EXAMINING RELATIONSHIPS BETWEEN FIRST-GRADE ACHIEVEMENT, STUDENT SOCIOECONOMIC STATUS, AND STUDENT-TEACHER RELATIONSHIPS

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Dedication

This dissertation is dedicated to my loving family and friends who have supported me throughout this incredible journey.

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Table of Contents

Acknowledgements…….....ii

List of Tables……..……iv

List of Figures…….……v

Abstract..…...……vi

Chapters

1. Introduction..…….…….....1
2. Review of Literature……..……6

    Student Teacher Relationships (STRs)

    Socioeconomic Status (SES)

    SES and STRs Interaction

    Characteristics Associated with Student Achievement

    The Current Study

3. Method….……33

    Dataset

    Measures for Regression Analysis

    Regression Analyses

    Propensity Score Weighting Analyses

    Measures for Propensity Score Weighting Analyses

4. Results…..……..……...50
5. Discussion……..……...65

References…...……..……...…. 86

Vita..…….....104

List of Tables

Tables Page

1. Descriptive Statistics for the Regression Analysis…… 39

2. Missing Data for the Regression Analysis…….40

3. Descriptive Statistics for the Propensity Score Analysis……...……49

4. Standardized Reading Achievement……..53

5. Standardized Math Achievement……...……56

6. Standardized STR-Conflict……59

7. Standardized STR-Closeness…….61

8. Unweighted Covariate Table……. 62

9. Weighted Covariate Table……. 63

10. STR-Conflict by SES……...64

11. STR-Closeness by SES……64

List of Figures

Figures Page

1. Interaction Between STR-Conflict and SES on Reading Achievement…….54

2. Interaction Between STR-Conflict and SES on Math Achievement…….57

Abstract

As recent literature has demonstrated, student-teacher relationships (STRs) and socioeconomic (SES) have been strongly associated with student academic achievement. This study was specifically interested in investigating the moderation effect between STRs and SES on academic achievement in addition to addressing the relationship between SES and academic achievement on STRs. Using a nationally representative dataset, the associations between these three variables of interest were investigated with regressions using Taylor series linearization and propensity score weighting. Results from the regression analyses demonstrated strong associations between the variables of interest including a statistically significant moderation effect between conflictual STRs and SES on both math and reading achievement. The propensity score weighting analysis demonstrated that when weighted on a variety of student-level covariates, there was a significant association between SES on STRs, where high SES students had closer and less conflictual STRs compared to low SES students. Based on these findings, it is important to continue exploring the intricate relationships between SES, STRs, and academic achievement as all of these variables strongly influence both student and teacher-level characteristics.

Chapter 1: Introduction

Student-teacher relationships (STRs) have been identified as an important factor in student academic achievement (Hamre & Pianta, 2001; Hughes, 2011; Hughes & Kwok, 2007; Mantzicopoulos, 2005; O'Connor & McCartney, 2007; Stipek & Miles, 2008). Much of the research conducted on STRs have focused on two different types, relationships characterized by closeness and relationships characterized by conflict (Baker, 2006; Hamre & Pianta, 2001; Zee, Koomen, & Van der Veen, 2013). Close STRs have been defined as when children experience affection, warmth, and open communication with their teacher, while STRs defined by conflict occur when the teacher struggles with the student and perceives the student to be angry or unpredictable (Pianta, 2001).

Research has demonstrated that close STRs are associated with many positive behavioral and academic outcomes. Examples include increased student social skills (Howes, Matheson, & Hamilton, 1994; Malecki & Elliott, 2002; Pianta & Stuhlman, 2004), increased student motivation and engagement in the classroom (Hughes & Kwok, 2006; Hughes, Luo, Kwok, & Loyd, 2008; Klem & Connell, 2004), and increased academic achievement (Baker, 2006; Hughes, 2011; McCormick, O'Connor, Cappella, & McClowry, 2013; O'Connor & McCartney, 2007; Zee et al., 2013). When students feel secure in the classroom, they are more willing to engage in academic challenges, progress socially by learning appropriate behaviors for the school environment and meet or exceed academic expectations set by the instructor (Hamre & Pianta, 2001).

However, STRs defined by conflict have been associated with two main negative outcomes that include decreased student social skills (Blankemeyer, Flannery, &

Vazsonyi, 2002; Hamre & Pianta, 2001; Hamre, Pianta, Downer, & Mashburn, 2007; Ladd, Birch, & Buhs, 1999) and reduced academic achievement (Buyse, Verschueren, Verachtert, & Van Damme, 2009; Hamre & Pianta, 2001; Mantzicopoulos, 2015; Spilt, Hughes, Wu, & Kwok, 2012; Stipek & Miles, 2008). Research suggests that STRs defined by conflict function as stressors for students that foster negative and pessimistic feelings regarding school and academics (Birch & Ladd, 1996; Ladd et al., 1999).

In addition to STRs, student socioeconomic status (SES) defined by Duncan, Featherman, and Duncan (1972) as a construct composed of indictors such as parent/guardian education level, occupational prestige, and household income is an important predictor of student academic achievement (Sirin, 2005). According to Mayer (1997) children with low SES have higher rates of single and teen parents, poorer health, and lower family income. Evans (2004) also established that low SES is more common in neighborhoods with more documented crime and pollution and Duncan, Ziol-Guest, and Kalil (2010) found there were long-term consequences such as decreased academic achievement and decreased lifetime earnings for children who grew up in poverty between their prenatal year and fifth birthday.

Multilevel modeling using nationally representative longitudinal datasets have also demonstrated that children with SES in the bottom 10% were the least prepared compared to other at-risk groups such as racial and ethnic minorities and were more than one standard deviation behind their more affluent peers (Chatterji, 2006). This trend of lower academic achievement was also true for individuals identified with a high-risk status such as high residential mobility and qualifying for free or reduced priced meals (Herbers et al., 2012; Okpala, Okpala, & Smith, 2001). Based on these research studies it

is evident that SES has strong links to academic achievement in school (Chatterji, 2006; Herbers et al., 2012; Stull, 2013).

Although student SES and STRs are important influencers of student achievement, there is little known about their interaction with academic achievement. In one of the few studies that investigated the interaction between SES and STRs, the dependent variable was student dropout intention. Even though there was not a statistically significant interaction, both SES and STRs had statistically significant main effects on the outcome variable (Bergeron, Chouinard, & Janosz, 2011). Malecki and Demaray (2006) analyzed social supports such as parental support and classmate support in addition to SES on academic GPA. Although this study did not directly analyze STRs, students with low SES and low parental or classmate support had lower GPAs compared to individuals with high SES and high parental or classmate support (Malecki & Demaray, 2006). Similarly, Sorhagen (2013) was interested in the effect of the interaction between teacher expectations and SES on school performance. Results from this study found that teachers' over and under estimation of academic abilities had stronger impacts on students from lower SES families compared to students from more affluent homes (Sorhagen, 2013).

As previously stated, prior studies have discussed academic achievement as applied to individual variables such as teacher closeness, teacher conflict, and student SES (Chatterji, 2006; Hamre & Pianta, 2001; Hughes, 2011; Hughes & Kwok, 2007; Ladd et al., 1999; O'Connor & McCartney, 2007). However, there has also been interest in the moderation (i.e., interaction) effect between STRs, student support structures, and SES on academic achievement and student dropout (Bergeron et al., 2011, Malecki &

Demaray, 2006; Sorhagen, 2013). Results have shown that constructs comparable to STRs and SES on student academic achievement result in statistically significant interactions where more student support and higher SES have greater achievement scores compared to individuals with less student support and low SES (Malecki & Demaray, 2006; Sorhagen, 2013).

Based on these studies, it is plausible to believe that there may be a moderation effect between STRs and SES on student academic achievement. The first objective of the current study is to explore how student SES and STRs, specifically how teachers' perceptions of closeness and conflict with their students, may be associated with first-grade academic achievement when accounting for student and teacher-level variables, with school fixed effects. It is hypothesized that students with low SES will score similarly compared to students from high SES when close to their teachers with the opposite effect found for students who conflict with their teachers.

The second objective in this study was to use propensity score weighting (PSW) to analyze links between SES on STRs when matched on student-level covariates. As demonstrated in the literature, STRs are bidirectional meaning that both teachers and students can influence the relationship (Stipek & Miles, 2008). Therefore, student-level covariates that influence STRs besides SES such as student behavior, student social skills, academic achievement, and student race were accounted for using PSW. By accounting for a diverse range of student-level covariates using PSW, the association between SES on STRs can be better understood because all students were weighted based on common characteristics to create two equal groups with the only difference being SES. Although exploratory in nature, it is hypothesized that students with higher SES

would have closer STRs and less conflictual relationships. Given the limited number of studies addressing these concerns, a nationally representative dataset was used to answer the following research questions:

1. Is teacher closeness, teacher conflict, and student SES associated with first-grade academic achievement when accounting for student and teacher-level variables with school fixed effects?
2. Is the association of first-grade academic achievement and student SES moderated by STRs, specifically teachers' perceptions of closeness and conflict with their students?
3. Is student SES and first-grade academic achievement associated with STRs, specifically teachers' perceptions of closeness and conflict with their students when accounting for student and teacher-level variables with school fixed effects?
4. Is the association of SES and STRs, specifically teachers' perceptions of closeness and conflict with their students, moderated by student academic achievement?
5. Does the effect of SES on teacher closeness and teacher conflict differ when weighted on student-level covariates using propensity score analysis?

Chapter 2: Literature Review

Student-Teacher Relationships

Student-teacher relationships (STRs) have been studied by numerous researchers as teachers have played a central role in promoting student academic growth within schools (Kumashiro, 2012). Although student achievement and student outcomes are important, it is crucial to understand how the bidirectional relationship between students and teachers can influence student learning and development (Phillippo & Stone, 2013). According Wentzel (2012), STRs are defined by the emotional support perceived by students from teachers and are typically examined in congruence with student academic outcomes. Pianta (2001) defined STRs more specifically by arguing that STRs can be characterized by closeness and by conflict.

Student teacher relationships – closeness. There is much evidence to support that when students experience affection, warmth, and open communication with their teacher, there are many positive outcomes. The results of close STRs include increased social skills (Howes et al., 1994; Malecki & Elliott, 2002; Pianta & Stuhlman, 2004), increased motivation and engagement in the classroom (Hughes & Kwok, 2006; Hughes et al., 2008; Klem and Connell, 2004), and increased academic achievement (Baker, 2006; Hughes, 2011; McCormick et al., 2013; O'Connor & McCartney, 2007; Zee et al., 2013).

Increased student social skills. Close STRs have been associated with increased student social skills (Howes et al., 1994; Malecki & Elliott, 2002; Pianta & Stuhlman, 2004). Malecki and Elliott (2002) investigated the social skills of a diverse group of elementary school students on academic achievement, arguing that teachers should

designate more class time towards developing positive social behaviors within children. The participants in this study included 139 students from Massachusetts. Teachers' perceptions of student social skills were measured using the Social Skills Rating System (SSRS; Gresham & Elliott, 1990) and academic achievement was measured using the Iowa Test of Basic Skills (ITBS; Hoover, Hieronymus, Frisbie, & Dunbar, 1993). The analysis used a test-retest design that allowed researchers to replicate relationships between variables at two different points in time. Results from regression and correlational analyses demonstrated that student social skills, as rated by their teachers, and prior achievement, were the only predictors of future academic achievement.

In a comparable study conducted by Pianta and Stuhlman (2004) using a subset of the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development (NICHD-SECC), parents and teachers observed and reported on the social and academic development of 490 children. STRs were measured using the Student-Teacher Relationship Survey (STRS; Pianta, 2001) and social skills were measured using the Observational Record of the Caregiving Environment (ORCE; NICHD Early Child Care Research Network, 1996). Hierarchical regression analyses found that when teachers reported high levels of closeness with their students, they also reported higher levels of social competence, resulting in increased academic achievement (Pianta & Stuhlman, 2004). Similar to Malecki and Elliott (2002), Pianta and Stuhlman (2004) believed that strong relationships between students and teachers result in higher student social skill ratings by the teacher because children demonstrate their social skills through daily interactions with their instructor.

In addition to close STRs resulting in higher social skill ratings, Howes et al. (1994) were interested in the association between STRs and student social competence with peers. The sample included 94 children, their mothers, and teachers. STRs were measured using the Waters and Deane (1985) Attachment Q-Set and teachers and students were observed together for 8 hours. Student relationships with peers were measured through observation, where trained observers watched and coded social behaviors for 20 minutes. Behaviors of interest included the number of invitations to peers, percent of initiations that were reciprocated, and percent of initiations that were positively responded to. Behaviors were coded as present or absent. Results from a MANOVA found that children who were classified as secure with their teacher were more sociable, positive, and engaged in more complex play with their peers. Maternal attachments were not found to predict student social competence with their peers (Howes et al., 1994). This study added to the literature by demonstrating that STRs appear to affect student social competence more than parental relationships.

Increased student engagement. Related to social skills, students who were more socially engaged felt closer to their teachers and were more willing to participate in classroom activities (Hamre & Pianta, 2001). This is especially important in elementary school when students develop autonomy and learn how to navigate novel situations (Little & Kobak, 2003). For example, Hughes and Kwok (2006) analyzed whether classroom engagement could mediate the relationship of STRs on peer acceptance. The participants were 415 first-grade students from three school districts in Texas. The instrument used to measure student-teacher support was the Teacher Relationship Inventory (TRI; Hughes, Cavell, & Willson, 2001) and the instruments used to measure

classroom engagement were eight items from the Conscientiousness scale from the Big Five Inventory (BFI; John & Srivastava, 1999) and two items from the Social Competence Scale (Conduct Problems Prevention Research Group, 2004). These instruments were chosen to measure engagement because they measured effort, attention, persistence, and cooperative participation in learning. Results from the study found that close STRs were beneficial for all children regardless of their race/ethnicity or sex. In addition, Hughes and Kwok (2006) found that STRs in second grade completely mediated the direct effect of first grade teacher support on peer acceptance. These results suggest that STRs allow children to be more engaged in the classroom and maneuver through new and challenging situations.

Much like Hughes and Kwok (2006), Hughes et al. (2008) investigated STRs, student engagement, and academic achievement in the classroom. This study was unique as it was built on an engagement model developed by Fredricks, Blumenfeld, and Paris (2004) that differentiated classroom engagement into behavioral engagement, emotional engagement, and cognitive engagement. Participants were from three school districts in Texas and included 784 elementary school students. To measure academic achievement, the WJ-III was used (Woodcock, McGrew, & Mather, 2001) and to measure engagement eight items from the Conscientious scale of the Big Five Inventory (John & Srivastava, 1999), two items from the Social Competence Scale (Conduct Problems Prevention Research Group, 2004) and 24 items from the California Child Q-Sort Questionnaire (Caspi, Block, Block, & Klopp, 1992), a modified personality test, were selected. In this 3-year longitudinal study, the results from a structural equation model (SEM) where Year 2 engagement mediated the association between Year 1 STRs and Year 3 math and

reading skills best fit the data (Hughes et al., 2008). These findings indicate that achievement, student engagement, and STRs directly influenced student academic achievement.

