Pianta & Steinberg, 1992; Pianta & Stuhlman, 2004). When creating the composite score, items from the conflict scale were reverse-coded prior. A mean composite of all 15

items was created. Higher scores on this composite indicated a more positive relationship (composite alpha = .86). The first grade student-teacher relationship was used as a control variable in all analyses.

Analytic Plan

First, I conducted preliminary analyses and examined descriptive statistics, zero-order correlations, and differences on study variables for children with and without complete data, for all study variables using SPSS 22. Then, gender and ethnicity differences on all study variables were examined. Next, multiple imputations were created to account for missing data. Then, I created the dichotomous instructional support quality variable based on previous research that has used spline regressions to determine an empirical cut-score for instructional support quality (Burchinal et al., 2010). I ran separate piecewise regressions for math and reading outcomes at first, third, and fifth grade. Last, post-hoc analyses were conducted given the findings of the piecewise regressions.

Results

Preliminary analyses

Preliminary analyses were conducted to examine the descriptive statistics of all study variables (Table 6), and the variables did not deviate from the recommended values for the normal distribution (i.e., skewness < 2 and kurtosis < 7; Tabachnick & Fidell, 2012). Zero-order correlations were examined among the study variables and to determine if first-grade age and mother reported income-to-needs were related to the study variables (Table 7). First-grade age was negatively related to first-grade instructional support and positively related to first-grade math performance; however

because first-grade age was not related to other study variables, it was not included as a covariate in analyses. First-grade income-to-needs was positively related to all study variables; thus, first-grade income-to-needs was included as a control variable in all models. Next, using independent samples *t*-tests, differences on study variables and covariates (preschool math and reading performance, and first-grade student-teacher relationship, age, and income-to needs) between children with complete data and children with incomplete data were examined. There were no significant differences between children with complete data and children with incomplete data on any study variables.

Given that previous work using instructional support quality thresholds has controlled for gender (Burchinal et al., 2014), independent samples *t*-tests were conducted to examine if boys and girls differed on study variables and covariates. There were significant differences between boys and girls on two study variables and three covariates. Girls had significantly lower first-grade math scores ($M = 469.66$, $SD = 14.21$) than boys ($M = 472.39$, $SD = 15.82$), $t\ (914.09) = -2.78$, $p < .01$. First-grade instructional support quality was significantly lower in boys' classrooms ($M = 3.85$, $SD = 1.04$) than girls' classrooms ($M = 4.02$, $SD = 1.04$), $t\ (882.44) = 2.41$, $p = .02$. Boys had significantly lower math ($M = 424.06$, $SD = 20.69$) and reading ($M = 369.09$, $SD = 373.08$) scores in preschool than girls (math $M = 428.46$, $SD = 16.10$; reading $M = 373.08$, $SD = 22.09$), $t\ (849.12) = 3.61$, $p = .04$ and $t\ (849.12) = 3.61$, $p < .01$, respectively. Additionally, in first grade, girls had significantly higher student-teacher relationship scores ($M = 4.46$, $SD = .51$) than boys ($M = 4.00$, $SD = 2.98$), $t\ (911.67) = 6.25$, $p < .01$. Given the significant differences between boys and girls, sex was included as a control variable in all analyses.

Lastly, independent samples *t*-tests were conducted to examine if there were differences between Caucasian and non-Caucasian children on study variables and covariates. Caucasian children had significantly higher scores on all study variables than non-Caucasian children (see Table 8). Given these significant differences, all study analyses controlled for child's ethnicity (0 = Caucasian, 1 = non-Caucasian).

Piecewise Regression Analyses

To account for missing data in study variables, multiple imputations were conducted using SPSS 22 prior to the study analyses. Prior to imputations the potential scale reduction factor (PSR), a diagnostic procedure, was examined to determine the number of appropriate burn-in iterations between datasets (Gelman, Carlin, Stern, & Rubin, 1995). After examining the PSR from the initial run, it appeared that 1000 iterations were appropriate to ensure the algorithms convergence. Accordingly, 50 imputed datasets, with 1000 burn-in iterations between datasets were created. Including 1000 iterations between each dataset helped ensure that each imputed dataset was a random sample. All subsequent analyses were conducted using the 50 imputed datasets and the original dataset, resulting in 51 analytic datasets. In SPSS 22, the results are then pooled, resulting in an aggregate result based on all 51 datasets.

Next, a dichotomous grouping variable was created for instructional support quality. Burchinal and colleagues (2010) used spline regression models to determine an empirical cut-score to categorized classrooms into low- and high-quality instructional support groups. Classrooms with an instructional support quality score between 1 and 3.24 were categorized as low quality, and classrooms with an instructional support quality score between 3.25 and 7 were categorized as high quality. Within the present

study, the dichotomous instructional support quality grouping variable was created using the same conventions as the aforementioned study. Approximately 24% of children were in classrooms with low-quality instructional support. See Table 9 for descriptive statistics of study variables for the low- and high-quality groups.

Separate piecewise regressions were conducted for math and reading outcomes at each grade (see Table 10 for unstandardized parameter estimates) using the multiple imputation datasets. First-grade income-to-needs, child sex (0 = female), previous academic performance, the first-grade student-teacher relationship, and ethnicity (0 = Caucasian) were included as covariates in all piecewise regression analyses. All continuous covariates were grand-mean centered to facilitate interpretation. At first grade, low-quality instructional support did not significantly predict first-grade math performance or reading performance [t (1021) = .81, p = .42; t (1021) = 1.15, p = .25, respectively]. Similarly, high-quality instructional support did not significantly predict first-grade math or reading performance [t (1021) = .14, p = .89; t (1021) = -.18, p = .86, respectively]. Low-quality first grade instructional support did not significantly predict third-grade math performance or reading performance [t (1021) = .05, p = .96; t (1021) = -.86, p = .39, respectively]. Additionally, high-quality first grade instructional support did not significantly predict third-grade math or reading performance [t (1021) = .98, p =.33; t (1021) = .13, p = .90, respectively]. The same pattern of results seen for first- and third-grade academic performance was also observed for academic performance in fifth grade. Specifically, low-quality first-grade instructional support did not significantly predict fifth-grade math performance or reading performance [t (1021) = 1.13, p = .26; t (1021) = .39, p = .70, respectively]. High-quality first grade instructional support did not

significantly predict fifth-grade math or reading performance [t (1021) = -1.46, p = .15; t (1021) = .20, p = .84, respectively].

Post-Hoc Analyses

Given that none of the hypothesized piecewise regression analyses were statistically significant, I conducted post hoc analyses to further examine the data. In these follow-up analyses, I did not include the dichotomous quality threshold variable. First, I applied a non-parametric loess procedure to examine a smoothed line of fit for the original data for reading and math at each grade using SAS 9.3. Then, I examined multiple linear regressions for both math and reading each grade using SPSS 22.

