This is to certify that the
dissertation entitled

THE ASSOCIATION OF TEACHER-STUDENT RELATIONSHIP QUALITY AND TEACHER SUPPORT WITH STUDENTS' SCHOOL SATISFACTION, CLASSROOM ADJUSTMENT, AND ACADEMIC ACHIEVEMENT

presented by

Hilda Nyougo Omae

has been accepted towards fulfillment
of the requirements for the

Doctoral degree in Measurement and Quantitative Methods

Kimberly S. Maier
Major Professor's Signature

12 August 2010
Date

THE ASSOCIATION OF TEACHER-STUDENT RELATIONSHIP QUALITY AND TEACHER SUPPORT WITH STUDENTS' SCHOOL SATISFACTION, CLASSROOM ADJUSTMENT, AND ACADEMIC ACHIEVEMENT

By

Hilda Nyougo Omae

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Measurement and Quantitative Methods

2010

ABSTRACT

THE ASSOCIATION OF TEACHER-STUDENT RELATIONSHIP QUALITY AND TEACHER SUPPORT WITH STUDENTS' SCHOOL SATISFACTION, CLASSROOM ADJUSTMENT, AND ACADEMIC ACHIEVEMENT

By

Hilda Nyougo Omae

As children grow, they transition from home to school environments, where they acquire and master knowledge and skills, and develop an image of themselves as learners and develop several types of relationships with adults as they grow. As they enter and remain in school, these relationships expand from being solely with parents and caretakers to include their teachers. Due to the large amount of time children spend in school, it is important to examine and understand how the school environment and its affordances, and the relationships that children form while there influence their lives, and especially their academic success or failure.

This study examines the influence of student-teacher relationships and teacher support on the academic achievement and satisfaction with school for K-5 students. Using longitudinal growth modeling, specifically, cross-classified random effects modeling, the study found that decreased conflictual relationships between teachers and students were associated with increased achievement in math and reading over time. Also, there was evidence of the Black-White test gap. Moreover, this gap was greater during K-3 than it was during 3-5 period.

DEDICATION

This dissertation is dedicated to my parents; my father Samson Nyambane and (to the memory of) my loving mother, Prisca Nyanchwa Nyansuku for their unrelenting belief in the value of education, and their unwavering support of my pursuits. Mbuya mono!

ACKNOWLEDGEMENTS

I would like to express my heartfelt gratitude to the faculty, family and friends that have seen me through this journey. It has been a long one, but it has finally come to an end!

To my advisor Dr. Kimberly Maier, thank you for the guidance and support you have given me throughout. You have been a guiding light and I will be forever grateful. God bless you.

To Dr. Joyce Grant, a mentor and friend; thank you for believing in me and getting me through the tough times. I will miss you! To Drs. Sandra Crespo and Chris Dunbar, thank you for your support. To Dr. Jack Schwille, thank you for believing in me and giving me a chance at the start of my graduate school.

Special thanks to my brother Gerald. G, I could never have done it without you. Thank you very much for the prodding, nudging, advise and constant support that you have provided in a myriad of ways through the years. But especially this last few months, thank you! We did it!

To my mother Prisca, wherever you are, thank you. Your love has carried me through the years – and I am going to depend on it for those to come.

To my father TFS Nyambane, it appears that your dividends are ready! Thank you for your firm belief in education, and for giving me the opportunity and encouragement to pursue it.

To my sisters Millie and Nyaboe, and my brothers Emerson, Nyagami, and Samaki; thank you for your encouragement.

To the "gals", thank you for your prayers, words of wisdom and encouragement. You truly stood in the gap for me. To all my friends, too many to name, thank you! A million blessings.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.1 Problem Statement

In the beginning of formal schooling, children enter a new environment that can be quite incomprehensible to them at the time. This marks the start of their transformation as members of other environments, besides their home. Once in the school environment, they form an image of themselves as students and embed this image into their identity. They learn the school rules and regulations and, how to relate with other students, their teachers, and the school principal. Perhaps more important, they master the required knowledge and skills. As they make this transition from home to school, they mainly rely on their parents, siblings, and teachers for emotional support as they navigate the school system and cope with new challenges.