Klem and Connell (2004) also concluded that STRs influenced student engagement in the classroom because student disengagement increased from elementary to middle to high school (Marks, 2000). Guided by the Self-System Process Model (Connell & Wellborn, 1991) that links social support from teachers, engagement, and school performance, Klem and Connell (2004) measured student engagement using the Research Assessment Package for Schools, developed by the Institute for Research and Reform in Education (RAPS; IRRE, 1998). This package contained multiple questionnaires that provided teacher perspectives on student engagement and students' perspectives on their own engagement. Results from this descriptive analysis found that 27% of students had self-reported receiving optimal levels of teacher support and 35% reported they had not. Of the students reporting high levels of teacher support, 89% were more likely to feel engaged in the classroom and 11% were considered at-risk. In contrast, students who experienced low levels of teacher support were twice as likely to feel disengaged from school, jumping from 35% to 73%. Klem and Connell (2004) concluded that STRs were important for creating an engaging school atmosphere. Within these learning environments when teachers are caring and have clear and high expectations, there were greater reports of classroom engagement by both the student and teacher, resulting in increased academic achievement.

Increased academic achievement. As previous research has demonstrated, close STRs can increase student social skills and student engagement in the classroom (Howes

et al., 1994; Hughes & Kwok, 2006; Hughes et al., 2008; Klem & Connell, 2004; Malecki & Elliott, 2002; Pianta & Stuhlman, 2004). Therefore, it is not surprising that another benefit of close STRs is a notable boost in academic achievement (Baker, 2006; Hughes, 2011; McCormick et al., 2013; O'Connor & McCartney, 2007; Zee et al., 2013). This is because when students are social and involved within the classroom they often take the initiative to learn.

In a study conducted by Baker (2006), STRs and school adjustment were analyzed in relation to academic achievement in elementary school given the evidence that children learn academic competences, beliefs, and attitudes towards school during this period (Baker, 1999). The sample included 1,310 kindergarten through fifth-grade students and 68 teachers from four elementary schools in the Southeastern United States. To measure STR quality, the STRS (Pianta, 2001) was used as well as the Behavior Assessment System of Children-Teacher Rating Scales for Children (Reynolds & Kamphaus, 1992) to measure behavior ratings. Academic achievement was measured using either the ITBS or the Stanford Achievement Test Series and were standardized using z-scores (Salvia & Yssledyke, 2003). Child report card questions relative to social development and positive work habits were used to measure classroom adjustment. Results from multiple regressions found that female students with positive relationships with their teachers had better outcomes than males with comparable STRs. There was also a significant interaction between STRs and school adjustment on reading achievement. Students with close STRs and high school adjustment had stronger reading scores compared to individuals with low school adjustment and close STRs suggesting

that STR quality can predict academic indicators of school success in elementary school (Baker, 2006).

Similar to Baker (2006), Zee et al. (2013) were interested in the relationship between STRs and academic adjustment on student achievement in addition to the role of student personality. The participants in this study included 8,545 students from 1,001 classes in 395 schools who participated in the first wave of the national COOL-cohort conducted in the Netherlands. COOL stands for the Cohort Survey School Career (ie., Cohort Onderzoek Onderwijsloopbanen). The teacher's perspective of the STR quality was measured using the Dutch translated STRS (Kooman, Verschueren, & Pianta, 2007) and the student's perspective of STR quality was measuring using seven questions generated by Peetsma, Wagenaar, and De Kat (2001). Academic achievement was measured using nationally normed achievement tests developed by the Dutch assessment institute (CITO). To determine the relationship between these nested variables, SEM was used to avoid the underestimation of standard errors by allowing for the simultaneous estimation of direct and indirect effects with robust standard errors. The final model established that conscientiousness, agreeableness, and personality instruments used to measure effort, attention, persistence, and cooperative participation in learning, were predictors of close STRs and that student motivational beliefs were mediated by the effects of student reported closeness on academic achievement (Zee et al., 2013).

Hughes (2011) analyzed STRs in relation to academic achievement as close STRs may enable teachers to generate more responsive educational instruction. Participants for this study included 784 children from three school districts in Texas. Both the student and teacher rated their relationships with each other using the Network of Relationships

Inventory (NRI; Furman & Buhrmester, 1985). Cognitive abilities were measured using the Universal Nonverbal Intelligence Test (UNIT; Bracken & McCallum, 1998) and the WJ-III (Woodcock et al., 2001). Results from regression analyses concluded that student reports of closeness to their teachers predicted perceived academic competence and math achievement. Teacher reports predicted student-perceived academic competence and behavioral engagement (Hughes, 2011). Implications from this study continue to emphasize the importance of developing strong STRs to increase student academic achievement.

Guided by the ecological model (Bronfenbrenner, 1977) and the notion that children develop within interrelated systems (Pianta & Walsh, 1996), O'Connor and McCartney (2007) tracked the quality of STRs and academic outcomes of children from preschool to third grade. Participants were from the NICHD-SECC dataset and included 880 children who completed the modified Strange Situation Procedure (Cassidy & Marvin, 1992), an attachment measure. Cognitive abilities were measured using the Woodcock-Johnson Psycho-Educational Battery-Revised (WJR; Woodcock & Johnson, 1990) and the Bayley Mental Development Index (Bayley, 1969). The quality of STRs was measured using the STRS (Pianta, 1992). Aligning with previous research, the results from this study found positive associations between close STRs and academic achievement and found a significant interaction, where close STRs buffered the effects of insecure maternal relationships on achievement (O'Connor & McCartney, 2007).

According to McCormick et al. (2013) it is difficult to estimate the causal relationship between STRs and academic achievement due to potential selection bias at both the student and school level. To address these concerns, two multilevel propensity

score matching techniques were used to estimate the effect of STRs on student achievement. The participants in this study included 324 Black and Hispanic students attending urban elementary schools and 60 kindergarten teachers from the longitudinal efficacy trial of INSIGHTS in Children's Temperament (McClowry, O'Connor, Cappella, & McCormick, 2011). Measures included child and family-level covariates related to STRs and academic achievement. STRs were measured using the STRS (Pianta, 2001) and academic achievement was measured using the WJ-III (Woodcock et al., 2001). Results from this study found a statistically significant relationship between high quality STRs in kindergarten and math achievement in first grade. There was no statistically significant relationship found between STRs and reading achievement (McCormick et al., 2013).

Student teacher relationships – conflict. Opposite of close student-teacher relationships, when students conflict with their teachers, there are negative outcomes. According to Pianta (2001), conflictual STRs have been defined as a negative relationship when the teacher struggles with the student and perceives the student to be angry or unpredictable. Results of these turbulent relationships are associated with two main negative variables that include decreased student social skills (Blankemeyer et al., 2002; Hamre & Pianta, 2001; Hamre et al., 2007; Ladd et al., 1999), and decreased academic achievement (Buyse et al., 2009; Hamre & Pianta, 2001; Mantzicopoulos, 2015; Spilt et al., 2012; Stipek & Miles, 2008).

Decreased student social skills. Conflictual STRs have been associated with poor student social skills, as conflict ratings from teachers typically align with the social skills of their students (Pianta & Stuhlman, 2004). Hamre and Pianta (2001) also found that

student-teacher conflict is more predictive of student social skills than close student-teacher relationships by longitudinally studying STRs for approximately 180 students from kindergarten through eighth grade. Furthermore, Ladd et al. (1999), observed 200 kindergarteners several times a week using 10 different trained observers. Observers gathered and coded the data into one of 16 categories to create a prosocial behavioral composite score and an antisocial behavioral composite score. STRs were measured using the STRS (Pianta, 2001). The analyses included correlations and hierarchical regression. A significant finding from this study emphasized that stressful teacher relationships adversely impacted classroom participation and hindered student social skills (Ladd et al., 1999), suggesting that these barriers can also impact student academic success in the classroom.

Hamre et al. (2007) were also interested in whether teacher judgements regarding relational conflicts indicated student social adjustment. Using data from the National Center for Early Development and Learning's multi-state study of pre-kindergarten and the state-wide early education program study, 2,282 pre-K students and 597 teachers were examined using the STRS (Pianta, 2001), the Teacher-Child Rating Scale (TCRS; Hightower, Work, & Cowen, 1986) and the Classroom Emotional Support Scale (CLASS; Pianta, La Paro, & Hamre, 2008). Results from a multilevel model found that teachers reported more conflict with males and older children. In addition, when teachers reported high levels of relational conflict, over half of the variance was explained by student misbehaviors resulting in decreased socialization in the classroom. The authors argued that in early childhood classrooms, it is especially important to pay attention to

the complex interactions between student-, teacher-, and school-level variables that influence STRs (Hamre et al., 2007).

Although Hamre et al. (2007) were mostly interested in student social adjustment, Blankemeyer et al. (2002), probed STRs regarding teacher preferred behavior, social competence, and school adjustment, including social skills. For this study, social skills were defined as well-adjusted and emotionally mature prosocial behaviors (LaFreniere & Dumas, 1996). The participants in this study included 1,432 elementary students from a previous longitudinal study conducted by Embry, Flannery, Vazsonyi, Powell, and Athna (1996). To measure STRs, students completed the Relationship with Teacher Questionnaire (Robin & Foster, 1989) and teachers completed the Child Behavior Checklist Teacher Report Form (Achenbach, 1991). The Walker-McConnell Scale of Social Competence and School Adjustment (Walker & McConnell, 1995) was used to measure student social skills. Data were analyzed using hierarchical multiple regressions and the results found that students with poor school adjustment or lower social skills had more negative relationships with their teachers. This was especially true for males (Blankemeyer et al., 2002).

Decreased academic achievement. As documented by previous research, distant or conflictual STRs are associated with decreased student social skills in the classroom (Blankemeyer et al., 2002; Hamre & Pianta, 2001; Hamre et al., 2007; Ladd et al., 1999). In addition to decreasing student social skills, conflictual STRs can also function as a stressor for students by fostering negative feelings regarding school and academics, resulting in decreased academic achievement (Buyse et al., 2009; Hamre & Pianta, 2001; Mantzicopoulos, 2015; Spilt et al., 2012; Stipek & Miles, 2008).

In an example by Mantzicopoulos (2005), child characteristics, classroom practices, and STRs from the perspective of the student were studied in relation to academic achievement. Student perceptions of conflict were collected using the Young Children's Appraisals of Teacher Support (Mantzicopoulos & Neuharth-Pritchett, 2003) and academic achievement was measured using the Woodcock-Johnson Tests of Achievement-Revised (Woodcock & Johnson, 1990). Researchers found significant correlations between student-teacher conflict and achievement, demonstrating that those who excelled in school had less conflictual relationships with their instructors. Furthermore, males, especially African American males, reported higher levels of conflict with their instructors (Mantzicopoulos, 2005).

Stipek and Miles (2008) also researched the relationship between STRs, aggression, and academic achievement. Consistent with previous studies, their prediction was that more aggressive children would develop negative relationships with their teachers leading to lower academic achievement. Measures used were the Child Behavior Scale (Ladd & Profilet, 1996), the STRS (Pianta, 2001) and the Teacher Rating Scale of School Adjustment (TRSSA; Birch & Ladd, 1997). Data were collected from 403 children from elementary school and path analysis was implemented. Results demonstrated that the effect of aggression on achievement was partially mediated by the conflictual relationships more aggressive students developed with their instructors. Specifically, aggression predicted student-teacher conflict, but conflictual STRs also predicted aggression. Despite the possibility of subjectivity within teacher ratings, the authors concluded that the relationship between aggressive behavior and achievement is reciprocal and can be influenced by conflictual STRs (Stipek & Miles, 2008).

To further investigate STRs, Buyse et al. (2009) used a longitudinal dataset of 122 schools and 3,798 children entering kindergarten. To measure the relationship quality between students and teachers the STRS was administered (Pianta, 2001) and to measure academic achievement, the Kindergartens' Language Achievement Test (Citogroep, 2013) was given. Results from a multilevel regression analysis found that student-teacher conflict was associated with poor social adjustment and lower reading achievement (Buyse et al., 2009). Implications from this study include creating interventions that place more emphasis on STRs and increasing knowledge regarding classroom disciplinary techniques (Hughes et al., 1999).

Additionally, Spilt et al. (2012) investigated the dynamics of STRs and reading achievement across elementary school. The participants consisted of 657 students with below average literacy skills. Student-teacher relationships were measured using the NRI (Furman & Buhrmester, 1985) and reading achievement was measured using the WJ-III Test of Achievement (Woodcock et al., 2001). The statistical analysis included growth mixture models, where latent classes corresponded to different growth curve patterns for the dependent variable measured across multiple time points. For males, a four-class solution was selected. Levels included low-stable, moderate, high, and high-stable levels of conflict. For females, a three-class solution was selected. Levels included low-stable, high levels that declined, and low levels that increased. For both males and females, those with low but increasing levels of conflict performed significantly lower than low-stable and high-declining groups on reading achievement (Spilt et al., 2012). These cases illustrated that conflictual STRs were associated with poor academic achievement.

Similar to Spilt et al. (2012), Hamre and Pianta (2001) were also interested in the association between STRs and academic achievement. In a longitudinal study, 179 children were followed from kindergarten through eighth grade to determine whether kindergarten teachers' perceptions of their relationships with students predicted later achievement. Cognitive development was measured using the Stanford-Binet Intelligence Scale-Revised (Thorndike, Hagen, & Sattler, 1986) and the ITBS (Hieronymus & Hoover, 1978). The students' classroom behaviors were measured using the Teacher-Child Rating Scale (Hightower et al., 1986) and STRs were measured using the STRS (Pianta, 1992b). The results suggested that negative STRs were strong predictors of negative work habit marks in elementary school through eighth grade compared to students who had positive STRs. Comparable results were not found for positive STRs suggesting that negative STRs have stronger effects (Hamre & Pianta, 2001).

As seen in work by Spilt et al. (2012) and stated within the literature, it is imperative to understand how STRs can influence student learning and development within schools. As stated, when students experience affection, warmth, and open communication with their teacher, there are many positive outcomes such as increased social skills (Howes et al., 1994; Malecki & Elliott, 2002; Pianta & Stuhlman, 2004), increased motivation and engagement in the classroom (Hughes & Kwok, 2006; Hughes et al., 2008; Klem and Connell, 2004), and increased academic achievement (Baker, 2006; Hughes, 2011; McCormick et al., 2013; O'Connor & McCartney, 2007; Zee et al., 2013). However, when a teacher perceives a student to be angry or unpredictable, there are two main negative outcomes that include decreased student social skills (Blankemeyer et al., 2002; Hamre & Pianta, 2001; Hamre et al., 2007; Ladd et al., 1999),

and decreased academic achievement (Buyse et al., 2009; Hamre & Pianta, 2001; Mantzicopoulos, 2015; Spilt et al., 2012; Stipek & Miles, 2008). In addition to these two categories of STRs, socioeconomic status (SES) has also been found to be a significant predictor of academic achievement as SES is an indicator of economic and educational privilege and has been linked to human qualities such as diligence, intelligence, determination, ambition and passion for life (Jeynes, 2002).

Student Socioeconomic Status

Socioeconomic status as famously defined by Duncan, Featherman, and Duncan (1972) includes indictors such as parent/guardian education level, occupational prestige, and household income or poverty levels as important predictors of student academic achievement (Sirin, 2005). In 2015, according to the National Center for Education Statistics (NCES), approximately 20% of children under the age of 18 were living in poverty (McFarland et al., 2017). As a consequence, children with low SES often have higher rates of single and teen parents, poorer health, and lower family income (Mayer, 1997). Evans (2004) also established that low SES is more common in neighborhoods with documented crime and pollution.