Loess procedure. For each grade, I fit a separate non-parametric loess curve to the scatterplots depicting the relation between first-grade instructional support quality and math and reading separately. The non-parametric loess procedure provides an empirically fitted curve to a scatterplot without any specification of the relation between the two variables (Jacoby, 2000), an approach that is helpful in determining if there are different linear relations among the variables for different values of the predictor (Ryan & Porth, 2007). Fitting a non-parametric loess curve is the first step taken when researchers are interested in examining the potential scores that can be used to conduct spline regression analyses based on the curve of the loess line. This approach allowed me to visually examine if there were any noticeable differences in the slope of the line at different values of instructional support quality, supporting the notion of a threshold. Upon examination, for both math and reading at all three grades, the loess curve of fit appeared relatively flat, with very little noticeable change in slope at any value of instructional support quality (see Figures 2, 3, and 4, for first-, third-, and fifth-grade scatterplots

respectively). There was no noticeable change in slope, thus there is a lack of support for the use of a threshold cut-score with the current data.

Linear multiple regression analyses. Although the loess line of fit appeared to be relatively flat, I decided to further investigate if there was a linear relation between first-grade instructional support quality and math and reading performance at each grade. At each grade level, I examined linear regression models for both math and reading. In all linear regression models, first-grade income-to-needs, child sex, previous academic performance, the first-grade student-teacher relationship, and ethnicity were included as covariates (Table 11). All continuous covariates were grand-mean centered to ease interpretation. First-grade instructional support did not predict math performance at any grade level [t (1023) = .10, p = .92; t (1023) = .40, p = .69, t (1023) = -.90, p =.37, at first, third, and fifth grade, respectively]. Similarly, first-grade instructional support did not predict reading performance at any grade [t (1023) = .19, p = .85; t (1023) = -.30, p =.76, t (1023) = .92, p = .36, at first, third, and fifth grade, respectively].

Discussion

The quality of the instructional support that children receive during the early elementary school years is deemed critical for their subsequent academic performance (Pianta et al., 2002; Ponitz et al., 2009). Previous research has shown that instructional support is positively related to children's academic performance (Burchinal et al., 2009; Burchinal et al., 2010). In addition, multiple theoretical approaches to learning and motivation, including sociocultural theoretical frameworks and SDT, emphasize the importance of high-quality instructional support to promote academic learning (Ryan & Deci, 2000; Vygotsky, 1978). Using a large sample of elementary school students, the

present study sought to extend previous work that has shown inconsistent findings regarding the effect of low- versus high-quality instructional support on children's academic performance.

I hypothesized that only high-quality first-grade instructional support would be positively related to children's academic performance at first, third, and fifth grades. Somewhat contrary to expectations, first-grade instructional quality (run separately for high instructional quality and low instructional quality groups) was not significantly related to children's academic performance at any grade. More surprisingly, no relation was observed between first-grade instructional quality and achievement at any of the grade levels tested even when simple linear models were tested. There are mixed findings in the literature regarding how instructional quality thresholds are related to preschool children's academic performance (Burchinal et al., 2009; Burchinal et al., 2010; Burchinal et al., 2014). The notion that instructional support quality thresholds during early elementary school matter for academic performance for the broad population of elementary learners was not supported by the findings from the present study. It is important to note the importance of null findings obtained on the large, diverse sample of children in the present study given the limited research on instructional quality thresholds and that most studies have included demographically limited samples and age groups. Although one could speculate extensively as to why the findings from the present study were non-significant, two overarching possibilities, sample characteristics and measurement instruments, are outlined below as to why the findings from the present study differ from previous research.

Sample Characteristics

Differences in sample characteristics across studies examining thresholds provide one possible explanation for the inconsistencies in findings. Burchinal and colleagues (2010) showed a significant relation between high-quality, but not low-quality, instructional support and children's academic performance among *low-income preschoolers*. In the present study, the sample consisted of *first grade, middle-income children* and their academic performance over time. Thus, two major differences in sample characteristics were grade-level and socio-economic status (SES). Children who participated in the Burchinal et al. (2010) study were enrolled in state-funded pre-kindergarten classrooms. For a significant percentage of children, preschool is their first experience in a formal educational environment. There may be a more noticeable impact of instructional support quality above certain thresholds on children's academic performance as preschool children are presented with content that is likely new to them; whereas once children are in elementary school they may be presented with content with which they are more familiar and the children may have a larger foundation of academic skills to build upon (Claessens, Engel, & Curran, 2013). Thus, it could be more difficult to detect gains in children's academic skill during first grade or later academic years, when children already have foundational academic skills, than during preschool when children are beginning to obtain foundational skills. More research is necessary that examines empirically-derived, sample-dependent instructional support quality thresholds in later grades to determine whether threshold cut-scores determined to be useful for preschool (Burchinal et al., 2010; Burchinal et al., 2014) apply at later grade levels. Surprisingly, post-hoc analyses in the present study did not show meaningful threshold

scores, as evidenced by graphical analyses that did not show a point at which the line of fit sharply increased or decreased, which indicated that first-grade instructional quality threshold scores could not be empirically derived for first-, third-, and fifth-grade academic performance. However, given the inconsistencies in findings across studies, the examination of unique, empirically derived thresholds at each grade level may be warranted given developmentally appropriate curricular shifts as children mature. It is possible that in later grades, higher quality thresholds may once again become operative, and this could be investigated by examining instructional support quality scores in the higher grades.

The sample in the present study included a substantial percentage of middle-income households (many of which were stable, two-parent families), whereas Burchinal and colleagues (2010) included only children from low-income backgrounds. Children from low-SES families typically enter school with more academic risk factors and lower achievement than their higher-SES peers (Duncan & Brooks-Gunn, 2000; McLoyd, 1998). One possibility for the discrepancy in findings may be related to the differences in academic skill that are attributable to SES. Children from low-SES backgrounds are often from homes where there are fewer opportunities for learning than their higher-income peers (Bradley, Corwyn, McAdoo, & Garcia Coll, 2001; Seccombe, 2002). Because of this difference, many early preschool intervention projects have focused on the compensatory benefits of high-quality preschool for low-income children (see Barnett, 2011). Furthermore, academic gains are especially prevalent in high-quality preschool classrooms for children from low-SES backgrounds (Magnuson, Meyers, Ruhm, & Waldfogel, 2004; Mashburn et al., 2008; Peisner-Feinberg et al., 2001). If children from

low-SES backgrounds have lower baseline academic performance score and are less ready to engage in the learning activities presented (McLoyd, 1998), their gains in academic performance may be substantial when learning is fostered through high-quality instructional support. Conversely, children from middle- to high-SES backgrounds may enter school with average or above average academic performance and a readiness to engage in learning. As well, they are likely to have continued support for learning at home (Bradley et al., 2001). Therefore the improvement in academic skills may not be as steep compared to their lower-SES peers. In order to provide a more comprehensive understanding of for whom and how instructional support quality thresholds are related to academic performance, research examining instructional quality thresholds among homogenous groups of SES backgrounds is needed.