Students who successfully navigate these early school life challenges gain a competitive advantage which becomes manifest years later (Entwisle & Hayduk, 1988) and this advantage may stay with them for the rest of their lives. On the other hand, students who do not have a positive school experience may develop negative traits that could linger for a very long time. In fact, both positive and negative teacher-child relationships observed in kindergarten have been linked to academic and behavioral outcomes in the eighth grade and beyond (Hamre & Pianta, 2001). This underscores the importance of early childhood school experiences in shaping the future of students.

How children adjust to school environments is a widely studied topic, in part because school is where children spend a large portion of their time. Hence, it is an important context in which they develop (Baker, Dilly, Aupperlee, & Patil, 2003). Indeed, students that perceive the school's social environment as warm and psychologically safe (e.g. by being in a positive classroom environment and having caring and supportive relationships with their teachers) tend to be satisfied with their school experiences, often leading to good social and academic performance. The reverse is also true (Baker, 1998; Goodenow & Grady, 1993; Pianta, 1999).

As children grow, both at home and at school, they acquire habits and attitudes that determine and shape their cognitive development. Because these habits and attitudes differ across social fabrics, it is imperative for those who seek to understand the confluence of schools and students' needs to also learn about the child's social setting. Existing literature posits that *social structural factors* such as gender, socio-economic status, and majority or minority status, and *social contextual factors* such as the influence of parents, teachers, and one's peers greatly affect a student's cognitive development (Alexander, Entwisle, Blyth, & McAdoo, 1988; Delpit, 1988). It also posits that the most critical time for shaping the academic future of a student is during the student's early years of schooling (Alexander et al. 1988). This implies that for one to be able to predict or explain academic achievement gaps among different student groups, one has to understand both the students' social settings as well as their early childhood school experiences in, for instance, preschool, kindergarten, and first through third grades.

Early childhood school experiences are greatly influenced and affected by the relationships that students build with teachers. In turn, the nature of such teacher-student relationships is influenced by, among other factors, the student's behavior, the student's family social and demographic background, as well as the teacher's perception of the student's social disposition and academic ability. In general, teachers tend to gravitate towards, and form relationships with, students who are cooperative, well behaved, and have a high aptitude (Birch & Ladd, 1998; Henricsson & Rydell, 2004; Pianta, 1994; Pianta & Nimetz, 1991). Indeed, it is not uncommon to find teachers who behave differentially, albeit unintentionally, towards high-achieving students compared to their low-achieving peers. The former group often receives more positive and supportive interactions and is held to high academic standards, while the latter group has more negatively affective interactions with low academic expectations placed on them (Baker, 1999; Henricsson & Rydell, 2004; Midgley, Feldlaufer, & Eccles, 1989).

Many studies have explored various factors that affect teacher-student relationships (Baker, 1998; Goodenow & Grady, 1993; Pianta, 1999) and how these relationships affect student outcomes (e.g. Pianta & Stuhlman, 2004; Baker, Kamphaus, Horne, & Winsor, 2006; Ewing & Taylor, 2009). The overwhelming finding from these studies is that teacher-student interactions matter, and the nature and quality of these interactions is important in predicting student outcomes (see for example Hughes, Gleason, & Zhang, 2005; Hughes & Kwok, 2006; Hughes, Zhang, & Hill, 2006).

However, majority of these studies (on teacher-student relationships) have focused either on very young children (Alexander, et al., 1988; Birch & Ladd, 1997; Hughes, Gleason, & Zhang, 2005; Pianta & Stuhlman, 2004), middle school children (Battistich, Schaps, & Wilson, 2004) or adolescent children (Roeser, Midgley, & Urdan, 1996; Wentzel, 1998). The elementary school years have received minimal attention, despite the importance of this period in the developmental outcomes of children. During these years, children develop beliefs about schooling, their academic capabilities, and form identities of who they are as learners (Baker, 1999; Entwisle & Hayduk, 1988). It is therefore important to study factors (such as interpersonal relationships) that may enhance (or impede) the processes of learning at this stage, and put measures in place that would promote student learning and development. Moreover, much of the previous research on student-teacher relationships uses samples with predominantly large proportions of Caucasian students relative to students of other races. In contrast, the sample used in this study is unique because 72% of the children belong to racial minority groups.

Thus, the purpose of this correlational study is to extend this strand of research by exploring the associations between the quality of relationships developed between teachers and their students, and student outcomes. The research questions answered by this research and hypotheses tested are explained in the next section.