According to Isaacs (2012), the repercussions of low SES can plague children even before they enter school with 48% of children in poverty classified as school ready by age five compared to 75% of children from families with moderate to high incomes. Supporting this notion, Duncan et al. (2010) found there were long-term consequences such as decreased academic achievement and decreased lifetime earnings for children who grew up in poverty between their prenatal year and fifth birthday. Using longitudinal data from the Panel Study of Income Dynamics (PSID), 1,589 individuals were tracked

from early childhood to as late as their 37th birthday. After controlling for contextual variables, children from poverty had lower academic success in grade school and had decreased earnings as an adult compared to more advantaged children. Furthermore, The Annie E. Casey Foundation (2014) using data from the National Assessment of Education Progress (NAEP) found that in fourth grade, 80% of students from lower income families were not proficient in reading compared to only 49% of students from higher income families. These statistics appear to be slightly more severe compared to tabulations from Isaacs (2012). Using the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B:2001), they found that children with low SES were more likely than other children to score low on math and reading skills with 30% of low SES children scoring very low on reading skills compared to only 7% from moderate- or high-income families (Isaacs, 2012).

Expanding from descriptive analyses, Chatterji (2006) used the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K:1998) to analyze reading achievement gaps in relation to low student SES with multilevel modeling. In this study, SES was measured in two ways, as a continuous composite variable that included parental education, occupation, and income, and as a categorical variable broken into five quintiles. Results found that SES was a significant predictor of reading achievement. Specifically, compared to other at-risk groups such as African Americans, children with low SES were the least prepared for reading when entering first grade. In addition, the poorest or least advantaged children in the first quintile were one standard deviation behind in first-grade reading compared to their more affluent peers (Chatterji, 2006).

Herbers et al. (2012) were also interested in the relationship between SES and reading achievement with children facing poverty, homelessness, and high residential mobility (HRM). The participants included 18,011 students from the Minneapolis, MN Public Schools. Measures of interest included first-grade oral reading, risk status, academic achievement, and control variables. Academic achievement was measured with a computer adaptive test called the Measures of Academic Progress. Risk status was based on student membership in four mutually exclusive groups. These included HRM, free meals, reduced priced meals, or general, individuals who were not HRM or qualified for free/reduced priced meals. Using HRM as the reference group, results from a regression analysis found that SES risk status and oral reading ability in first grade predicted reading ability in grades 3 through 8. Even though, oral reading ability predicted higher reading achievement for all risk statuses, these effects were even greater for the HRM and the free meals group suggesting that early reading achievement is especially important for students who experience higher levels of risk (Herbers et al., 2012).

Although Chatterji (2006) and Herbers et al. (2012) analyzed SES in relation to reading achievement, Okpala et al. (2001) investigated the intersections between parental involvement, family SES, and student achievement. Participants included 4,256 fourth-grade students from 42 classrooms in North Carolina. Academic achievement scores were measured using state required end-of-grade exams, parental involvement was measured by the number of volunteer hours completed, and free/reduced priced lunches were used as proxy for student SES as suggested by Caldas and Bankston (1999). Results from regression models found that parental volunteer hours did not predict math scores.

However, eligibility for free and reduced priced lunches were negatively associated with academic achievement in math, suggesting that student SES is strongly related to academic achievement (Okpala et al., 2001).

Stull (2013) also investigated family SES, parental expectations, and student achievement, but instead used data from the ECLS-K:1998. The final analytic sample included 19,100 students enrolled in approximately 900 kindergarten programs. SES was measured using a composite variable that included parental education, occupation, and income. Item response theory results from math, science, and reading subject domains were combined to create the general knowledge domain. Parental expectations were gathered via a 45-50-minute interview where parents were asked questions regarding their household, educational expectations for their child, and their attitudes and behavior towards parenting. To determine the relationship between student achievement, family SES, educational expectations, achievement and SES were collapsed into three categories by quartile (the lowest quartile, the middle two quartiles, and the highest quartile). The general knowledge domain was regressed on school, teacher, parent, and child characteristics. Results from the study found that parents, regardless of SES, had high expectations for their children and that family SES did have a direct effect on achievement (Stull, 2013).

As seen in the literature, SES is arguably the most widely used contextual variable in educational research (Sirin, 2005) and is similar to STRs as they are both important predictors of student academic achievement within schools. This is because SES, a common indicator of economic and educational privilege (Jeynes, 2002) and STRs,

defined by the emotional support perceived by students (Wentzel, 2012) can directly influence how students are able to learn and develop within schools.

SES and STRs Interaction

Although the importance of SES and STRs on academic achievement has been studied individually, the interaction between these two variables could be equally important as student SES may be moderated by STRs on academic achievement. Specifically, STRs for students from wealthier families may be less important as they have more resources necessary to promote achievement, where students from lower income families may depend more on the teachers for resources and support. Although it is also possible that close STRs that are less conflictual may actually benefit high SES students since they have more resources and may not have to focus on more survival problem such as scarce food or housing shortages.

In one of the few studies that addressed this moderation effect, the researchers (Bergeron et al., 2011) were interested in determining whether STRs and achievement motivation predicted dropout intention. The participants in this study included 2,360 students enrolled in French public high schools in Quebec, Canada. Nine hundred eighty-four students were from 10 low SES schools and 1,376 students were from 9 high SES schools. Self-report scales were used to assess participants' achievement motivation and STRs were adapted based on the work of Pianta (2001). Hierarchical multiple regression was used where each step was characterized by the addition of new predictors. Results from the study found that most predictors of dropout intention were comparable for both high SES schools and low SES schools. However, there was not a statistically significant

interaction reported between SES and positive and negative STRs on dropout intention (Bergeron et al., 2011).

While Bergeron et al. (2001) were interested in SES and STRs, Malecki and Demaray (2006) were interested in the interaction between SES and social supports such as parental support and classmate support on academic GPA. Even though this study did not directly analyze STRs, it analyzed other types of social supports important for school success. The participants in this study included 164 students in grades 6 through 8 from an urban middle school in Illinois. Student SES was classified using eligibility for free and reduced priced meals, where 110 students were classified as having low SES and 54 students were classified as having high SES. The students' perceptions of social support were gathered using the Child and Adolescent Social Support Scale (CASSS; Malecki, Demaray, & Elliott, 2000). Total GPA was comprised of quarterly report cards for reading, language arts, social studies, math, and science where the first through fourth quarter grades were averaged. Results from a regression analysis found statistically significant interactions between parental support and SES and classmate support and SES on GPA. Students with low SES and low parental or classmate support had lower GPAs compared to individuals with high SES and high parental or classmate support (Malecki & Demaray, 2006).

Similar to Bergeron et al. (2011) and Malecki and Demaray (2006), Sorhagen (2013) was interested in how teacher expectations in elementary school can disproportionately affect the school performance of low SES high school students. The participants in this study included 1,273 students and 894 teachers from the NICHD-Study of Early Child Care and Youth Development. Demographic data such as family

SES were collected during home interviews with the children and parents. Student achievement was measured using the WJ-III (Woodcock et al., 2001) and student ability was measured using teacher ratings of student academic skills and performance compared to other children in the same grade level. The teacher discrepancy score was computed by taking the difference between the teacher's report of academic ability and the student's performance on the standardized achievement test. Results from this study show that when teachers had high expectations, all students regardless of SES performed well on the WJ-III subscales. However, when teachers underestimated the math and language abilities of students, those from low SES backgrounds scored lower than students from high SES backgrounds. This demonstrates that a teacher's estimation of academic abilities may have a stronger impact on students from low SES families compared to students from more affluent homes (Sorhagen, 2013).

As found in the current literature, understanding interactions or moderation effects are important because the relationship between two variables may actually depend on a third variable. In this case, the relationship between SES and academic achievement may actually depend on STRs or similar variables as documented in studies by Bergeron et al. (2011), Malecki and Demaray (2006), and Sorhagen (2013).

Characteristics Associated with Student Achievement

Furthermore, like STRs and SES, student-level and teacher-level characteristics such as student race, sex, disability status, previous academic achievement, teacher race, and teacher sex can influence student academic achievement. It is important to control for these variables as they can account for additional variance within the different statistical models.

Student race. A well-documented student-level characteristic associated with academic achievement is student race. According to the 2015 Nation's Report Card collected by the NAEP (2016), of the students in fourth grade, 51% of White students were considered proficient in mathematics compared to 26% Hispanic and 19% Black students. In eighth grade, 43% of White students were considered proficient in mathematics compared to 19% Hispanic and 13% Black students. For reading in 2015, in fourth grade 46% of White students were considered proficient compared to 21% Hispanic, and 18% Black. In eighth grade, 44% of White students were considered proficient in reading compared to 21% Hispanic and 16% Black (NAEP, 2016). Research by Burchinal et al. (2011) investigated the Black-White achievement gap noted by the NAEP. The academic achievement of 214 American youth from 4.5 years of age through fifth grade was analyzed. Black-White achievement gaps were found in students as early as three years old and continued to be prominent throughout all years of the study. Additionally, Murphey, Madill, and Guzman (2017) using the ECLS-K:2011 found that Latinx and White students made similar academic gains in math and reading in kindergarten, however, because Latinx students started the academic year behind, they continued to remain behind. These research studies demonstrate that a large racial achievement gap still exists in the United States.

Student sex. In addition to student race, student sex is also associated with student academic achievement. According to the NAEP, in 2015 for mathematics, there was a 2-point achievement gap between males and females at grade 4 and there was no measurable achievement gap for grade 8 (NAEP, 2017). For reading achievement in 2015, the NAEP found a significant difference between males and females, with females

scoring 7 points higher than males in fourth grade and 10 points higher in eighth grade (NAEP, 2016). The Progress in International Reading Literacy Study (PIRLS:2006), part of the International Association for the Evaluation of Educational Achievement (IEA) supported the NAEP finding, as girls scored higher than boys in every country except Luxembourg and Spain (Mullis, Martin, Kennedy, & Foy, 2007).

Disability status. Disability status is also an important variable to account for. According to the 2013 NAEP there were large achievement gaps between students with and without disabilities. Overall, students with disabilities were 20 percentage points below their non-disabled peers in reading proficiency and 27 percentage points below in math proficiency (NCES, 2014). In eighth grade, 65% of students with disabilities scored below basic in math and 60% scored below basic in reading. However, in fourth grade, 45% of students with disabilities scored below basic in math and 69% scored below basic in reading (NCES, 2014). These differences demonstrate the individuals with disabilities are scoring lower than their non-disabled peers on national standardized tests.

Previous academic achievement. Similar to student race and sex, previous academic achievement is another important variable to consider when analyzing student achievement. Since students begin the academic year starting at different skills levels, accounting for prior student achievement becomes important to see true academic gains (Solmon, Wise, & Podgursky, 2004). Stronge (2010) found that controlling for previous achievement can provide more accurate estimates of school and teacher effectiveness. In a study by Wang and Guthrie (2004) that investigated the effects of motivation and frequency of reading on text comprehension between fourth-grade students from the United States and China, prior academic achievement was controlled for. Using a

correlational analysis, the researchers concluded that current reading comprehension was positively correlated with past reading achievement for students from the United States and from China (Wang & Guthrie, 2004). Hemmings, Grootenboer, and Kay (2010) also investigated prior achievement and found that prior achievement and attitudes towards mathematics accounted for 70% of the variance on a standardized mathematics examination, thus demonstrating the predictive ability of prior achievement.

Teacher race. In addition to student-level characteristics, teacher-level characteristics can be associated with student academic achievement. For ethnic and racial minority students, teacher race has been found to be especially important. In a study by Cherng (2017), using the ELS:2002, English and math teachers were found to underestimate the academic abilities of minority students, influencing student grades and expectations. Approximately 18% of math teachers and 13% of English teachers reported their class was too hard for Black students compared to White students (8% of math teachers and 6% of English teachers) (Cherng, 2017). When minority students were placed in classrooms with teachers of their own race/ethnicity, students scored significantly higher in math, but not in reading. However, when a student was matched with a teacher of the same race for consecutive years, reading achievement gains became statistically significant. This became particularly prominent after the third and fourth year of exposure (Dee, 2004). These examples demonstrate that teacher race is associated with academic achievement.

Teacher sex. The evidence regarding the influence of teacher sex on achievement has been mixed. According to Dee (2004) using the NELS: 1988, when students were taught by individuals who shared their sex, engagement and achievement increased and

misbehavior decreased. In science, social studies, and English, Dee (2004) found that female teachers raised the achievement of girls by 4% of a standard deviation, and lowered achievement of boys by 4% of a standard deviation, creating a sex gap of 8% of a standard deviation, that Dee (2004) argued represents the sex achievement gap found in the United States. Contrary to Dee (2004), Winters, Haight, Swaim, and Pickering (2013) used the Florida Department of Education data to follow approximately 1.70 million same sex student-teacher assignments for five years. Results from the study did not find a statistically significant relationship between student-teacher sex matching and academic achievement for elementary school students but found small effects (.008 standard deviations) for student-teacher sex matching in middle and high school (Winters et al., 2013). Due to the varied information regarding teacher sex on academic achievement, it becomes important to account for this variable in the model.

The Current Study

Informed by prior research, the goal of the current study is to further analyze the relationships between STRs, SES, and academic achievement, as there are possible bidirectional relationships between these three variables of interest. The first objective was to explore student SES and STRs, specifically how teachers' perceptions of closeness and conflict with their students may be associated with first-grade academic achievement when accounting for student and teacher-level variables, with school fixed effects. It is hypothesized that students with low SES and high SES will score similarly when close to their teachers with the opposite effect found for students who conflict with their teachers.

The second objective in this study was to determine whether SES and academic achievement may be associated with STRs, specifically conflictual or close relationships when accounting for student and teacher-level variables with school fixed effects. Due to the bidirectional nature of these variables and their effects (i.e., do STRs predict academic achievement or does academic achievement predict STRs), it becomes important to analyze these variables in multiple ways.

The third objective in this study was to use PSW to analyze links between SES on STRs when matched on student-level covariates. As demonstrated in the literature, STRs are bidirectional suggesting that both the student and the teacher can influence the STR (Stipek & Miles, 2008). To better understand how student SES impacts STRs, PSW was used to weight students based on student-level covariates such as student behavior, student disability status, academic achievement, and student race to create two equal groups with the only difference being SES. By accounting for a variety of student-level covariates using PSW, the association between SES on STRs can be better understood because the student-level covariates would be the same between groups allowing the researcher to better isolate the possible association between SES on STRs. Although exploratory in nature, it is hypothesized that students with higher SES would be closer to their teachers and have less conflictual relationships.

Given the limited number of studies addressing the bidirectional nature of academic achievement, SES, and STRs, exploring the moderation effects between these three variables of interest, and using PSW to determine possible links between SES on STRs when weighted on student-level covariates, a nationally representative dataset was used to answer the following research questions:

1. Is teacher closeness, teacher conflict, and student SES associated with first-grade academic achievement, specifically math and reading achievement, when accounting for student and teacher-level variables with school fixed effects?
2. Is the association of first-grade academic achievement, specifically math and reading achievement, and student SES moderated by STRs, specifically teachers' perceptions of closeness and conflict with their students?
3. Is student SES and first-grade academic achievement, specifically math and reading achievement associated with STRs, specifically teachers' perceptions of closeness and conflict with their students when accounting for student and teacher-level variables with school fixed effects?
4. Is the association of SES and STRs, specifically teachers' perceptions of closeness and conflict with their students, moderated by student academic achievement, specifically math and reading achievement?
5. Does the effect of SES on teacher closeness and teacher conflict differ when weighted on student-level covariates using propensity score analysis?