Although the findings from the present study are inconsistent with findings from existing research (Burchinal et al., 2009; Burchinal et al., 2010), one other study also failed to detect a relation between high-quality instructional support and academic performance (Burchinal et al., 2014). Interestingly, this study shared many similar sample characteristics (i.e. low-income preschoolers) with the study conducted by Burchinal and colleagues (2010). Therefore, researchers should be cautious about generalizing empirically derived cut-scores from sample to sample, even when similar sample characteristics are evident. Given the inconsistencies in findings across multiple studies, further research is needed that not only examines instructional support quality thresholds among elementary school children, but also among different samples of low-income preschool children.

Measurement Instruments

The second possibility for the inconsistent findings between the present study and the study conducted by Burchinal and colleagues (2010) is related to aspects of the measurement instrument used to quantify instructional support quality. Specifically, previous research (Burchinal et al., 2009; Burchinal et al., 2010; Burchinal et al., 2014) has determined instructional support quality threshold cut-scores using the Classroom Assessment Scoring System (CLASS; Pianta, La Paro, & Hamre, 2004). However, the present study examined instructional support as measured using the COS-1 (NICHD ECCRN, 2002), which was used to inform the creation of the CLASS tool (Pianta, 2003). As expected, given that the COS-1 was a precursor of the CLASS, the two tools have many similarities. Still, differences do exist across the two assessments. The instructional support measure of the COS-1 consists of four distinct aspects of instructional quality (i.e. literacy instruction, evaluative feedback, instructional conversation, and child responsibility), whereas the CLASS consists of three aspects of instructional quality (i.e. concept development, quality of feedback, and language modeling). Specifically, within the COS-1, literacy instruction focuses on the richness of the literacy environment through the exposure to language, and child responsibility is a measure of the opportunities available for the child to take on responsibility within the classroom. Aspects of the literacy instruction scale, such as asking children to make predictions about stories and relating the story to their lives, are measured within the CLASS; however, in the CLASS, these approaches are obtained throughout the day and not just during literacy instruction. Importantly, the types of behavior described within the child responsibility scale of the COS-1 do not directly map onto any of the three scales of the

CLASS. The inclusion of similar, but not identical, aspects of instructional support may preclude our ability to generalize the threshold cut-off scores from previous research to the present study.

The distribution of instructional support quality scores varied greatly between the study by Burchinal and colleagues (2010) and the present study. Two main concerns can be identified when examining the differences in instructional support quality scores between the two studies: (a) the mean scores in the two studies are varied and (b) the distribution of scores in the two studies are quite different, with greater diversity observed in the present study. The mean score for instructional support was much lower in the study by Burchinal et al. ($M = 2.04$) than in the present study ($M = 3.94$). If the mean scores were examined in relation to the quality categories outlined by the publisher of the measure, an average score of 2.04 would be considered low-quality, characterized by few, if any, instances of instructionally supportive teaching techniques. According to the publisher, an average score of 3.94 in the present study would be considered mid-range quality. Classrooms within the mid-range are characterized by occasional occurrences of instructionally supportive teaching practices. Furthermore, approximately 95 percent classrooms had scores between 1.00 to 3.74 in the study by Burchinal and colleagues (2010), whereas 95 percent of classrooms scored between 1.86 and 6.02 in the present study. Overall, when examining the range of scores in the Burchinal et al. (2010) study, the majority of classrooms had scores below the average instructional support quality score observed in the present study. Taken together, the differences in the mean and distribution of scores between the two studies may have implications as to the inconsistent findings regarding the two studies. One possibility is that because the COS-1

and the CLASS are not identical measures, classrooms scored using the COS-1 (in the present study) had overall higher scores based on the properties of the measure. Given the differences between the two measures, more research is necessary that examines instructional support quality thresholds using the CLASS. Another possibility may be that the differences in means and distribution of scores are related to the many differences in sample characteristics as outlined in the above section, and as such, future research should examine the notion of quality thresholds among varying samples. Finally, there is the issue of unmeasured "third variables." The preschool classrooms examined in the Burchinal et al. study and the first-grade classrooms measured in the current study may have differed in ways not captured by the instructional quality measures used that could have been consequential for academic performance.

Post-Hoc Linear Regression Findings

Surprisingly, when post-hoc analyses were conducted in the present study, there was no significant linear relation between first-grade instructional support quality and academic performance at any grade. The non-significant linear model is contrary to previous research that has shown a positive relation between instructional support quality and children's academic performance (Curby et al., 2009b; Hamre & Pianta 2005; Pianta et al., 2002); however, these previous studies examined concurrent relations during kindergarten and first-grade, whereas the present study examined the relation between first-grade instructional support and academic performance in later grades, which may preclude our ability to compare and generalize findings across studies. It is important to note that the concurrent relation between first-grade instructional support and first-grade academic performance was examined in the present study. Hamre and Pianta (2005) used

first grade data from the NICHD-SECCYD dataset to examine a similar relation; however, the focus of the study was to illustrate the importance of instructional support for high-risk children (e.g. demographic risk and behavioral problems) as compared to their low-risk peers. Examining all of the children in a single sample in the present study may have prevented the detection of the linear relation between instructional support quality and academic performance for some children. Given the different approaches in the present study and the study by Hamre and Pianta (2005), future research could examine instructional support quality thresholds among different risk categorizations to extend previous research.

Future Research, Limitations, and Conclusion

Overall, there are inconsistent findings regarding the relation between instructional support quality thresholds and academic performance. Some research has shown that only high-quality instructional support is related to academic gain (Burchinal et al., 2009; Burchinal et al., 2010), whereas other research, including the present study, has shown no relation between instructional support quality thresholds and academic performance (Burchinal et al., 2014). Theoretical frameworks of learning and motivation to learn support the notion that higher levels of instructional support contribute to academic gains. Specifically, a child's learning potential is maximized when he or she experiences high-quality instruction that is catered to the child, helping ensure that the child is challenged and supported during learning (Goldhaber, 2000). Not only do instructionally supportive teaching techniques maximize learning potential within each interaction, but they also promote children's feelings of competence and autonomy within

the classroom, which is important to promote subsequent academic motivation and performance (Deci & Ryan, 2012).

Further research examining instructional quality thresholds is needed, as thresholds are increasingly being used to assess teacher performance and to make decisions regarding incentives (Tout et al., 2009), and the current state of the literature is lacking in terms of consistent and generalizable findings. In the above sections, differences between the present study and other studies are outlined regarding possible reasons as to why findings are inconsistent and future direction for researchers. Ultimately, more research is needed using identical measures of instructional quality among children from samples with varying characteristics, including SES and grade, as the cut-scores in previous work cannot be generalized to all populations. Additionally, both previous research and the present study exclusively examined instructional support quality and did not account for other aspects of classroom quality; as such, precaution should be taken regarding the interpretation and generalization of findings. Given that instructional support is only one aspect of the classroom quality, it is possible that inconsistent findings may be attributed to an incomplete portrayal of the classroom quality by inclusion of only a single aspect of quality. Future research should examine the notion of thresholds while accounting for multiple different aspects of classroom quality, which will provide a more accurate portrayal of the multi-dimensional nature of classroom quality. In addition, future research should also measure and control for other aspects of the classroom environment (e.g., classroom organization, classroom management, and classroom-level child behavior) in an attempt to understand if and how quality thresholds operate above and beyond other indicators of high-quality classroom

interactions. Overall, advancement of the current state of the literature will allow researchers and educators to better understand what is considered high-quality instructional support and the implications for high- versus low-quality instructional support for children's academic outcomes.

The present study is not without limitations. One limitation of the present study is that the majority of children were Caucasian, which limits the ability to generalize findings to other populations. Although significant findings were absent in the present study, future research should examine the relation between instructional support quality thresholds and academic performance among non-Caucasian samples to better understand the patterns of relations among other ethnic groups. Additionally, previous studies often use concurrent measures of instructional support and academic performance when examining instructional support quality thresholds. However, in the present study, concurrent measures of third- and fifth-grade instructional support were not included as they were beyond the scope of the study. Future research should examine concurrent measures of instructional support quality thresholds and academic performance during elementary school to further the state of existing literature. Given the structure of data collection, academic performance data were only available at a single time point each year. Although children's previous measure of the WJ-R was controlled for in all analyses, these measures occurred two years prior to the study year of interest. Ideally, future research that uses data from two data collection time points during the same academic year (i.e. fall and spring) may more accurately portray children's baseline academic performance upon entry for each grade.

Literature that speaks to how instructional support quality thresholds may be related to children's academic performance is still emerging. Although the present study did not replicate findings from previous research, it provides an important foundation regarding replication and future directions for researchers. Specifically, researchers can use the findings from the present study to inform their study design and approach to threshold scores. Ultimately, more research is needed before policymakers and educators use pre-determined cut scores to incentivize or evaluate teacher performance. As future research examines instructional support quality thresholds for academic performance among different samples and age groups, more information will be available to educators, policymakers, and researchers regarding the use of thresholds as evaluative tools to determine classroom quality.

General Discussion

Extensive research has shown that first-grade experiences are extremely important for children's academic outcomes (Alexander et al., 1993). As such, the overarching goal of this dissertation was to expand upon current literature and to help create a more nuanced understanding regarding the importance of first-grade academic experiences for children's academic outcomes using two studies. Although the two studies were similar in that they both examined first-grade academic experiences, it is important to reflect on each study independently when contemplating study implications. Each study has important implications for future research, even though the consistency of findings from the present studies and the current literature were varied.

Study one examined the mediating role of first-grade behavioral engagement between first-grade academic experiences and second-grade academic performance. To my knowledge, this is one of the first studies to examine this question while accounting for the simultaneous occurrence of multiple academic experiences. Importantly, consistent with previous work, study one illustrates the importance of behavioral engagement a mediating mechanism between some first-grade academic experiences and second-grade academic outcomes (Buhs & Ladd, 2001; Dotterer & Lowe, 2010; Ladd et al., 1999; Ponitz et al., 2009). As only some of the hypothesized results were significant, researchers can expand upon these findings in the future. Specifically, the current study was limited in the types of academic experiences that could be included. Future research can use modeling techniques similar to those employed in this study to examine if behavioral engagement mediates the relations between types of academic experiences not depicted in this study and academic performance. First grade is a critical time for

children's cognitive development (Entwisle & Alexander, 1998) and there are numerous academic experiences that have yet to be and should be examined using a similar methodological approach as study one. Once more information is available regarding the patterns of the mediating process between many different academic experiences and academic performance, researchers can begin to focus on ways to promote or alter these academic experiences, which will have direct implications for children's academic engagement and performance over time.

Study two examined the possibility that some minimal level of first-grade instructional support quality is necessary to promote children's academic performance. Although previous research has shown that high-quality instructional support is needed to support children's academic performance (Burchinal et al., 2009; Burchinal, et al., 2010), the findings were not replicated in the present study. Null findings from study two provide important information for future research examining instructional support quality thresholds, as this is a newly emerging literature. Specifically, researchers should be cautious when attempting to use threshold cut-scores that are not empirically derived for their specific sample given the inconsistencies in the current literature, including the present study (Burchinal et al., 2010; Burchinal et al., 2014). In addition, to fully understand whether some level of instructional quality is critical for particular populations of students, researchers will need to take care when deciding what other classroom characteristics and aspects of quality that should be included as covariates. Hopefully the two studies conducted as part of this dissertation will provide researchers with new information regarding the importance of first-grade experiences for children's

academic outcomes and prompt new perspectives and approaches for future work examining this critical developmental period.

In sum, ecological developmental theory (Bronfenbrenner, 1995) stipulates that environment-development relations are complex. Findings from this study, taken in concert with findings from prior studies, attest to such complexities. Given these complexities, it is likely that several studies, each with attention to particular aspects of the overall classroom experience and each with attention to particular competencies and motivational tendencies, will be needed to provide the kind of guidance needed to improve teaching practice and children's academic performance.

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Table 1
Descriptive Statistics for Study Variables

	Parental Involvement	Positive Peer Interactions	Student-Teacher Relationship	Instructional Support	Behavioral Engagement	Math	Reading
Mean	2.29	1.53	4.35	3.94	55.94	3.35	3.34
SD	0.41	0.36	0.53	1.03	4.69	0.91	0.95
Minimum	0.96	0.40	1.87	1.25	28.00	1.00	1.00
Maximum	3.31	2.00	5.00	7.00	60.00	5.00	5.00
Skewness	-0.27	-0.64	-1.10	0.19	-1.84	-0.16	-0.48
Kurtosis	-0.24	0.30	1.19	-0.44	4.43	-0.74	-0.58

Table 2
Correlations among Study Variables

	1	2	3	4	5	6	7	8
1.Parental Involvement: MR								
2.Positive Peer Interactions: TR	.12**							
3.Student-Teacher Relationship: TR	.17**	.66**						
4.Instructional Support: OB	.07*	.13**	.10**					
5.Behavioral Engagement: OB	.07*	.18**	.17**	.12**				
6.Math: TR	.14**	.17**	.12**	-.01	.14**			
7.Reading: TR	.16**	.27**	.24**	.06	.17**	.78**		
8.Age: MR	.01	-.03	-.10**	-.09*	-.01	.06	.04	
9.Income-to-needs: MR	.20**	.09**	.11**	.10**	.07**	.23**	.24**	.06

Note. ** $p < .01$, * $p < .05$. Age and income-to-needs were included as covariates. MR= mother report, TR = teacher report, OB = observational measure

Table 3
Covariances and Residual Variances of First-Grade Predictors and First-Grade Academic Performance

	Parental Involvement	Positive Peer Interactions	Student-Teacher Relationship	Instructional Support
Parental Involvement: MR	*.16*** *(.96)*			
Peer Interactions: TR	.01* (.10)	*.11*** *(.87)*		
Student-Teacher Relationship: TR	.03** (.15)	.10** (.62)	*.26***(.90)*	
Instructional Support: OB	.02 (.05)	.03** (.10)	.03 (.06)	*1.04*** *(.98)*
Math: TR	.04** (.10)	.06 ** (.18)	.06** (.13)	.06 (.06)
Reading: TR	.04** (.10)	.08** (.25)	.10** (.22)	.04 (.04)
R^2	.04	.13	.10	.03

Note. * $p < .05$, ** $p < .01$. Unstandardized estimates are followed by standardized estimates; reported *p*-values are for unstandardized estimates. Residual variances for first grade predictors are italicized on the diagonal. First grade math and reading were exogenous variables and therefore their residual variances were not estimated parameters. Covariances among first grade predictors and academic performance are on the off-diagonal. MR= mother report, TR = teacher report, OB = observational measure.