Chapter 3: Methods

Dataset

The data used for this study were from the restricted-use Early Childhood Longitudinal Study, Kindergarten Class of 2010-2011 (ECLS-K:2011), conducted by the National Center for Education Statistics (NCES).[1] The goal of the ECLS-K was to longitudinally study a nationally representative group of children from kindergarten through elementary school. Specially, the ECLS-K:2011 followed a cohort of children from their kindergarten year (2010-2011 academic year) through fifth grade (2015-2016 academic year). This is the third and latest study in the ECLS-K program and contains assessments of children, interviews with parents, and questionnaires completed by both teachers and school administrators. As part of the data collection, a stratified probability proportion to size sample design was used, meaning that the sampling frame was stratified by state, public/private sectors, and school eligibility (Ingles, Pratt, Alexander, Jewell, Lauff, Mattox, & Wilson, 2014).

In this current cross-sectional study using the ECLS-K[2], the spring 2012 wave when the participants were in first grade was selected. In this wave, data were collected from child assessments, parental interviews, and classroom teacher questionnaires. The data were then narrowed to exclude children enrolled in private schools, schools with less than three teachers to estimate school fixed effects, and children who skipped first grade, were retained in kindergarten, or were missing teacher-level data. The final analytic sample for the regression analysis consisted of 9,530 students, 3,420 teachers, and 850 schools, out of a possible 11,440 students, 3,760 teachers, and 1,520 schools representing

[1] For more information about the ECLS-K:2011 visit https://nces.ed.gov/ecls/kindergarten2011.asp
[2] As part of the restricted use data agreement with the NCES, all counts were rounded to the nearest 10.

a weighted sample of approximately 2.53 million students out of a possible 2.99 million students. The final analytic sample for the PSW analysis consisted of 3,750 students representing a weighted sample of approximately 1 million students. Descriptive statistics for the variables used in this study can be found in Table 1 and Table 3.

Measures for Regression Analysis

Reading assessment. The reading assessments included in the ECLS were conducted in two stages. The first section contained 30 of a possible 100 questions that measured a wide variety of reading skills such as letter recognition, beginning and ending sounds, word recognition, rhymes, vocabulary knowledge, and reading comprehension questions that asked students to identify information and make correct inferences within and across texts (Tourangeau et al., 2015). The second section varied in difficulty and was adaptive based on the student performance in part one, meaning that students were administered questions deemed appropriate for their reading ability. If the student was routed to the low or middle second test, they received an additional 18 items to answer. However, if the student was routed to the highest test, they did not receive these items since they were considered too easy. The reading assessment was conducted in two stages to maximize the accuracy of the measurement and to decrease the amount of time needed to administer the exam.

Next, an IRT-based overall scale score was created for the reading domain. This score was constructed by estimating the number of questions the student would have answered correctly if administered all 100 questions in the first stage and all 47 questions in the second stage. Student theta levels for each test item or probabilities of correct answers, were summed for each student to create their composite IRT reading score

(Tourangeau et al., 2015). For first-grade students the reading assessment score was conducted in both the spring and fall. The reading assessment score for the spring had a weighted mean of 70.09, a weighted standard deviation of 12.52, and a range from 25.27-95.13 and the reading assessment for fall had a weighted mean of 50.00, a weighted standard deviation of 11.25, and a range from 21.69-90.35.

Mathematics assessment. The mathematics assessment in the ECLS was conducted in two stages and was designed to measure conceptual knowledge, procedural knowledge, and problem solving (Tourangeau et al., 2015). The first stage consisted of 17 items that were administered to all children. These items were administered using easel pages and word problems. Graph labels were read to the students to reduce the likelihood that student reading ability would influence math scores. The scores on the first assessment determined whether students were sorted into the low, middle, or high performing group. The second assessment corresponded to the student's ability level and included questions that had an option of using wooden blocks. Student theta levels for each test item or probabilities of correct answers, were summed for each student to create their composite IRT math score (Tourangeau et al., 2015). For first-grade students the math assessment score was conducted in both the spring and fall. The math assessment score for the spring, had a weighted mean of 63.43, a weighted standard deviation of 12.70, and a range from 17.15-93.68. For the fall, the math assessment score had a weighted mean of 43.66, a weighted standard deviation of 11.13, and a range from 6.27-81.12.

Teacher closeness. The teacher closeness scale was developed from the STRS (Pianta & Steinberg, 2002) and contained seven items on a five-point scale ranging from

"definitely does not apply" to "definitely applies." The score was calculated when teachers provided a rating on at least five of the seven items. The closeness subscale measured the "affection, warmth, and open communication that the teacher experiences with the student" (Tourangeau, 2015, pp. 27). High scores on this scale indicate that the teacher perceived they had a close relationship with the student. The closeness scale has a weighted mean of 4.30, a weighted standard deviation of 0.66, a range from 1.00 to 5.00, and a reliability estimate of .89 (Cronbach, 1951).

Teacher conflict. The teacher conflict scale was also developed from the STRS (Pianta & Steinberg, 2002) and contained eight items on a five-point scale ranging from "definitely does not apply" to "definitely applies." The score was calculated when the teacher provided a rating on at least five of the eight items. The conflict subscale measures the "teacher's perception of negative and conflictual aspects of the teacher's relationship with the student" (Tourangeau 2015, pp. 27). High scores on this scale indicate that the teacher perceived their relationship with that student to be characterized by conflict. The conflict scale had a weighted mean of 1.64, weighted standard deviation of .80, a range of 1.00 to 5.00, and a reliability estimate of .89 (Cronbach, 1951).

Socioeconomic status. To measure SES, a normalized continuous variable containing five difference components was used. These components included the first parent/guardian's education level, the second parent/guardian's education level, the first parent/guardian's occupational prestige score, the second parent/guardian's occupational prestige score, and household income (Tourangeau et al., 2015). Due to the stability of SES, if a student's SES was not reported for the spring of 2012, prior SES reports from the fall of 2011 or the spring of 2011 were used instead. Since this variable was

normalized, the weighted mean was -0.10, the weighted standard deviation was 0.79, and the range was from -2.33 to 2.60. For the current study, the ECLS-K SES variable in this study was also divided into quintiles to create a factored categorical variable to analyze possible interactions between SES and STRs. Quintile 1 (20%) represented students with low SES, Quintile 2 (20%) represented students with low-middle SES, and Quintile 3 (20%) represented students with middle SES, Quintile 4 (20%) represented students with high-middle SES, and Quintile 5 (20%) represented students with high SES.

Student demographic information. Student-level characteristics were identified in the survey. Demographic attributes included: students identifying as either a male (51%) or female (49%), with male students as the reference group, student race identification, White (53%), Black (13%), Hispanic (25%), Asian (4%), and Other (5%), with White as the reference group, fall reading achievement (*M*=50.00, *SD*=11.25, *Range*=21.69-90.35), fall math achievement (*M*=43.66, *SD*=11.13, *Range*=6.27-81.12), fall STR conflict scores (*M*=1.60, *SD*=0.78, *Range*=1.00-5.00), and fall STR closeness scores (*M*=4.38, *SD*=0.61, *Range*=1.00-5.00). Students were identified as having a disability if parents answered "yes" to at least one question regarding a disability diagnosis (i.e., autism, emotional disturbance, or speech/language impairment) or indicated that their child was in therapy services. If a student was missing data for this survey question, the student was identified as not having a disability. Overall, 12% of students were identified with a disability and 88% of students were identified without one. This statistic was similar to the national average of 12.90% reported by the NCES for the 2011-2012 academic year (Snyder, de Brey, & Dillow, 2016).

Teacher demographic information. In the ECLS questionnaire, teachers identified their sex as either female (96%) or male (4%), dummy coded with male teachers as the reference group. Teacher race/ethnicity, specifically White (80%), Hispanic (9%), Black (6%), Asian (2%), and Other (2%) were also dummy coded with White as the reference group. The Other category was composed of teachers who identified as multi-racial, American Indian, or Hawaiian/Pacific Islander.

Table 1: Descriptive Statistics for the Regression Analysis

	%	*M*	*SD*	*Range*
Teacher level (*N*=3,420)				
Female (1=Yes)	96%			
White	80%			
Black	6%			
Hispanic	9%			
Asian	2%			
Other	2%			
Student Level (*N*=9,530)				
Female (1=Yes)	49%			
White	53%			
Black	13%			
Hispanic	25%			
Asian	4%			
Other	5%			
Disability Status (1=Yes)	12%			
Socioeconomic Status Quintile 1	20%			
Socioeconomic Status Quintile 2	20%			
Socioeconomic Status Quintile 3	20%			
Socioeconomic Status Quintile 4	20%			
Socioeconomic Status Quintile 5	20%			
Socioeconomic Status Normalized		-0.10	0.79	-2.33-2.60
Spring Reading Achievement		70.09	12.52	25.27-95.13
Fall Reading Achievement		50.00	11.25	21.69-90.35
Spring Math Achievement		63.43	12.70	17.15-93.68
Fall Math Achievement		43.66	11.13	6.27-81.12
Spring Student-Teacher Relationships - Conflict		1.64	0.80	1.00-5.00
Fall Student-Teacher Relationships - Conflict		1.60	0.78	1.00-5.00
Spring Student-Teacher Relationships - Closeness		4.30	0.66	1.00-5.00
Fall Student-Teacher Relationships - Closeness		4.38	0.61	1.00-5.00

Notes: Weighted analyses shown.

Regression Analyses

Multiple imputations. All student-level variables had less than 5% missing data (see Table 2). To address this missing data, multiple imputations were implemented as this is the recommended method necessary for accurate variability and standard error

estimates (Dong & Peng, 2013). Following guidelines suggested by Allison (2001) and Bodner (2008), the MICE (multivariate imputation by chained equations) package (van Buuren & Groothuis-Oudshoom, 2011) in R 3.3 (R Core Team, 2016) was used to impute 10 complete datasets, as approximately 8% of the total data was missing. The MICE package (van Buuren & Groothuis-Oudshoom, 2011) uses predicted mean matching for continuous variables, logistic regression for binary variables with only two levels, and Bayesian polytomous regression for factored variables with more than two levels.

Table 2: Missing Data for the Regression Analysis

	% Missing
Teacher Level (N=3,420)	
Sex	0.00%
Race	0.00%
Student Level (N=9,530)	
Sex	0.20%
Race	0.10%
Socioeconomic Status	4.70%
Disability Status	0.00%
Spring Reading Achievement	0.50%
Fall Reading Achievement	0.70%
Spring Math Achievement	0.50%
Fall Math Achievement	1.00%
Spring Student-Teacher Relationship - Conflict	0.60%
Fall Student-Teacher Relationship - Conflict	2.60%
Spring Student-Teacher Relationship - Closeness	0.60%
Fall Student-Teacher Relationship Closeness	2.60%

Regression using Taylor series linearization. Since students were nested within teachers and teachers were nested within schools, responses could have become correlated due to shared commonalities (Raudenbush & Bryk, 2002). Although multilevel

modeling is a common solution for analyzing clustered data, since the research questions were primarily focused on the student level and the data were not collected by simple random sampling, regression using Taylor series linearization (TSL) was implemented instead (Huang, 2014; 2016) using the *survey* package (Lumley, 2004; 2016). By using TSL, standard errors were appropriately estimated to acknowledge clustering found in the data since TSL accounts for the different clusters and strata identified in the dataset to correctly identify the variance of the actual estimate (Kneipp & Yarandi, 2002). School-level clustering was accounted for by using fixed effects where each school was factored and assigned a dummy code. In addition, the weights used in the analysis were normalized by taking the raw weight and dividing it by the mean of the weights (Hahs-Vaughn, 2005). All models were built over several stages to assess improvements in model fit and changes in R^2 specifically for the student and teacher-level control variables, and the interactions of interest.

Student SES and STRS on academic achievement. To answer the first and second research questions, standardized first-grade achievement scores was the outcome variable and the predictors were the teacher and student-level variables including SES, the standardized STR conflict scale, and the standardized STR closeness scale. To better understand the relationships between these three variables on academic achievement, five regression models were developed: (1) the teacher-level model that controlled for teacher sex and teacher race; (2) the control model that adjusted for teacher sex, teacher race, student sex, student race, student SES, student disability, and previous achievement from the fall; (3) the STR model, that included the previous model variables plus the standardized STR closeness scale and standardized STR conflict scale; (4) STR conflict

scale interaction model, that was built on the STR model and included the interaction between the SES variable and the STR conflict scale; (4) STR closeness scale interaction model, that was built on the STR model and included the interaction between the SES variable and the STR closeness scale; and (5) the final model, that included the previous variables plus the interaction between the STR conflict scale and the categorical SES variable.

Academic achievement and student SES on STRS. To answer the third and fourth research questions, specifically whether academic achievement and student SES predicted STRs for closeness and conflict, four regression models were developed: (1) the teacher-level model that controlled for teacher sex and teacher race; (2) the control model that accounted for the teacher-level variables plus the student-level variables of race, sex, disability status, and the previous STRs from the fall, (3) the academic achievement model that controlled for the previous model variables in addition to standardized math and reading scores from the spring; (4) the interaction model that accounted for the variables in Model 3 plus analyzed the interaction between student SES and the standardized math and reading scores from the spring.

Propensity Score Weighting Analyses

Propensity score weighting procedure. To answer the fifth research question and further determine whether the effect of a teacher's relationship with their students differ based on SES, PSW was implemented. Propensity score weighting was selected to determine whether student SES predicted either STRs defined by conflict or defined by closeness when weighted on standardized student-level covariates. As the literature has demonstrated, student-level covariates beyond SES can influence the relationship

students have with their teachers. To decrease the bias and variance of the SES effect estimates, approaches to learning scale, self-control scale, interpersonal skills scale, externalizing behavior scale, internalizing behavior scale, attentional focus scale, inhibitory control scale, academic achievement, student disability status, student race, and student sex were selected as student-level covariates (Brookhart, Schneeweiss, Rothman, Glynn, Avorn, & Sturmer, 2006). By accounting for a variety of student-level covariates using PSW, the possible effect of SES can potentially be isolated to better determine the association of SES on STRs.

To calculate the propensity scores, the treatment variable needed to be dichotomous. Therefore, the SES variable was divided into quintiles, where Quintile 1 and Quintile 5 became the dichotomous treatment variable. Specifically, students below the 20th percentile of SES were coded as 0 and students above the 80th percentile of SES were coded as 1. Since SES is a binary predictor, effect sizes can be interpreted using Cohen's (1992) *d* with the commonly used effect size interpretation guidelines (0.20 = small, 0.50 = moderate, and 0.80 = large). By only selecting students with extreme SES in Quintile 1 or Quintile 5 and eliminating schools with less than two students to estimate school fixed effects, the dataset was narrowed from a possible 11,440 students to 3,870 students representing a weighted sample of approximately 929,000 students.

Logistic regression using maximum likelihood estimation was used to estimate the propensity scores, where the logit was the log odds of the probability for having high SES. The propensity scores or estimated probabilities of the treatment assignment given the covariates were obtained from the estimated logits, where Z_i was the treatment and $e_i(X)$ was the estimated propensity score weight (Agresti, 2002; Fox, 2008).

$$e_i(X) = \frac{\exp(logit(Z_i = 1|X))}{1 + \exp\,(logit(Z_i = 1|X))}$$

To estimate the logistic regression model, the general linear model function was used where the "family" option was specified as binomial with a logit link and the weights were specified as the normalized ECLS-K:2011 survey weights. The propensity scores estimated using the logistic regression model calculated the average treatment effect of the treated (ATT) or the difference between the expected values of the potential outcomes of all individuals in the high SES and low SES groups (Leite, 2017). The ATT was of interest because it determines what the differences in STRs would be if all students came from high SES instead of from low SES backgrounds. Specifically, ATT increases understanding regarding how exposure to low SES affected those individuals who did have low SES.