Table 4
Path Estimates from Covariates to First-Grade Predictors

	First Grade Predictors			
	Parental Involvement	Positive Peer Interactions	Student-Teacher Relationship	Instructional Support
Model Covariates				
First Grade Age: MR	-.01 (-.01)	-.04 (-.03)	-.19** (-.10)	-.32** (-.10)
First Grade Income to Needs: MR	.03** (.19)	.01 (.03)	.01 (.07)	.03** (.09)
Kindergarten Engagement: TR	.03 (.03)	.33** (.36)	.40** (.29)	.22* (.08)

Note. * $p < .05$, ** $p < .01$. Unstandardized estimates are followed by standardized estimates; p-values are for unstandardized estimates. MR= mother report, TR = teacher report

Table 5
Hypothesized Indirect Effects

Indirect Effect	Parameter Estimates (SE) [LCI, UCI]
Math Performance	
Parental Involvement→Behavioral Engagement→Math	.006 (.007) [-.004, .026]
Peer Interactions→ Behavioral Engagement→Math	.022 (.013) [.003, .056]*
Student-Teacher Relationship→ Behavioral Engagement→Math	.011 (.009) [.000, .034]
Instructional Support→ Behavioral Engagement→Math	.007 (.004) [.001, .017]*
Reading Performance	
Parental Involvement→Behavioral Engagement→Reading	.006 (.007) [-.004, .026]
Peer Interactions→ Behavioral Engagement→Reading	.021 (.013) [.003, .060]*
Student-Teacher Relationship→ Behavioral Engagement→Reading	.011 (.008) [.000, .033]
Instructional Support→ Behavioral Engagement→Reading	.006 (.004) [.001, .017]*

Note. * indicates the indirect effect does not contain zero, which supports the hypothesized mediated effect. Unstandardized parameter estimates are followed by the standard errors (SE) in parentheses. The 95% bias-corrected CI for each indirect effect is in brackets [lower CI, upper CI].

Table 6
Descriptive Statistics for Study Variables

	Mean	Standard Deviation	Minimum	Maximum	Skewness	Kurtosis
Instructional Support Quality	3.94	1.04	1.00	7.00	0.19	-0.39
First Grade Reading	454.76	22.13	372.00	514.00	0.08	0.06
First Grade Math	470.99	15.07	421.00	516.00	-0.01	-0.30
Third Grade Reading	495.46	16.98	427.00	536.00	-0.70	0.71
Third Grade Math	498.38	11.76	431.00	515.00	-1.11	2.79
Fifth Grade Reading	511.46	16.03	437.00	557.00	-0.56	1.42
Fifth Grade Math	510.66	11.77	438.00	544.00	-0.98	3.62

Note. Descriptive statistics were estimated for the original, non-imputed dataset only.

Table 7
Correlations between Study Variables

	Predictors/Covariates			Outcome Variables					
	Instructional Support Quality	Age	Income-to-Needs	First Grade Reading	First Grade Math	Third Grade Reading	Third Grade Math	Fifth Grade Reading	Fifth Grade Math
Predictor/Covariates									
Instructional Support Quality				.11**	.08*	.08*	.07*	.09**	.05
Age	-.07*			.03	.16**	-.01	.03	-.03	.03
Income-to-Needs	.10**	.08*		.22**	.30**	.23**	.25**	.25**	.27**
Student-Teacher Relationship	.11**	-.12**	.10**	.15**	.10**	.14**	.15**	.09*	.11**

Note. ** $p<.01$ * $p<.05$. Correlations were computed using the non-imputed dataset. Age and income to needs were included in the correlation table to determine if they should be included as covariates in the final models.

Table 8
Group Mean Differences on Study Variables by Ethnicity

	Caucasian	Non-Caucasian	*t*-test
Instructional Support Quality	3.99 (1.03)	3.71 (1.07)	$t(266.70) = 3.22^{**}$
54 Months Reading	373.24 (20.47)	363.22 (23.36)	$t(277.17) = 5.47^{**}$
54 Months Math	429.37 (16.10)	414.63 (22.53)	$t(243.69) = 8.52^{**}$
First Grade Reading	456.91 (21.26)	446.57 (23.50)	$t(282.78) = 5.58^{**}$
First Grade Math	473.12 (14.34)	462.79 (15.02)	$t(289.40) = 8.60^{**}$
Third Grade Reading	497.85 (14.97)	486.86 (20.64)	$t(262.68) = 7.07^{**}$
Third Grade Math	500.08 (10.69)	492.28 (13.32)	$t(277.24) = 7.66^{**}$
Fifth Grade Reading	513.74 (14.42)	503.46 (18.67)	$t(270.29) = 7.20^{**}$
Fifth Grade Math	512.50 (10.66)	504.20 (13.16)	$t(277.62) = 8.18^{**}$
Income to Needs	4.38 (3.14)	2.58 (2.20)	$t(380.40) = 8.93^{**}$
Student-Teacher Relationship	4.40 (0.49)	4.18 (0.65)	$t(243.04) = 4.31^{**}$

Note. ** $p < .01$. Means are followed by standard deviations. *t*-tests were conducted using the non-imputed dataset.

Table 9
Descriptive Statistics by Instructional Quality Group

	Mean	Standard Deviation	Minimum	Maximum
Low-Quality Group				
Instructional Support Quality	2.62	0.40	1.00	3.00
First Grade Reading	452.24	22.46	398.00	514.00
First Grade Math	469.22	15.85	421.00	508.00
Third Grade Reading	494.02	17.17	440.00	528.00
Third Grade Math	497.65	12.57	448.00	525.00
Fifth Grade Reading	509.57	15.56	457.00	542.00
Fifth Grade Math	510.09	11.60	461.00	544.00
High-Quality Group				
Instructional Support Quality	4.34	0.82	3.25	7.00
First Grade Reading	455.35	22.08	372.00	514.00
First Grade Math	471.81	19.99	428.00	516.00
Third Grade Reading	495.50	16.98	427.00	536.00
Third Grade Math	498.66	11.72	431.00	525.00
Fifth Grade Reading	512.08	16.22	437.00	557.00
Fifth Grade Math	510.89	11.91	438.00	542.00

Note. Descriptive statistics by group were estimated with the non-imputed dataset.

Table 10
Estimates from Piecewise Regression Analyses

	Math Performance	Reading Performance
	First Grade	
Low-Quality Instructional Support Intercept	468.98 (1.59)**	456.98 (2.39)**
High-quality Instructional Support Intercept	468.60 (0.88)**	454.99 (1.40)**
54-months Academic Performance	0.46 (0.02)**	0.51 (0.03)**
Income-to-Needs	0.64 (0.14)**	0.46 (0.22)*
Student-Teacher Relationship	0.07 (0.78)	2.77 (1.24)*
Gender (0 = female)	4.86 (0.78)**	1.38 (1.23)
Ethnicity (0 = Caucasian)	-2.61 (1.04)*	-3.81 (1.59)*
Low-Quality Instructional Support Slope	1.66 (2.03)	3.62 (3.14)
High-Quality Instructional Support Slope	0.08 (0.56)	-0.16 (0.90)
	Third Grade	
Low-Quality Instructional Support Intercept	498.70 (1.22)**	494.98 (1.51)**
High-quality Instructional Support Intercept	497.94 (0.67)**	495.68 (0.86)**
First Grade Academic Performance	0.49 (0.02)**	0.55 (0.02)**
Income-to-Needs	0.19 (0.10)	0.27 (0.14)
Student-Teacher Relationship	1.50 (0.60)*	0.29 (0.77)
Gender (0 = female)	0.23 (0.60)	0.95 (0.77)
Ethnicity (0 = Caucasian)	-1.60 (0.77)*	-4.42 (0.96)**
Low-Quality Instructional Support Slope	0.08 (1.55)	-1.66 (1.92)
High-Quality Instructional Support Slope	0.42 (0.42)	0.07 (0.57)
	Fifth Grade	
Low-Quality Instructional Support Intercept	512.49 (1.07)**	511.63 (1.21)**
High-quality Instructional Support Intercept	511.81 (0.60)**	511.93 (0.67)**
Third Grade Academic Performance	0.70 (0.02)**	0.78 (0.02)**
Income-to-Needs	0.36 (0.11)**	0.37 (0.12)**
Student-Teacher Relationship	-0.31 (0.52)	-1.02 (0.60)
Gender (0 = female)	-0.16 (0.55)	0.05 (0.64)
Ethnicity (0 = Caucasian)	-2.16 (0.67)**	-1.15 (0.80)
Low-Quality Instructional Support Slope	1.61 (1.42)	.61 (1.57)
High-Quality Instructional Support Slope	-0.57 (0.39)	0.08 (0.42)

Note. $^{*}p < .05$, $^{**}p < .01$. Results are pooled estimates from the original dataset and 50 imputed datasets. Unstandardized estimates are presented, followed by standard errors in parentheses. Standardized estimates are not available when analyzing multiple imputation datasets. Income to needs and student-teacher relationship were collected at first grade.

Table 11
Estimates from Linear Multiple Regression Analyses

	Math Performance	Reading Performance
	First Grade	
Intercept	468.60 (1.65)**	454.30 (2.80)**
54-months Academic Performance	0.46 (0.02)**	0.51 (0.03)**
Income-to-Needs	0.65 (0.14)**	0.47 (0.22)*
Student-Teacher Relationship	0.09 (0.78)	2.80 (1.24)*
Gender (0 = female)	0.49 (0.78)**	1.42 (1.23)
Ethnicity (0 = Caucasian)	-2.66 (1.04)*	-3.94 (1.59)**
Instructional Support	0.04 (0.38)	0.12 (0.65)
	Third Grade	
Intercept	497.99 (1.28)**	496.31 (1.71)**
First Grade Academic Performance	0.49 (0.02)**	0.54 (0.02)**
Income-to-Needs	0.19 (0.10)	0.26 (0.14)
Student-Teacher Relationship	1.51 (0.60)*	0.29 (0.77)
Gender (0 = female)	0.24 (0.60)	0.94 (0.76)
Ethnicity (0 = Caucasian)	-1.59 (0.77)*	-4.36 (0.95)**
Instructional Support	0.12 (0.30)	-0.12 (0.40)
	Fifth Grade	
Intercept	512.30 (1.27)**	510.70 (1.34)**
Third Grade Academic Performance	0.70 (0.02)**	0.78 (0.02)**
Income-to-Needs	0.37 (0.10)**	0.37 (0.12)**
Student-Teacher Relationship	-0.31 (0.52)	-1.03 (0.60)
Gender (0 = female)	-0.15 (0.55)	0.05 (0.64)
Ethnicity (0 = Caucasian)	-2.24 (0.67)**	-1.18 (0.80)
Instructional Support	-0.27 (0.30)	0.29 (0.32)

Note. * $p < .05$, ** $p < .01$. Results are pooled estimates from the original dataset and 50 imputed datasets. Unstandardized estimates are presented, followed by standard errors in parentheses. Standardized estimates are not available when analyzing multiple imputation datasets