To evaluate the balance of the standardized student covariates, the standardized mean differences between the weighted means from the logistic regression of the students above the 80th percentile of SES and the students below the 20rd percentile of SES were compared. The *tableone* package (Yoshida & Bohn, 2018) was used to compute the weighted means for continuous covariates, weighted proportions for the categorical covariates, standard deviations, and standardized mean differences between the two SES groups for each covariate. According to Lanza, Moore, and Butera (2013) treatment groups are considered to be balanced on the measured covariates when the standardized mean differences are less than 0.20. A standardized mean difference of less than 0.20 is often used because it is considered a small effect size (Cohen, 1988). When covariate balance is achieved, it provides evidence that the distribution of each covariate for the

treated and untreated students are similar, demonstrating that selection bias due to the covariates have been diminished (Leite, 2017).

After covariate balance was achieved, two linear regressions were conducted with school fixed effects to eliminate any potential school effects. In the first regression, the standardized STR-Conflict scale was the outcome variable and the predictor was SES, where low SES was the reference group. In the second regression, the standardized STR-Closeness scale was the outcome variable and again the predictor was SES, where low SES was the reference group. Statistically significant findings would suggest that SES when weighted on student-level covariates may be related to either STRs characterized by closeness or conflict.

Measures for Propensity Score Weighting Analyses

As variables other than SES may influence the relationship a student has with their teacher, it was important to select student-level covariates that may influence STRs. The approaches to learning scale, self-control scale, interpersonal skills scale, externalizing behavior scale, internalizing behavior scale, attentional focus scale, inhibitory control scale, disability status, race, sex, math achievement, and reading achievement were the student-level covariates that were weighted for the PSW analysis (Gresham & Elliott, 1990; Putnam and Rothbart, 2006; Tourangeau et al., 2015). These variables were selected due to their associations with STRs and possible ability to help isolate the effect of SES on STRs.

Approaches to learning scale. The Approaches to Learning scale asked teachers to report how often their students exhibited a selected set of learning behaviors. These behaviors included the ability to keep belongings organized, showing eagerness to learn

new things, working independently, adapting to changes in routine, completing tasks, paying attention, and following classroom rules. The Approaches to Learning scale was the mean rating on the seven behavior items and a score was computed when the teacher provided a response on at least four of the seven items. Higher scores indicated positive learning skills (Tourangeau et al., 2015). The Approaches to Learning scale had a weighted mean of 3.05, a weighted standard deviation of 0.71, a range from 1.00-4.00, and a Cronbach (1951) reliability estimate of .91.

Social skills rating system. Four social skills scales were created from teacher responses to the Social Skills Rating System (SSRS; Gresham & Elliott, 1990). Due to copyright reasons, the individual items contributing to each scale were not included in the ECLS-K:2011 dataset. The four teacher subscales in the SSRS included Self-Control (4 items), Interpersonal Skills (5 items), Externalizing Problem Behaviors (5 items), and Internalizing Problem Behaviors (4 items). A score was computed for each of these scales when the teacher provided a rating on at least a minimum number of items that composed the scale. The minimum number of items that were required to compute a scale were as follows: Self-Control (3 out of 4 items), Interpersonal Skills (4 out of 5 items), Externalizing Behaviors (4 out of 5 items), and Internalizing Behavior Problems (3 out of 4 items). Higher scores indicated that the student exhibited the behaviors represented by the scale more frequently (Tourangeau et al., 2015). The weighted means, standard deviations, range, and Cronbach's alpha (1951) for each scale were: Self-Control (*M*=3.20, *SD*=0.62, *Range*=1.00-4.00, α=.81), Interpersonal Skills (*M*=3.13, *SD*=0.66, *Range*=1.00-5.00, α=.86), Externalizing Behaviors (*M*=1.72, *SD*=0.61, *Range*=1.00-4.00, α=.88), and Internalizing Behaviors (*M*=1.54, *SD*=0.50, *Range*=1.00-4.00, α=.76).

Children's behavior questionnaire. The Children's Behavior Questionnaire developed by Putnam and Rothbart (2006) asked teachers to indicate how often their students exhibited social skills and behaviors related to inhibitory control and attentional focusing. The teachers were asked to indicate on a 7-point Likert scale how "true" or "untrue" statements were related to potential situations that could have occurred within the past 6 months. If the statement did not apply, teachers could indicate "not applicable." Due to copyright restrictions, the data for individual items were not included in the ECLS-K:2011. Scores were computed when the teacher provided a rating of at least four of the six items on the Inhibitory Control and Attentional Focusing subscales. Higher scores on the Attentional Focus scale indicated that the child exhibited more behaviors that demonstrate the ability to focus attention on cues in the environment relevant to the current task and higher scores on the Inhibitory Control scale indicated that the child exhibited more behaviors that demonstrate the ability to resist the temptation to do something that is not appropriate or needed. The weighted means, standard deviations, range, and Cronbach's (1951) alpha for each scale were: Attentional Focus (M=4.84, SD=1.29, $Range$=1.00-7.00, α=.83) and Inhibitory Control (M=5.01, SD=1.28, $Range$=1.00-7.00, α=.86).

Student-level demographic information. For the PSW student-level characteristics were also included in the model (see Table 3). The three student-level demographic characteristics included whether a student identified as either a female (49%) or male (51%), with male students as the reference group. Student race/ethnicity, specifically White (41%), Hispanic (35%), Black (14%), Asian (5%), and Other (5%) were also dummy coded with White as the reference group. The Other category was

composed of students who identified as either multiracial, American Indian, or Hawaiian/Pacific Islander. In addition, students were identified as having a disability if parents answered "yes" to at least one question regarding a disability diagnosis (i.e. autism, emotional disturbance, or speech/language impairment) or indicated that their child was in therapy services. If a student was missing data for this survey question, students were identified as not having a disability. Overall, 12% of students were identified with a disability and 88% of students were identified without one. In addition, student math and reading achievement were student-level characteristics that were accounted for in the PSW model. Math achievement had a weighted mean of 62.64, a weighted standard deviation of 13.68, a range from 15.57-93.68. Reading achievement had a weighted mean of 69.22, a weighted standard deviation of 13.70, a range from 25.27-95.13.

STRs-closeness and STRs conflict. The outcome variables for the propensity score models were the STRs, specifically closeness and conflict. The teacher closeness scale was developed from the STRS (Pianta & Steinberg, 2002) and contained seven items on a five-point scale ranging from "definitely does not apply" to "definitely applies." The closeness subscale measured the "affection, warmth, and open communication that the teacher experiences with the student" (Tourangeau, 2015, p. 27). The closeness scale had a weighted mean of 4.30, a weighted standard deviation of 0.67, a range from 1.00 to 5.00, and a reliability estimate of .89 (Cronbach, 1951).

The teacher conflict scale was also developed from the STRS (Pianta & Steinberg, 2002) and contained eight items on a five-point scale ranging from "definitely does not apply" to "definitely applies." The conflict subscale measures the "teacher's

perception of negative and conflictual aspects of the teacher's relationship with the student" (Tourangeau 2015, p. 27). The conflict scale had a weighted mean of 1.63, weighted standard deviation of .78, a range of 1.00 to 5.00, and a reliability estimate of .89 (Cronbach, 1951).

Table 3: Descriptive Statistics for the Propensity Score Analysis

	%	*M*	*SD*	*Range*
Student Level (*N*=3,750)				
Female (1=Yes)	49%			
White	45%			
Black	13%			
Hispanic	32%			
Asian	5%			
Other	5%			
Disability Status (1=Yes)	12%			
Socioeconomic Status Quintile 1	58%			
Socioeconomic Status Quintile 5	42%			
Approaches to Learning Scale		3.07	0.70	1.00-4.00
Self-Control Scale		3.21	0.62	1.00-4.00
Interpersonal Skills Scale		3.14	0.66	1.00-4.00
Externalizing Behavior Scale		1.72	0.61	1.00-4.00
Internalizing Behavior Scale		1.54	0.50	1.00-4.00
Attentional Focus Scale		4.87	1.30	1.00-7.00
Inhibitory Control Scale		5.02	1.28	1.00-7.00
Math Achievement		62.64	13.68	15.57-93.68
Reading Achievement		69.22	13.70	25.27-95.13

Notes: Weighted analyses shown.

Chapter 4: Results

Regression Using Taylor Series Linearization

A series of four multiple regression models using TSL to estimate appropriate standard errors to account for clustering were conducted with imputed data to investigate the relationships between student academic achievement, STRs, and SES. All continuous variables within the models including the outcome variables were standardized (M=0, SD=1) to allow the regression coefficients to be interpreted as standardized regression coefficients for continuous predictors and as an effect size measure for binary predictors. Comparisons between dummy coded variables such as race/ethnicity groups can be interpreted using Cohen's (1992) d with the commonly used effect size interpretation guidelines (0.20 = small, 0.50 = moderate, and 0.80 = large).

STR-closeness, STR-conflict, and SES on reading achievement. In the first set of multiple regressions, standardized reading achievement was the outcome variable and STR-closeness, STR-conflict, and student SES were the variables of interest. In Model 1, only teacher-level characteristics were accounted for resulting in a low pooled R^2=.231. At the teacher level, Hispanic (B=-0.16, p<.01) teachers had lower student reading scores compared to White teachers. However, female teachers (B=0.19, p<.01) had higher student reading scores compared to male teachers.

In Model 2, both student and teacher-level demographic variables were included. Compared to Model 1, much more of the variance within the model was accounted for resulting in a pooled R^2=.676 and all the teacher-level variables were no longer statistically significant. At the student level, both Black (B=-0.10, p<.001) and Hispanic (B=-0.09, p<.001) students had lower reading scores compared to White students.

Females (B=0.07, p<.001) had higher reading scores compared to males, and students with a disability (B=-0.18, p<.001) had lower reading scores than students without a disability. Previous reading achievement from the fall (B=0.73, p<.001) and SES (B=0.10, p<.001) were also strong predictors of reading achievement.

In Model 3, approximately the same amount of variance was accounted for (pooled R^2=.680) with the addition of the STR-Conflict and STR-Closeness variables. The same variables from Model 2 were also statistically significant in Model 3. Additionally, both of the STR variables were statistically significant with higher levels of conflict (B=-0.05, p<.001) associated with decreased reading achievement and higher levels of closeness (B=0.04, p<.001) associated with increased reading achievement.

Model 4 investigated the interactions between the two STR variables and SES in addition to including variables from the previous models. The interaction did not account for any additional variance. The same variables from Model 4 were also statistically significant in addition to the interaction between STR-Conflict and SES (B=0.02, p<.05).

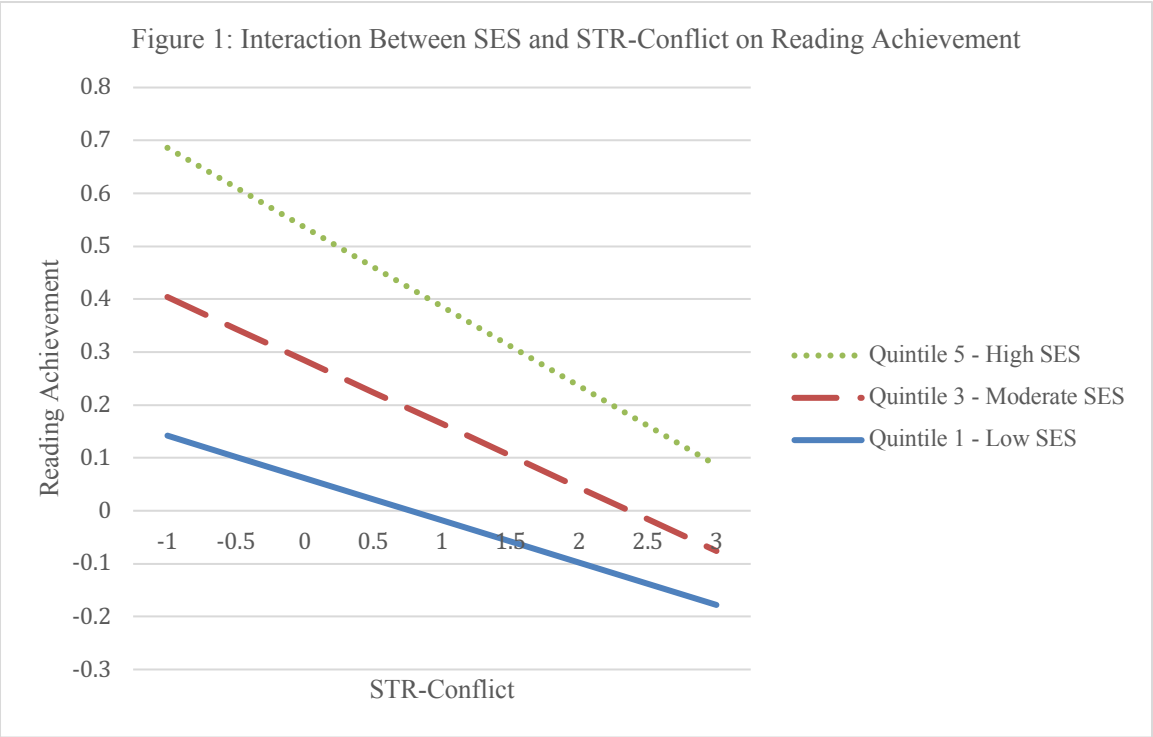
To further investigate the interaction between STR-Conflict and SES, the SES variable was split into categorical quintiles, where Quintile 1 represented students with low SES, or below the 20th percentile, and Quintile 5 represented students with high SES, or above the 80th percentile. This approach was suggested by Hayes and Montoya (2017) to allow for a simple slopes analysis. The standardized regression coefficients in this model were similar to the two previous models and the pooled R^2 was approximately the same at .681. The interactions between STR-Conflict and Quintile 5 and STR-Conflict and Quintile 3, with Quintile 1 as the reference group demonstrated that students from low and moderate to high SES who conflicted less with their teachers had similar

achievement scores (B=0.05, p<.05) suggesting a small effect size. Specifically, moderate to high SES students outperformed low SES students when there were conflictual STRs. Results from a simple slopes analyses found that the moderating effect between STR-Conflict and SES on standardized reading achievement was statistically significant for all levels (see Figure 1) or STR-Conflict greater than -1 standard deviations.

Table 4: Standardized Reading Achievement

	Model									
Predictors	1		2		3		4		5	
Teacher Level (3,420)										
Black[1]	-0.01		0.02		0.01		0.01		0.01	
Hispanic[1]	-0.16	**	-0.02		-0.03		-0.03		-0.03	
Asian[1]	0.05		0.05		0.04		0.05		0.04	
Other[1]	-0.05		-0.05		-0.06		-0.06		-0.07	
Female (1=Yes)	0.19	**	0.03		-0.002		-0.002		-0.01	
Student Level (N=9,530)										
Black[1]			-0.10	***	-0.07	*	-0.07	*	-0.06	*
Hispanic[1]			-0.09	***	-0.10	***	-0.10	***	-0.09	***
Asian[1]			-0.04		-0.04		-0.03		-0.02	
Other[1]			-0.001		0.01		0.01		0.01	
Female (1=Yes)			0.07	***	0.03	*	0.03	*	0.03	*
Disability Status (1=Yes)			-0.18	***	-0.16	***	-0.16	***	-0.16	***
Fall Reading Achievement			0.73	***	0.72	***	0.72	***	0.73	***
Socioeconomic Status (SES)			0.10	***	0.09	***	0.09	***		
Spring STR - Conflict					-0.05	***	-0.05	***	-0.08	***
Spring STR - Closeness					0.04	***	0.04	***	0.04	***
Spring STR - Conflict:SES							0.02	*		
SES - Quintile 2[2]									0.09	***
SES - Quintile 3[2]									0.16	***
SES - Quintile 4[2]									0.18	***
SES - Quintile 5[2]									0.19	***
Spring STR - Conflict[3]:SES Quintile 2[2]									0.04	
Spring STR - Conflict[3]:SES Quintile 3[2]									0.04	*
Spring STR - Conflict[3]:SES Quintile 4[2]									0.02	
Spring STR - Conflict[3]:SES Quintile 5[2]									0.05	**
R^2	.231		.676		.680		.681		0.681	

Notes: *p <.05, **p <.01, ***p <.001. [1]White is the reference group. [2]SES - Quintile 1 is the reference group. STR represents student teacher relationship. School fixed effects are accounted for in all models.



STR-closeness, STR-conflict, and SES on math achievement. In the second set of multiple regression models, the standardized math achievement variable was the outcome variable and STR-closeness, STR-conflict, and student SES were the variables of interest. In the first model that explored teacher-level variables, the pooled R^2=.241, suggesting that very little variance was accounted for. In this model, only teacher race was statistically significant with Hispanic (B=-0.11, p<.05) teachers predicting lower student math achievement and Asian (B=.21, p<.05) teachers predicting higher math achievement compared to White teachers.

The second model added student-level characteristics in addition to teacher-level variables resulting in an approximate 49% increase in the pooled R^2. Compared to the previous model, there were no teacher-level variables that were statistically significant. At the student-level, Black (B=-0.23, p<.001), Hispanic (B=-0.13, p<.001), and the Other

category (B=-0.11, p<.01) of students had lower math scores compared to White students. Females scored lower (B=-0.08, p<.001) compared to males and individuals with a disability scored lower (B=-0.13, p<.001) than individuals without a disability. Previous math achievement from the fall (B=0.76, p<.001) and socioeconomic status (B=0.07, p<.001) were also strong predictors of spring math achievement.

Model 3 added the STR-Conflict and STR-Closeness scales to the prior student and teacher-level variables. Both the STR-Conflict (B=-0.04, p<.001) and STR-Closeness (B=0.03, p<.001) scales were statistically significant predictors of math achievement, although both predictors of interest had small effect sizes. All variables from the previous model continued to be significant in this model.

The next model explored the interaction between the variables of interest, STR-Conflict, STR-Closeness, and SES. The same variables from the previous models were also statistically significant in addition to the interaction between STR-Conflict and SES was statistically significant (p<0.05). The interaction did not account for any additional variance.

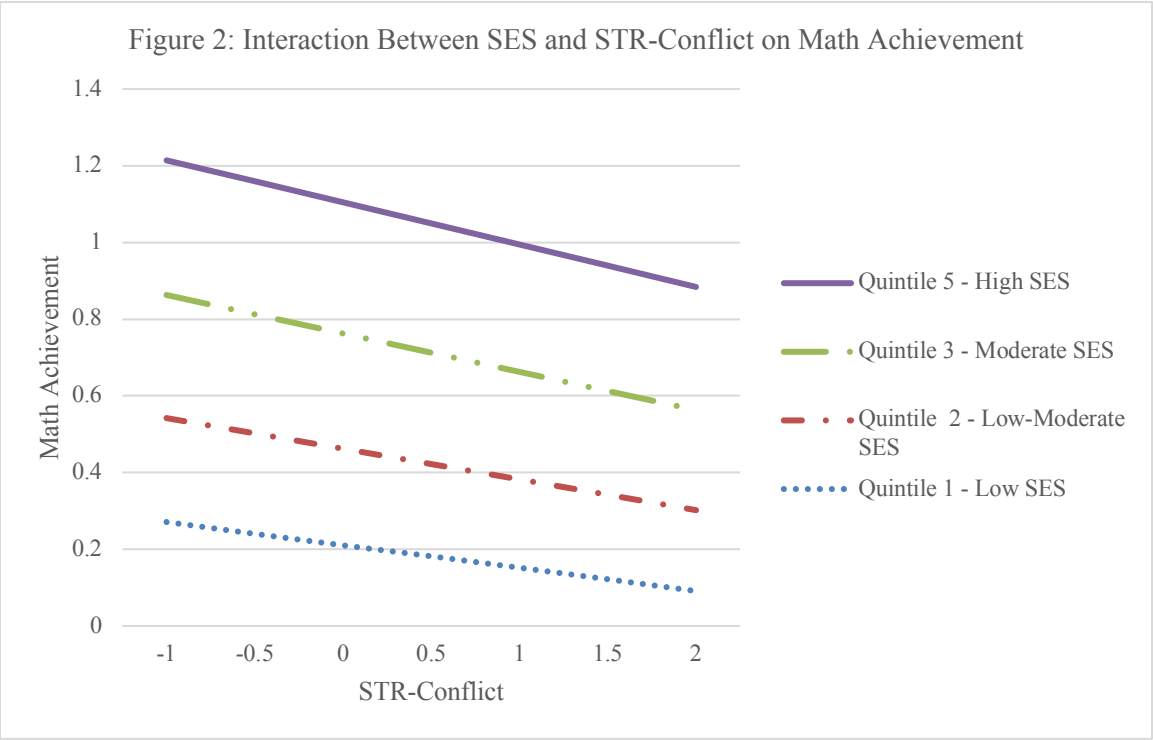
The final model investigated the interaction between STR-Conflict and the SES variable that was split into categorical quintiles, where Quintile 1 represented students with low SES, or the 20th percentile, and Quintile 5 represented students with high SES, or above the 80th percentile. The interactions between STR-Conflict and Quintile 2, 3, and 5 with Quintile 1 as the reference group, demonstrated that students with higher SES and less conflict with teachers had a tendency to have higher math achievement scores (p<0.05), although the effect sizes were small by Cohen's (1992) standards. The interactions were also probed and the results from the simple slopes analysis (Hayes &

Montoya, 2017) found that the moderating effect between STR-Conflict and SES on standardized math achievement was statistically significant for all levels (see Figure 2) or STR-Conflict greater than -1 standard deviations.

Table 5: Standardized Math Achievement

	Model				
Predictors	1	2	3	4	6
Teacher Level (3,420)					
Black[1]	-0.03	0.02	0.01	0.01	0.01
Hispanic[1]	-0.11 *	-0.05	-0.05	-0.05	-0.05
Asian[1]	0.21 *	0.07	0.07	0.07	0.07
Other[1]	-0.01	-0.04	-0.05	-0.05	-0.05
Female (1=Yes)	0.12	-0.03	-0.05	-0.05	-0.05
Student Level (N=9,530)					
Black[1]		-0.23 ***	-0.21 ***	-0.21 ***	-0.21 ***
Hispanic[1]		-0.13 ***	-0.13 ***	-0.13 ***	-0.13 ***
Asian[1]		-0.03	-0.03	-0.03	-0.02
Other[1]		-0.11 **	-0.10 **	-0.10 **	-0.10 **
Female (1=Yes)		-0.08 ***	-0.10 ***	-0.10 ***	-0.10 ***
Disability Status (1=Yes)		-0.13 ***	-0.12 ***	-0.12 ***	-0.12 ***
Fall Math Achievement		0.76 ***	0.75 ***	0.75 ***	0.76 ***
Socioeconomic Status (SES)		0.07 ***	0.07 ***	0.07 ***	
Spring STR - Conflict			-0.04 ***	-0.03 ***	-0.06 ***
Spring STR - Closeness			0.03 ***	0.03 ***	0.03 ***
Spring STR - Conflict:SES				0.02 *	
SES - Quintile 2[2]					0.04 ***
SES - Quintile 3[2]					0.09 ***
SES - Quintile 4[2]					0.09 ***
SES - Quintile 5[2]					0.13 ***
Spring STR - Conflict[3]:SES Quintile 2[2]					0.04 *
Spring STR - Conflict[3]:SES Quintile 3[2]					0.04 *
Spring STR - Conflict[3]:SES Quintile 4[2]					0.01
Spring STR - Conflict[3]:SES Quintile 5[2]					0.05 *
R^2	.241	.727	.729	.729	.729

Notes: *p <.05, **p <.01, ***p <.001. [1]White is the reference group. [2]SES - Quintile 1 is the reference group. STR represents student teacher relationship. School fixed effects are accounted for in all models.



Academic achievement and SES on STR-conflict. In the third set of multiple regression models, the standardized STR-Conflict variable was the outcome variable and academic achievement and student SES were the variables of interest. In Model 1, teacher-level variables were investigated. Female teachers (B=-0.27, p<.001) were less likely to have relationships with their students characterized by conflict compared to male teachers. Black (B=-0.15, p<.05) and Hispanic (B=-0.12, p<.05) also had lower conflictual STRs compared to White teachers. There was also very little variance accounted for with a pooled R^2=.126.

Model 2 accounted for more variance with the addition of student-level variables (pooled R^2= .398). At the teacher level, Black (B=-0.14, p<.05), Hispanic (B=-0.16, p<.01), the Other category of teachers (B=-0.20, p<.01), and female (B=-0.24, p<.001) teachers were less likely to have conflictual relationships with their students compared to

White and male teachers. At the student level, Black (B=0.27, p<.001) students were more likely to have conflictual relationships with their teachers, but Asian (B=-0.19, p<.001) students were less likely compared to White students. Females (B=-0.22, p<.001) and students with higher levels of SES (B=-0.08, p<.001) were also less likely to have conflictual relationships, although students with a disability (B=0.15, p<.001) and individuals with previous STRs defined by conflict (B=0.49, p<.001) were more likely to have conflictual relationships with their teachers.

In the third model, the same variables from Model 2 were significant with the addition of spring math, spring reading scores, and Hispanic students on conflictual STRs. Both spring math (B=-0.05, p<.01) and spring reading (B=-0.04, p<.01) achievement scores were significant predictors of STRs characterized by conflict. In addition, Hispanic students (B=-0.07, p<.05) were also less likely to have conflictual STRs compared to White students. This model accounted for slightly more variance with a pooled R^2=.402. In this model, previous conflictual STRs had the largest effect size at 0.48. In addition, Black students compared to White students and females compared to males had moderate effect sizes at 0.24 and -0.22 respectively.

The final model investigated the interactions between spring math and SES and spring reading and SES. Both of the interactions were not significant (p>.05), although all the variables from the previous model were still significant in the final model. Variance accounted for remained the same suggesting that Model 3 was the best fitting model.

Table 6: Standardized STR - Conflict

	Model							
Predictors	1		2		3		4	
Teacher Level (3,420)								
Black[1]	-0.15	*	-0.14	*	-0.14	**	-0.14	**
Hispanic[1]	-0.12	*	-0.16	**	-0.16	**	-0.16	**
Asian[1]	-0.01		0.01		0.02		0.02	
Other[1]	-0.10		-0.20	*	-0.20	*	-0.20	*
Female (1=Yes)	-0.27	***	-0.24	***	-0.23	**	-0.23	**
Student Level (9,530)								
Black[1]			0.27	***	0.24	***	0.24	***
Hispanic[1]			-0.05		-0.07	*	-0.07	*
Asian[1]			-0.19	***	-0.19	***	-0.19	***
Other[1]			0.05		0.05		0.05	
Female (1=Yes)			-0.22	***	-0.22	***	-0.22	***
Disability Status (1=Yes)			0.15	***	0.12	**	0.12	**
Socioeconomic Status (SES)			-0.08	***	-0.05	**	-0.04	**
Fall STR - Conflict			0.49	***	0.48	***	0.48	***
Spring Math					-0.05	**	-0.05	***
Spring Reading					-0.04	**	-0.04	**
Spring Math:SES							0.003	
Spring Reading:SES							-0.02	
R^2	.126		.398		.402		.402	

Notes: *p<.05, **p<.01, ***p<.001. [1]White is the reference group. STR represents student teacher relationship. School fixed effects are accounted for in all models.

Academic achievement and SES on STR-closeness. In the final set of multiple regression models, the standardized STR-Closeness variable was the outcome and academic achievement and student SES were the variables of interest. The first model investigated the teacher level, where female teachers (B=0.37, p<.001) were more likely to have close relationships with their students compared to male teachers. Little variance was accounted for in this model with a pooled R^2=.199.

Model 2 explored both teacher and student-level characteristics. In addition to the teacher-level variable that were statistically significant in Model 1, there were statistically significant student-level characteristics as well. Black (B=-0.21, p<.001), Asian (B=-0.16, p<.01), and the Other category (B=-0.11, p<.05) of students were less likely to have close relationships with their teachers compared to White students. However female students (B=0.28, p<.001), compared to male students, student SES (B=0.11, p<.001), student disability status (B=-0.10, p<.01), and a history of previous close relationships (B=0.26, p<.001) with teachers resulted in students having closer STRs. This model accounted for little variance at 30%.

The third model investigated the addition of spring math and spring reading achievement. Both spring math (B=0.09, p<.001) and spring reading (B=0.03, p<.01) achievement were significant predictors of close STRs. All variables from the previous model continued to be significant except disability status was also no longer statistically significant. The amount of variance accounted for was slight more at 31%. Within this model, being a female compared to a male teacher had a moderate effect size at 0.35. In addition, being a female student compared to a male student, having a previously close STR, and being an Asian student compared to a White student had moderate effect sizes at 0.29, 0.24, -0.16 respectively.

The final model probed the interaction between spring math and SES and spring reading and SES. Both of the interactions were not significant (ps>.05), although all variables from the previous model except SES were still significant in the final model. Variance accounted for remained the same suggesting that Model 3 is the best fitting model.

Table 7: Standardized STR - Closeness

	Model			
Predictors	1	2	3	4
Teacher Level (3,420)				
Black[1]	0.05	0.03	0.04	0.04
Hispanic[1]	-0.03	0.01	0.01	0.01
Asian[1]	0.15	0.15	0.13	0.13
Other[1]	0.01	0.09	0.09	0.08
Female (1=Yes)	0.37 ***	0.36 ***	0.35 ***	0.35 ***
Student Level (9,530)				
Black[1]		-0.21 ***	-0.15 **	-0.15 **
Hispanic[1]		-0.02	0.01	0.01
Asian[1]		-0.16 **	-0.16 **	-0.16 **
Other[1]		-0.11 *	-0.10 *	-0.10 *
Female (1=Yes)		0.28 ***	0.29 ***	0.29 ***
Disability Status (1=Yes)		-0.10 **	-0.05	-0.05
Socioeconomic Status (SES)		0.11 ***	0.07 ***	0.08 ***
Fall STR - Closeness		0.26 ***	0.24 ***	0.24 ***
Spring Math			0.09 ***	0.09 ***
Spring Reading			0.03 *	0.03
Spring Math:SES				-0.01
Spring Reading:SES				0.001
R^2	.199	.301	.309	.309

Notes: *p <.05, **p <.01, ***p <.001. [1]White is the reference group. STR represents student teacher relationship. School fixed effects are accounted for in all models.

SES on STR-Closeness and STR-Conflict with Propensity Score Weighting

After completing a logistic regression using maximum likelihood estimation, where the logit was the log odds of the probability for having high SES, the propensity scores of the treatment assignment given the selected standardized student-level

covariates were obtained from the estimated logits. To investigate whether covariate balance was achieved, standardized mean differences (SMDs) needed to be below the benchmark of 0.20 (Lanza, Moore, & Butera, 2013). In Table 8, without the PSW, covariate balance was not achieved because the SMDs were above 0.20 for all student-level covariates except student sex, student disability status, and the Other category for student race. Achieving covariate balance is necessary to decrease bias and the variance of the treatment effect estimates (Brookhart, Schneeweiss, Rothman, Glynn, Avorn, & Sturmer, 2006). As seen in the unweighted covariate table, there were 2,110 students in the low SES group and 1,640 students in the high SES group.