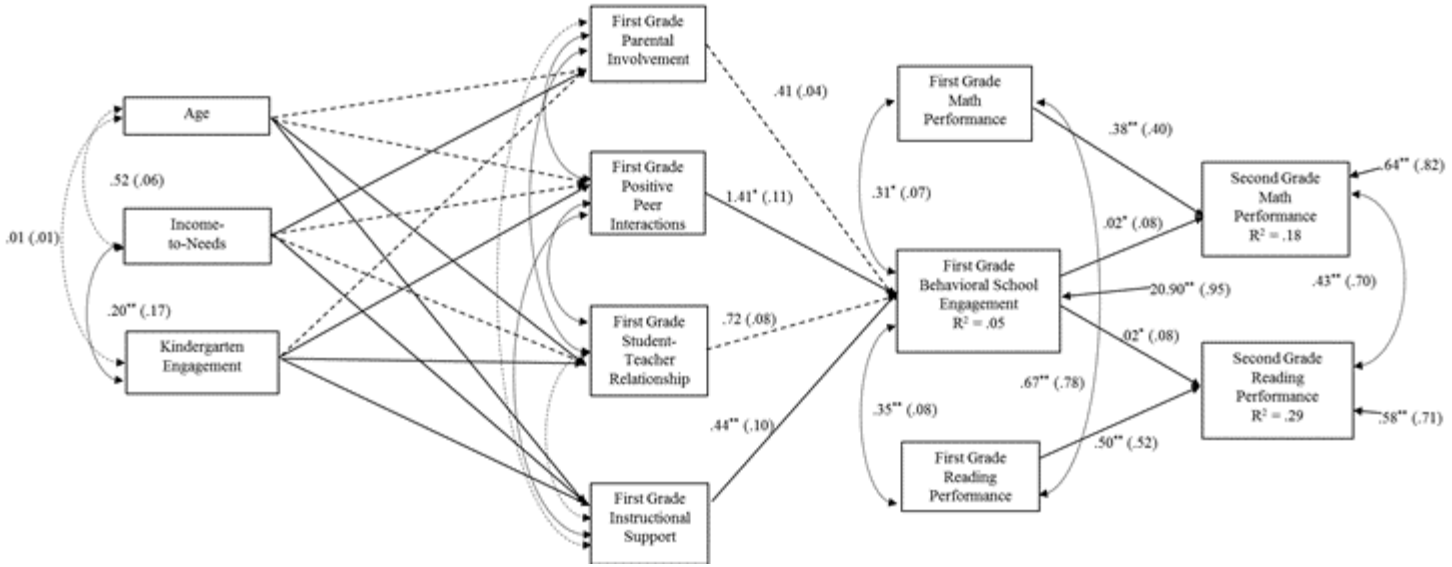

Figure 1. Relations between first-grade academic experiences, first-grade behavioral engagement, and second-grade academic performance. This figure depicts the hypothesized relations among first grade predictors, first grade behavioral engagement, and second grade math and reading performance. ** $p < .01$ * $p < .05$. Unstandardized estimates are followed by standardized estimates in parentheses. *p*-values correspond to unstandardized estimates. Model fit was good, χ^2 (19) = 123.68, $p < .01$; RMSEA = .08, 90% CI [.065-.09]; CFI = .95; SRMR = .05. Solid lines represent significant relations; dashed lines represent non-significant relations. Although not depicted first grade reading and math were allowed to covary with parental involvement, peer interactions, student-teacher relationship, and instructional support given all first grade variables were measured during the same semester; see Table 3 for covariances. See Table 4 for parameter estimates from age, income-to-needs, and kindergarten engagement to first-grade predictors

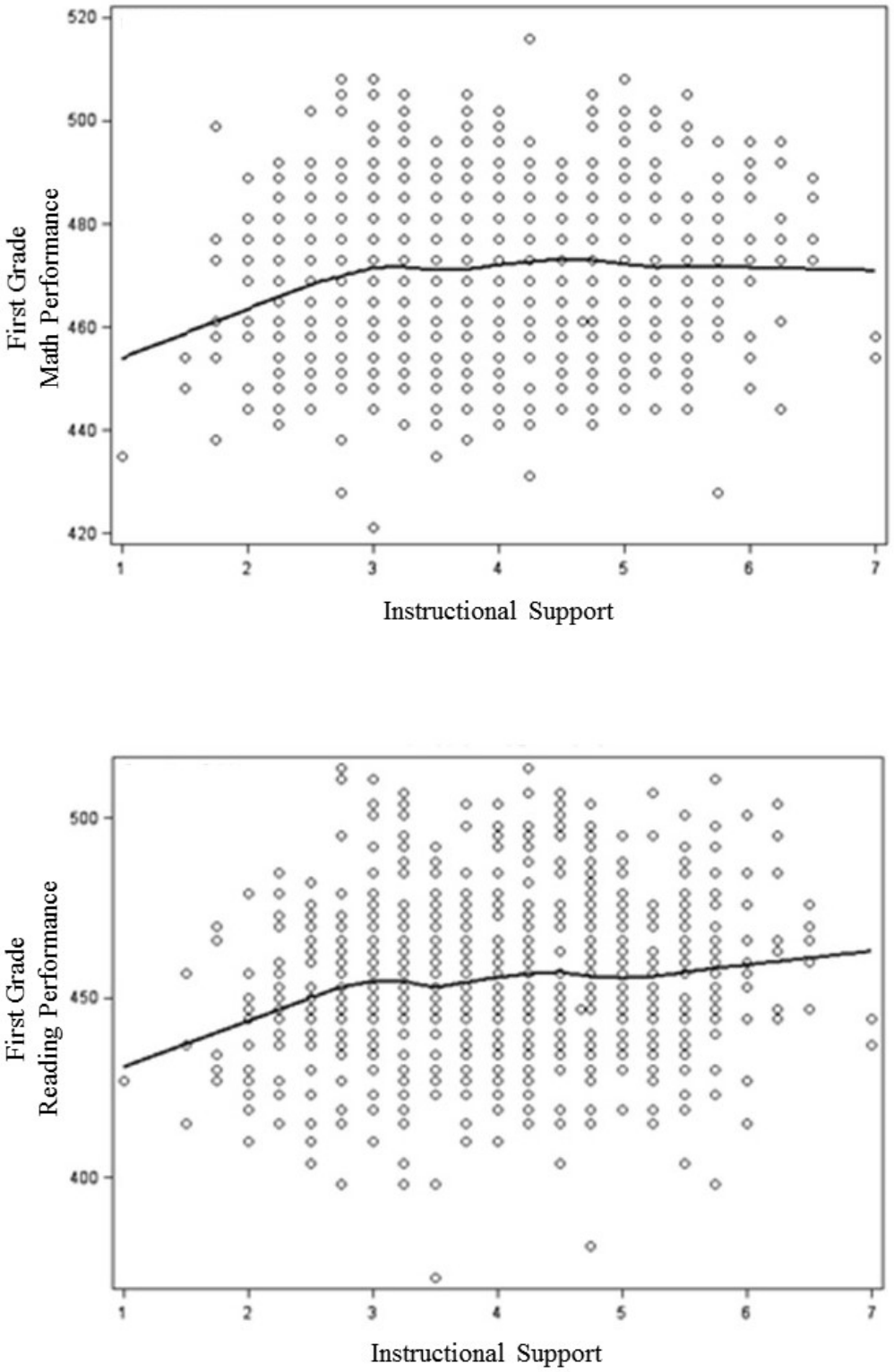

Figure 2. Non-parametric loess plots for instructional support vs. first-grade academic performance in mathematics (top) and reading (bottom). Scatterplots were created using the original dataset.