Table 8: ATT Unweighted Covariate Table

	Low SES (N=2,110)			High SES (N=1,640)			SMD
Covariates	Mean	SD	%	Mean	SD	%	
Approaches to Learning	-0.25	1.03		0.32	0.89		0.599
Self Control	-0.20	1.03		0.24	0.92		0.446
Interpersonal Skills	-0.21	1.02		0.24	0.91		0.460
Externalizing Behavior	0.12	1.05		-0.20	0.85		0.333
Internalizing Behavior	0.1	1.08		-0.15	0.84		0.262
Attentional Focus	-0.24	1.00		0.33	0.93		0.590
Inhibitory Control	-0.21	1.01		0.25	0.92		0.480
Math Achievement	-0.59	0.96		0.60	0.84		1.327
Reading Achievement	-0.59	1.02		0.57	0.82		1.256
Student Disability (1=YES)			11.30			11.70	0.012
Female (1=YES)			48.60			50.60	0.040
Student Race							1.481
White			22.00			68.90	1.07
Black			19.30			3.50	0.512
Hispanic			49.40			7.30	1.054
Asian			5.00			13.70	0.305
Other			4.40			6.50	0.091

Notes: SMD = Standardized Mean Differences

However, after the PSW was completed, covariate balance was evaluated again. In Table 9, covariate balance was achieved because the SMDs for each covariate is less

than the benchmark of 0.20 (Lanza, Moore, & Butera, 2013). This table provides evidence that the distribution of each covariate for low and high SES students were similar, demonstrating that selection bias due to the covariates had been removed (Leite, 2017). After covariate balance was achieved there were 1,390 students in the low SES group and 1,640 students in the high SES group.

Table 9: ATT Weighted Covariate Table

	Low SES (N=1,390)			High SES (N=1,640)			SMD
Covariates	Mean	SD	%	Mean	SD	%	
Approaches to Learning	0.24	0.93		0.32	0.87		0.093
Self Control	0.15	0.94		0.24	0.89		0.098
Interpersonal Skills	0.18	0.93		0.24	0.89		0.064
Externalizing Behavior	-0.17	0.88		-0.20	0.82		0.032
Internalizing Behavior	-0.12	0.96		-0.15	0.82		0.038
Attentional Focus	0.26	0.94		0.33	0.91		0.076
Inhibitory Control	0.20	0.93		0.25	0.90		0.053
Math Achievement	0.47	0.72		0.60	0.84		0.171
Reading Achievement	0.46	0.75		0.57	0.82		0.149
Student Disability (1=YES)			10.30			11.70	0.043
Female (1=YES)			48.10			50.60	0.050
Student Race							0.058
White			68.50			68.90	0.009
Black			3.70			3.50	0.008
Hispanic			7.90			7.30	0.022
Asian			14.60			13.70	0.025
Other			5.30			6.50	0.049

Notes: SMD = Standardized Mean Differences

After covariate balance was achieved, two linear regressions with school fixed effects were conducted. In the first regression, the standardized STR-Conflict scale was the outcome variable and the predictor was SES, where low SES was the reference group. Results from this regression seen in Table 10, suggests that high SES was associated with less conflictual STRs (B=-0.10, p<.05) compared to having low SES. Since SES is binary, the regression coefficient can be interpreted as an effect size measure, indicating a small effect size.

Table 10: STR-Conflict by SES

	Model	
Predictor		1
High SES[1]	-0.10	*
Constant	-0.48	

Notes: *p<.05, **p<.01, ***p<.001
[1]Low SES is the reference group.
School fixed effects were accounted for in this model.

In the second regression, the standardized STR-Closeness scale was the outcome variable and the predictor was again SES, where low SES was the reference group. Results from the regression seen in Table 11, suggest that high SES was associated with having closer STRs (B=0.27, p<.001). High SES had a moderate effect size at 0.27.

Table 11: STR-Closeness by SES

	Model	
Predictor		1
High SES[1]	0.27	***
Constant	-2.94	

Notes: *p<.05, **p<.01, ***p<.001
[1]Low SES is the reference group.
School fixed effects were accounted for in this model.

Chapter 5: Discussion

The goal of this study was to answer several questions that emerged in the literature regarding student teacher relationships (STRs), socioeconomic status (SES), and student academic achievement using a nationally representative dataset. By implementing a series of four multiple regressions, this study has addressed gaps in the literature by exploring the relationships between STRs, SES, and academic achievement, in addition to probing the moderation effects between STRs and SES on student academic achievement. Furthermore, propensity score weighting (PSW) was used to analyze the possible links between SES on STRs when weighted on student-level covariates. As other student-level covariates besides SES may influence STRs, it was important to account for student-level covariates to better understand the association between student SES on STRs.

STR-Closeness, STR-Conflict, and SES on Reading Achievement

The first goal of this study was to determine whether teacher closeness, teacher conflict, and student SES were associated with first-grade reading achievement when accounting for student and teacher-level variables with school fixed effects. Previous research has demonstrated that STRs and student SES are major contributors to student academic achievement (Baker, 2006; Hughes, 2011; Jeynes, 2002; McCormick et al., 2013; O'Connor & McCartney, 2007; Zee et al., 2013). Specifically, the literature has shown that students who are closer to their teachers have higher academic achievement compared to students who conflict with their teachers, and students with higher SES typically outperform students with lower SES (Baker, 2006; Duncan et al., 2010; Hamre & Pianta, 2001; Hughes, 2011; Isaacs, 2012; Spilt et al., 2012).

Results from a series of regressions appear to support the previous literature. As seen in Table 4, Model 4, student SES, and STRs were statistically significant predictors of reading achievement. Although the effect sizes in this model may appear to be small according to Cohen's guidelines (1992), these estimates represent the academic benefit of just one year. Therefore, it could be argued that these statistically significant effect sizes may compound yearly becoming potentially larger and more meaningful. In addition to the three variables of interest, it should be noted that at the student level, previous reading achievement, being non-disabled, and being a female predicted higher reading achievement. However, Black and Hispanic students had lower reading achievement when compared to White students.

These results regarding student-level characteristics appear to support the previous literature as the 2015 Nation's Report Card collected by the NAEP (2016) found that 46% of fourth-grade White students were considered proficient in reading compared to 21% Hispanic and 18% Black. For eighth-grade students the numbers were similar with 44% of White students considered proficient in reading compared to 21% Hispanic and 16% Black (NAEP, 2016). In 2015, fourth-grade females were found to have scored 7 points higher than males and in eighth grade, females scored 10 points higher (NAEP, 2017). Students with a disability scored 20 percentages points below their non-disabled peers in reading proficiency (2014).

In addition, the results for student SES, close STRs, and conflictual STRs on reading achievement also appear to align with the previous literature. As Chatterji (2006) found using the ECLS-K:1998, SES was a significant predictor of reading achievement and students with low SES were the least prepared to enter first grade compared to

minority students and male students. Chatterji (2006) speculated the high variability between students in reading achievement could be due to differences in early care, preschool, and parenting. Furthermore, low SES students typically experience higher rates of single and teen parents, poorer health, lower family income, and live in less safe neighborhoods (Evans, 2004; Mayer, 1997). As demonstrated in these examples, there are additional barriers students from low SES face that could negatively impact their academic achievement.

Although SES is typically viewed as a stable variable, it is important to consider other factors that could influence reading achievement for all students including those from low SES backgrounds. STRs are factors that have been found to influence reading achievement as found in the current study. Aligning with Baker's (2006) results, close STRs were found to be protective factors for children with learning challenges and increased the academic achievement, social skills, and positive behavioral outcomes for all children. Due to these findings, Baker (2006) suggested developing interventions that specifically target relationship enhancement between students and teachers (Pianta & Hamre, 2001).

Opposite of close STRs, a factor that influences academic achievement are conflictual STRs. As demonstrated by the results of the current study, students who have conflictual relationships with their teachers typically reported lower academic achievement. Mantzicopoulos (2005) found statistically significant correlations between conflictual STRs and achievement and argued that students who had less conflictual relationships with their instructors had higher academic achievement. Hamre and Pianta (2001) also concluded that negative STRs predicted negative work habits that resulted in

lower academic achievement and that the effects of STRs can be long and persistent. In addition, Hamre and Pianta (2001) argued that studying STRs is a necessity for individuals researching in education, designing interventions, or engaging in prevention work as STRs effect many student outcomes.

The Moderation Effect Between SES and STR-Conflict on Reading Achievement

The second goal of this research study was to determine whether the association of first-grade reading achievement and student SES were moderated by STRs, specifically teachers' perceptions of closeness and conflict with their students. The previous literature regarding the moderation effect between STRs and SES on student achievement have been mixed as researchers have only explored similar constructs to these variables of interest. As found by Malecki and Demaray (2006) students with low SES and low parental or classmate support had lower GPAs compared to individuals with high SES and high parental or classmate support and Sorhagen (2013) found that teachers' over and under estimation of academic abilities had stronger impacts on students from lower SES families compared to students from more affluent homes. These studies demonstrate that the relationship between SES and academic achievement may actually depend on STRs or similar variables.

Results from a series of regressions added to the literature by exploring the moderation effect between STRs and SES on academic achievement. As previously seen in Table 4, Models 4 and 5, there was a moderation effect between conflictual STRs and SES. To probe the interaction further, SES was divided into five categorical groups, or quintiles. Results from this interaction were seen in Figure 1 from the previous chapter. Specifically, low SES students in Quintile 1 scored similarly to high SES students in

Quintile 5 when there were high conflictual STRs (i.e., at 3 SDs). However, when students experienced low levels of conflict (i.e., at -1 SDs) with their teachers, high SES students in Quintile 5 outperformed low SES students in Quintile 1 by approximately 0.55 SDs, indicating a moderate effect size.

As demonstrated by the interaction, regardless of SES level, all slopes were negative suggesting that less conflict may increase student reading achievement. However, students from moderate to high levels of SES had steeper slopes compared to students from low SES suggesting that less conflictual STRs were more beneficial for these students. The results from this interaction suggest that classroom interventions focused on reducing conflictual STRs would be beneficial for all students, but especially for individuals from moderate to high SES (Hamre & Pianta, 2001). Even though, STRs may be more beneficial for high SES students, Sorhagen (2013) argues that students from low SES may still depend on their teacher for more academic support as they have less resources at home compared to students from high SES.

Furthermore, as suggested by research conducted by Hamre and Pianta (2001), STRs defined by conflict result in stronger effects on academic achievement compared to close STRs suggesting that conflictual relationships result in increased behavior infractions, lower social skills, and worse work habits in school. This appears to be supported in the current study as conflictual STRs had a slightly stronger effect size at -0.05 compared to close STRs at 0.04. The interaction in the current study could be related to higher variability within the conflictual ratings (M=1.64, SD=0.80, $Range$=1.00-5.00) compared to the closeness ratings (M=4.30, SD=0.66, $Range$=1.00-5.00). Due to this higher variability, it may be possible to explain why there was a significant interaction

between conflictual STRs and SES and not close STRs and SES on reading achievement, as a majority of teachers rated being very close to their students.

STR-Closeness, STR-Conflict, and SES on Math Achievement

In addition to exploring how teacher closeness, teacher conflict, and student SES were associated with first-grade reading achievement, this study also examined the relationship between these three variables of interest on math achievement when accounting for student and teacher-level variables with school fixed effects. Similar to reading achievement, previous research has continued to demonstrate that STRs and student SES have strong associations with student math achievement (Baker, 2006; Hughes, 2011; McCormick et al., 2013).

As seen in Table 5 from the previous chapter, results from the regression analyses in Model 4 suggest that student SES, conflictual STRs, and close STRs are meaningful predictors of student math achievement. It should be noted that at the student level, previous math achievement predicted current math achievement with a large effect size at 0.75. Students who were Black, Hispanic, or part of the Other category in race had lower math achievement compared to White students and students with a disability or were female also had lower math scores.

As stated earlier for reading achievement, these results appear to support the previous literature as the Nation's Report Card found that White students typically outperformed Black and Hispanic students (NAEP, 2016). With small to moderate effect sizes that could possibly compound yearly, it is important to reiterate the significance of these achievement gaps especially because they are already appearing in first grade and may widen as the student progresses through school. This emphasizes the need to

continue supporting diverse students who may have less resources and support (Cherng, 2017).

Furthermore, previous literature on STRs have established that STRs are important predictors for academic achievement, where close STRs predict higher achievement and conflictual STRs predict lower achievement (Baker, 2006; Hughes, 2011; Jeynes, 2002; McCormick et al., 2013; O'Connor & McCartney, 2007; Zee et al., 2013). Hughes (2011) and McCormick et al. (2013) found that STRs specifically influence longitudinal math achievement. As recommended by Hughes (2011), professional development programs utilizing STRs should focus on positive relationships and should create intervention programs that are sustained over time within a teacher's classroom with the appropriate amount of support.

Similar to STRs, SES is an important predictor of math achievement (Okpala et al., 2001; Stull, 2013; Sirin, 2005). As speculated for reading achievement, students from lower SES families have fewer resources to aid in academic success (Sirin, 2005) and have to overcome additional barriers such as higher rates of single and teen parents, lower health status, and living in neighborhoods with more documented crime and pollution (Evans, 2004; Mayer, 2007). Since poverty is typically a stable factor that has the ability to harm multiple aspects of a child for many years, the results from the current study are important as they suggest close STRs are beneficial for all students regardless of their background.

The Moderation Effect Between SES and STR-Conflict on Math Achievement

To address the second research question, the moderation effect between STRs, specifically teachers' perceptions of closeness and conflict with their students, and

student SES on math achievement was investigated. As stated for the moderation effect between these two variables of interest on reading achievement, Malecki and Demaray (2006) and Sorhagen (2013) found significant moderation effects, demonstrating that the relationship between SES and academic achievement may depend on STRs or similar variables.

As seen in Table 5, Models 4 and 5, there was a significant relationship between conflictual STRs and SES. As demonstrated by the interaction, all of the slopes were negative suggesting that regardless of SES, less conflictual STRs may increase student math achievement. However, students from higher SES statuses had slightly steeper slopes compared to students from low SES or Quintile 1, suggesting that less conflictual STRs may actually be more beneficial for higher SES students. Less conflictual STRs may benefit students from high SES more than students from low SES because high SES students have more resources in the home and may not have to worry about major survival issues such as food or housing (Sorhagen, 2013).

STRs and SES on Reading Achievement Versus Math Achievement

Although there was an interaction between conflictual STRs and SES on both reading and math achievement, there was not a statistically significant moderation effect between close STRs and SES on math or reading achievement. This result was surprising because it may be assumed that less conflictual STRs automatically result in close STRs. However, after revisiting the operational definitions of the STR Conflict Scale and STR Closeness Scale, this may not necessarily be true. According to Pianta (2001), when a teacher endorses a high conflict score, the "teacher struggles with the student, perceives the student as angry or unpredictable, and feels ineffective with that student" (p. 11).

However, when a teacher endorses a high closeness score, the "teacher perceives that the student is well, the student views the teacher as supportive and the student effectively uses the teacher as a resource" (Pianta, 2001, p. 11). Based on how these scales were operationally defined, it is possible for a teacher to not have a conflictual or close relationship with a student. This is because a teacher may not struggle or perceive a student as angry and also may not think the student views the teacher as supportive or as an effective resource.

In addition, there were notable differences between the regression models with math achievement as the outcome variable compared to reading achievement. Although Black and Hispanic students had lower achievement compared to White students, the effects for math achievement were larger compared to reading achievement. The potential difference in effects between math and reading, especially for Black students, could be due to the emphasis placed on reading achievement in first grade, potentially resulting in diverse students falling farther behind in math.

Second, there were differences between males and females on reading and math achievement. For reading achievement, females scored statistically significantly higher compared to males, however, for math, females scored statistically significantly lower. These results appear to align with both national and world-wide trends regarding sex and academic achievement (Mullis, Martin, Kennedy, & Foy, 2007; NAEP, 2017) demonstrating that it is important to continue supporting all students with regards to math and reading achievement.

Another explanation for the differences between math and reading achievement scores could be because first-grade is focused on reading achievement. According to an

Issue Brief from the NCES based on data from the ECLS-K:1999 (Lanahan, Princiotta, & Enyeart, 2006), 98% of first-grade students worked on language arts or reading projects daily, where 60% of the first-grade students receiving reading instruction spent more than 90 minutes a day working on lessons or projects in reading and language arts. The NCES found this was more than 10 times the percentage for any other subject including math, where the typical lesson length was between 31 and 60 minutes in duration (Lanahan et al., 2006). Reading is also associated with group work and collaboration between students and teachers. This relates to how reading is presented, typically with large group story time, where math is less collaborative, more independent, and potentially more isolating.

Academic Achievement and SES on STR-Conflict.

To answer the third research question of whether student SES and first-grade academic achievement is associated with STRs, specifically teachers' perceptions of closeness and conflict with their students, multiple regressions were implemented. As seen in Table 6, Model 3, SES and academic achievement in math and reading were significant predictors of conflictual STRs. Additionally, Black, Hispanic, and the Other category of students had more conflictual relationships with their teachers compared to White students, and Asian students had less conflictual relationships with their teachers compared to White students. Females also had less conflictual relationships compared to males and students with a disability had more conflictual relationships compared to non-disabled peers.

These results appear to align with the literature as lower SES, minority status, and lower academic achievement have been linked with conflictual STRs (Hamre & Pianta,

2001; Hughes & Kwok, 2007; Ladd et al., 1999). According to Hughes and Kwok (2007), the reasons for these discrepancies are not known, however, it is hypothesized that because the teacher workforce is predominantly middle-class Caucasians, these teachers may not relate as well to minority and lower SES students resulting in more conflictual STRs and lower academic achievement in school. Other researchers such as Saft and Pianta (2001) found that when minority students were matched with teachers of the same race/ethnicity, there were lower conflictual STR ratings. Although this regression analysis cannot explain why minority students, students from low SES, and students with low academic achievement have higher conflict rating with their teachers, it does appear to replicate what has been found in the literature (Hamre & Pianta, 2001; Hughes & Kwok, 2007; Ladd et al., 1999; Saft & Pianta, 2001). This is important because student achievement and student demographic characteristics such as minority status and SES are associated with how students and teachers interact in the classroom.

To address the fourth research question regarding whether the association between SES and STRs were moderated by academic achievement, the interactions between math achievement and SES and reading achievement and SES on conflictual STRs were investigated. Results from Table 6, Model 4 do not show an interaction between the two achievement variables and SES. Based on previous research this may not be surprising because high and low SES students who do not conflict with their teachers would be expected to have higher achievement and high and low SES students who do conflict with their teachers would be expected to have lower achievement.

Research by Bergeron et al. (2011) demonstrated that there was not a statistically significant interaction between SES and STRs on dropout intention. Since dropout

intention has been used as a predictor of academic achievement, results from this study appear to support the previous literature, although it should be noted that Bergeron et al. (2011) studied older students than compared to the current study. This suggests that regardless of whether a student is from high or low SES, lower academic achievement appears to predict higher conflictual STRs.

Academic Achievement and SES on STR-Closeness

To address the third research question of whether student SES and first-grade academic achievement is associated with STRs, specifically teachers' perceptions of closeness and conflict with their students, multiple regressions were implemented, where the outcome variable was close STRs. Results from Table 7, Model 3 from the previous chapter, demonstrate that reading achievement, math achievement, and SES were significant predictors of close STRs. Similar to previous regressions, higher SES and higher achievement predicted closer STRs. Furthermore, at the teacher level, female teachers were closer with their students compared to male teachers. At the student level, Black, Asian, and the Other category of students were less close with their teachers compared to White students, but female students had closer STRs compared to male students.

The demographic results from the regression analyses appear to align with previous research studies. As seen in a study completed by Spilt, Kooman, and Jak (2012) female teachers reported closer and less conflictual relationships with students compared to male teachers. The researchers hypothesized that female teachers were more socialized to develop nurturing relationships and were more accepting of student misbehavior compared to male teachers (Spilt et al., 2012). Yiu (2013) also found that

Asian students were the least close with their teachers. It was hypothesized that because the STR-Closeness Scale (Pianta, 2001) measures a student's willingness to approach the teacher, Asian students may be at a disadvantage. In Asian culture, individuals are taught values such as discreetness and respect for authority (Kim, 2009; Lin & Fu, 1990). Therefore, if teachers were to interpret these behaviors as internalizing, the closeness rating may have become compromised (Yiu, 2013). This demonstrates that demographic characteristics such as sex and race can influence the type of STRs experienced.

Results from the regression analyses regarding achievement and SES on close STRs also appear to align with the previous literature, as students with higher achievement and higher SES reported closer relationships with their teachers. Although a majority of studies investigating the relationship between these three variables have academic achievement as the outcome variable, many of these studies use regression analyses where the data are correlational (Howes et al., 1994; Hughes & Kwok, 2006; Hughes et al., 2008; Klem & Connell, 2004; Malecki & Demaray, 2006; Malecki & Elliott, 2002; Pianta & Stuhlman, 2004). Due to the nature of this data, it is possible that the relationship between these variables are bidirectional where academic achievement and SES could also predict close STRs (Stipek & Miles, 2008).

To address the fourth research question of whether the association of SES and STRS were moderated by student academic achievement, the interactions between math achievement and SES and reading achievement and SES on close STRs were also of interest. Results from Table 7, Model 4, do not show an interaction between the two achievement variables and SES. Based on previous research this is not a surprising result because high and low SES students who are not close with their teachers would be

expected to have lower achievement and high SES and low SES students who are close with their teachers would be expected to have higher achievement. Again, research by Bergeron et al. (2011) found that the predictors SES and STRs did not have a moderating effect on dropout intention, a variable often used as a proxy for academic achievement. Regardless of SES, higher academic achievement appears to predict close STRs.

STRs and SES on STR Conflict Versus STR Closeness

When comparing the same predictors with the outcome variable of closeness versus conflict, there were notable differences in the size of effects. At the student level, Black students were more likely to have a conflictual STR versus a close STR when compared to White students (i.e., moderate effect size of 0.24 versus an effect size of 0.15 respectively). Interestingly, Asian students were less likely to have a conflictual or close relationship with their teacher when compared to White students (i.e., moderate effect size of -0.19 versus an effect size of -0.16). When comparing different races with conflictual versus close STRs, it is important to note that students who did not have a conflictual relationship with their teacher may not automatically have a close relationship with their teacher or vice versa (Yiu, 2013). This may relate to how Pianta (2001) operationally defined the closeness and conflict scales for STRs to make two separate constructs.

In addition to student race, there were differences between student sex on conflictual and close STRs. Females were more likely to have close relationships with their teachers versus conflictual relationships when compared to male students (i.e., moderate effect size of 0.29 versus a moderate effect of -0.22 respectively). This difference is important to note because unlike student race, student sex appears to have a

larger and more reciprocal effect when comparing this variable on conflictual and close STRs. The results found in this study support the previous literature as males have a tendency to be less close and more conflictual with teachers compared to females (Baker, 2006; Blankemeyer et al., 2002). Koepke and Harkind (2008) believe this difference is because males have a tendency to demonstrate connectedness through action-oriented behavior, while female students are perceived as gentle and share their intentions through verbal communication. Koepke and Harkind (2008) also noted that a majority of teachers are female and may not understand the action-oriented behavior male students use.

SES on STR-Closeness and STR-Conflict with Propensity Score Weighting

To answer the final research question of whether the effect of teacher closeness and teacher conflict differ when weighted on student-level covariates, PSW was used. As demonstrated in Table 8, the covariates selected for this analysis were not balanced until the propensity score weighting was performed. Table 9, from the previous chapter, demonstrated that covariate balance was achieved as the standardized mean difference for each variable was less than 0.20. After the covariates were balanced, two linear regressions were completed. For the first linear regression, the dichotomous SES variable predicted conflictual STRs and the second regression predicted close STRs. Results from these regressions found statistically significant relationships between SES on both close and conflictual STRs.

The outcome from the PSW analysis adds to the literature by asserting there is a relationship between SES and STRs, where high SES had a greater effect size on close STRs than conflictual STRs when compared to students from low SES (i.e., 0.27 versus -0.10 respectively), although both relationships were statistically significant. These results

appear to suggest that SES has stronger effects on close relationships when weighted on a variety of student-level covariates. These results are interesting because they appear to be slightly different compared to the regression results. In the regression models, SES had a slightly stronger effect on conflictual relationship (effect size of -0.05) compared to close relationships (effect size of 0.04). However, the PSW just weighted on student-level covariates compared to the regression analyses that accounted for differences at the student, teacher, and school level.

In addition, the results of the PSW are important because there are many factors that can influence a student's relationship with their teacher. By accounting for student-level characteristics that can influence STRs such as approaches to learning, interpersonal skills, internalizing and externalizing behaviors, the effect of SES was potentially isolated to give better insight into how SES can affect STRs. Clearly, based on the results in this study, SES can influence the relationship a student develops with their teacher or the relationship a teacher develops with their students.

Similar to the current study, research by McCormick et al. (2013) used a multilevel propensity score analysis to determine the relationship between STRs and academic achievement. Although McCormick et al. (2013) concluded a causal relationship between positive STRs and math achievement, the variables used to measure STRs and student-level covariates were similar to the current study. To help isolate the effects of STRs, McCormick et al. (2013) controlled for STRs using the STRS (Pianta, 2001), the Sutter-Eyberg Student Behavior Inventory (Eyberg & Pincus, 1999) to measure internal and externalizing behaviors, and the Attention Sustained subtest from the Leiter International Performance Scale (Roid & Miller, 1997). McCormick et al.

(2013) concluded that controlling for other factors that could have influenced STRs helped to isolate the effects on academic achievement, much like how the current study used student-level covariates to isolate the effects of SES on STRs. Since the student-level was well controlled for in the current study and used measures similar to other studies, it may give the results in this study more credibility.

Limitations

Despite using a nationally representative dataset, there were several limitations that must be accounted for when interpreting the results. For the regressions, the data were correlational in nature and cannot establish causation. Therefore, it is possible that the relationships between SES, STRs, and academic achievement were bidirectional. Second, with regard to the STR scales, social desirability when filling out the instruments may have occurred as most teachers reported being close to their students versus having conflictual relationships. Third, for the propensity score analysis, due to the covariates selected, it is possible that there were other unaccounted student-level variables that may have created more equal groups. Finally, Koepke and Harkind (2008) found that first and second-grade teacher ratings of their relationships with their students did not correlate with the student's reports on the same relationship. Both male and female students rated their relationship as statistically significantly less close than what the teacher reported. In the current study, the STRS measure (Pianta, 2011) was teacher reported. Therefore, it is possible that the estimations for close STRs were higher and the estimations for conflictual STRs were lower than the true scores.

Educational Implications

Based on the results of this study, there are three main educational implications that can be drawn. First, close STRs result in associated with higher academic achievement for both math and reading compared to conflictual STRs. Although this finding has been emphasized in the literature, it is important to reiterate that positive STRs, a malleable factor, is beneficial for all students (Howes et al., 1994; Malecki & Elliott, 2002; Pianta & Stuhlman, 2004). This demonstrates that resources and interventions should focus on ways to decrease conflictual STRs and increase close STRs for better student outcomes.

Second, it is important to note that there are still large achievement gaps between minority students and majority students, and males and females. Specifically, in reading, minority students are 0.07 to 0.10 standard deviations behind majority students and in math minority students are 0.10 to 0.21 standard deviations behind majority students. Females performed slightly better than males in reading (0.03 standard deviations higher) but are performing worse than males in math (0.10 standard deviations lower). These differences are important to note because it demonstrates that achievement gaps still exist in the United States for first-grade students.

Finally, educators should be aware the SES is still a large predictor of student academic achievement. This is important because low SES students may not have the same amount of resources that high SES students have. Without as many resources, achievement may decrease. By being aware of these differences, teachers can intervene and provide more support to individuals who may have less resources in their homes.

Future Directions

After completing the regression analysis and the PSW, there are two specific directions that I would like to take this research. First, I would be interested in replicating this study with third or fourth-grade students, instead of first-grade students using the data available in the restricted use ECLS-K:2011 dataset. As stated earlier, reading achievement is the focus of first-grade, where math achievement is more heavily focused on in third and fourth grade. I would be interested in determining whether the achievement gap between minority and White students, and female and male students widened or narrowed in subsequent years when both math and reading achievement have had the opportunity to be the focus in the classroom.

Second, I would be interested in continuing to explore the relationship between SES on STRs when using PSW. Specifically, I would be interested in adding more student-level covariates and would also be interested in adding teacher-level covariates as well. As demonstrated in the regression analysis, there are teacher-level variables that may influence STRs, so it would also be important to include those variables in the model.

Conclusions

The results from this study have attempted to unpack the complex relationships between SES, STRs, and academic achievement through a series of regression models and propensity score analysis. As seen from the results, many of the findings regarding student and teacher-level demographic characteristics have replicated the previous literature. Specifically, there are strong associations between SES, STRs, and academic achievement.

In addition to replicating previous studies, this study has added to the current literature in three important ways. First, this study uncovered statistically significant moderation effects between conflictual STRs and SES on both reading and math achievement. This has demonstrated that less conflictual STRs, may be beneficial for all students regardless of SES, but may be the most beneficial for students from high SES backgrounds. By implementing interventions that work on developing more positive relationships between students and teachers, all students regardless of SES level could benefit academically.

Second, this study has replicated results using SES, STRs, and academic achievement, using a nationally representative dataset. As a majority of the studies investigating the relationships between these three variables of interest have use smaller datasets. Replicating the literature using a national dataset is important because the results can be generalizable to all first-grade students in the United States. Based on this study, it is evident that SES and STRs influence academic achievement and SES and academic achievement influence STRs.

Finally, this study has added to the literature by investigating the relationship between SES on STRs using PSW. Although exploratory in nature, by matching on student-level covariates that could possibly influence STRs, the effect of SES was potentially isolated to suggest that SES can influence whether STRs are close or conflictual. This is important because longitudinal data is not often used to make comparisons between groups of children who have lower and higher SES on STRs. This analysis could be an important first step in clarifying the relationship between these two variables.

Overall, this study accomplished the goal of better understanding the intricacies of SES, conflictual STRs, close STRs, and academic achievement using a nationally representative dataset of first-grade students. The results from this current study continue to highlight the importance of these three variables of interest in improving outcomes for all students. Furthermore, this study emphasized the importance of building close STRs versus conflictual STRs in the classroom and how these relationships can potentially act as a protective factor against negative outcomes.

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