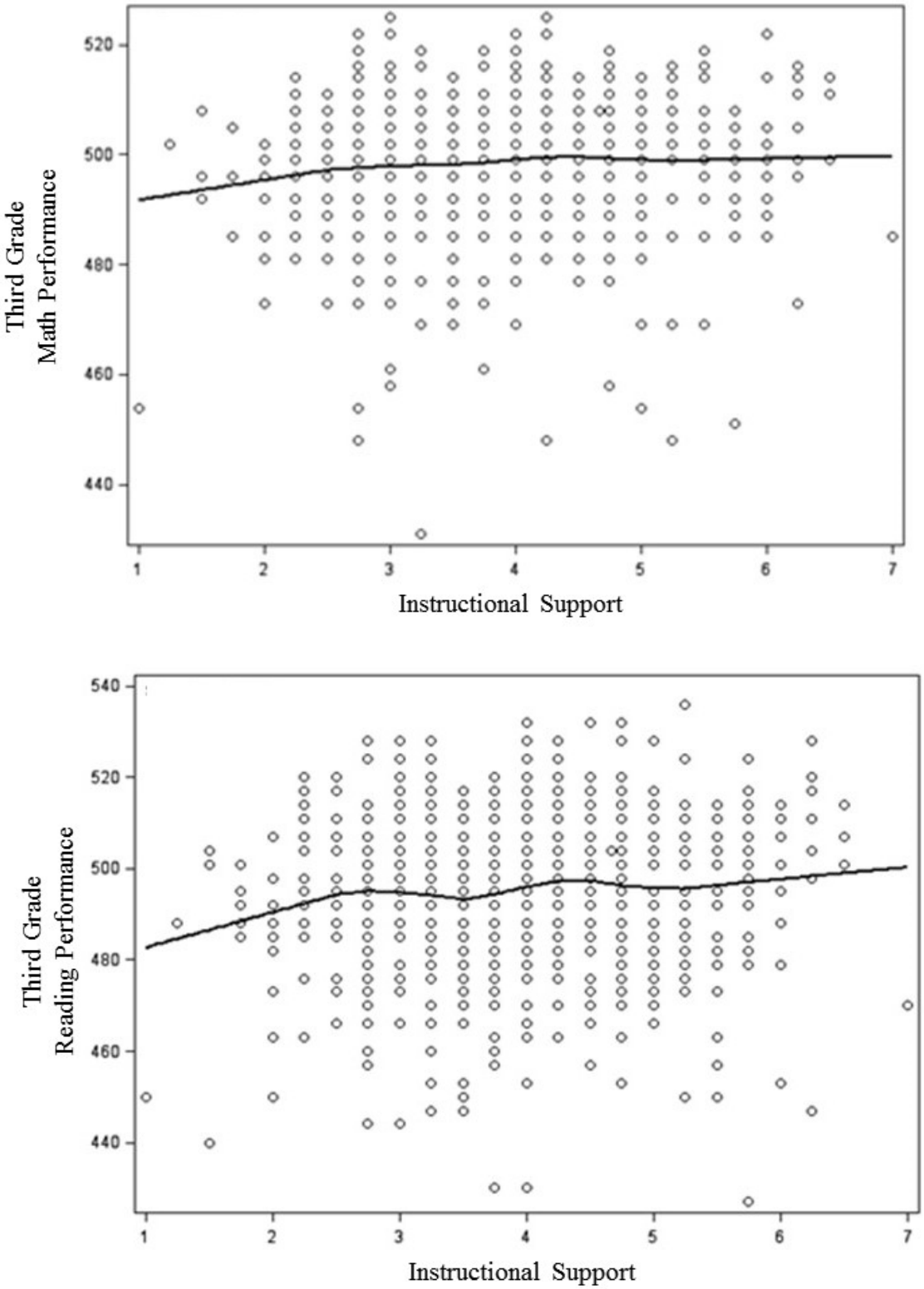

Figure 3. Non-parametric loess plots for instructional support vs. third-grade academic performance in mathematics (top) and reading (bottom). Scatterplots were created using the original dataset

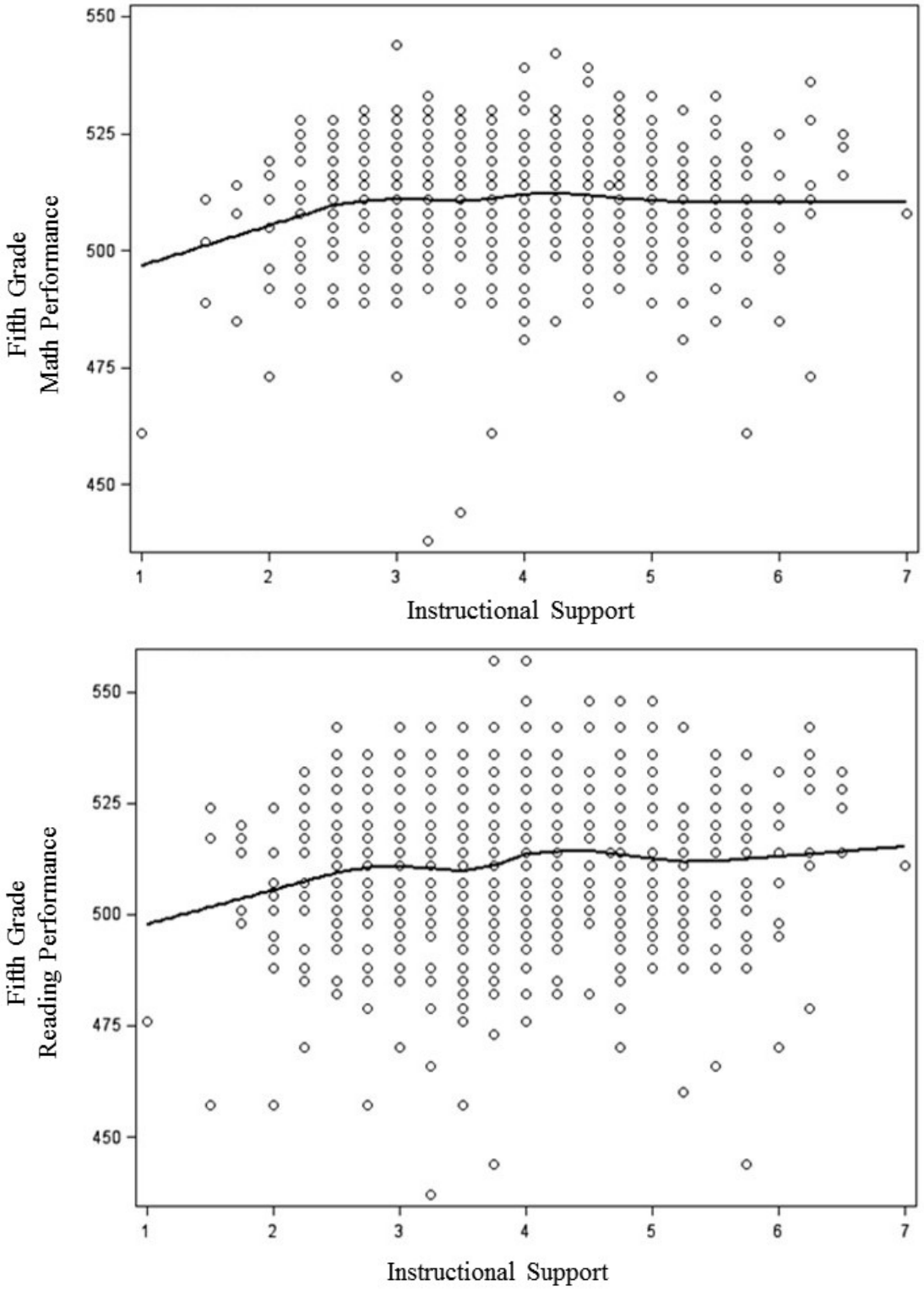

Figure 4. Non-parametric loess plots for instructional support vs. fifth-grade academic performance in mathematics (top) and reading (bottom). Scatterplots were created using the original dataset