1.2 Research Question and Hypothesis

The *objective* of this study is to determine how, and to what extent, changes in *teacher-student interaction variables* are related to student outcomes. To accomplish this objective, this study answers the following overarching research question:

What is the relationship, over time, between a student's *overall satisfaction with school, adjustment to classroom environment,* and *academic achievement,* and the *quality of teacher-student relationships*, and *teacher support* ?

To answer this question the following hypotheses were tested empirically:

Hypothesis 1: Close student-teacher relationships and increased teacher support are strongly and positively related to larger gains in (student) overall satisfaction with school, adjustment to classroom environments, and academic achievement for students with behavior problems over time.

Hypothesis 2: Over time, conflictual relationships between teachers and students and a reduction in teacher support are related to smaller gains in (student) overall satisfaction with school, adjustment to classroom environments, and academic achievement for students with behavior problems.

The objective is accomplished by analyzing data on students and their teachers from four elementary schools in a small city in Southeastern United States. The data is analyzed using a two-level cross-classified random effects model explained in Chapter three.

1.3 Organization of dissertation

The dissertation is organized into five chapters. Chapter two contains a review of selected literature on teacher-student relationships and student outcomes. The estimation model and data used for analyses are described in Chapter three with detailed explanations of measures used to construct student and teacher variables. The results are presented in Chapter four, which are then discussed and summarized in Chapter five. The strengths and limitations of the study are also highlighted, along with suggestions for future research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the literature linking teacher-student relationships and teacher support to student outcomes. The goal of the review is to enhance understanding of the current literature and to clarify the contribution this study makes to existing literature. The overarching theme of the selected literature is that teacher-student relationships manifested as closeness or conflict are related to learning outcomes of students. The review is divided into three subthemes that highlight different issues related to teacher-student quality and student learning outcomes.

First, Section 2.2 begins with a review of studies that focus on the evidence that the quality of teacher-student relationships is related to academic achievement. The studies reviewed here provide such evidence. Next, Section 2.3 reviews literature linking students' social environments to academic achievement. Evidence is provided by this literature that supports the notion that students' social environments, including parent-child relationships, influence the behavior of students; which in turn, influence the quality of teacher-student relationships formed; which in turn affect student outcomes. Last, Section 2.4 reviews literature providing evidence that race is related to teacher-student relationships which, are in turn, related to learning outcomes.

.

2.2 Teacher-student relationship quality and academic achievement

Children develop several types of relationships with adults as they grow (Bowlby, 1982; Hughes, Cavell, & Jackson, 1999). As they enter and remain in school, these relationships expand from being solely with parents and caretakers to include their teachers. Existing studies have found that these relationships are important influences on a student's academic success or failure. In effect, one would expect the influence from such relationships to span other areas of a student's life beyond academics. This is true, especially, for relationships established during the early part of a student's learning journey such as kindergarten and elementary school. At that level, teachers play the role of *'the adult in the room'* and, in this way, substitute for parents in shaping the child's behavior that would become entrenched in the child's personality in later years.

Indeed some studies have found that even academic expectations of teachers and parents for the children are an important influence on the children's performance. For example, Entwisle and Hayduk (1982) found that the nature of childhood teacher-student relationships are linked to student outcomes; not only in grade school but also in later years. In that study, the authors focused on a group of students from an earlier study conducted between 1971 and 1977 when the students were in first, second, and third grades. They examined the 1980 standardized scores for these students to see if observed variables in the first study had any lasting effect four to nine years later. Specifically, they considered how the children's self-expectations and achievement scores, parents' expectations, peer's expectations, and absences in early schooling may be related to outcomes in later years. They found that a parent's academic expectations for their child were important in explaining that child's performance. Also important was the influence of teachers. Because this was one of the earliest studies to focus on student-to-adult relationships, as a factor influencing student outcomes, its findings among others, provided impetus for researchers to focus more on the role of child-parent relationships and teacher-student relationships in student learning.

In a follow-up study, Entwisle and Hayduk (1988) examined the influence of parents and teachers on a child's long-term school performance. They used the same data as in the preceding study but utilized regression models allowing them to study both individual and joint effects of several variables. Consistent with previous studies reviewed by these authors, they found that the performance expectations of parents and teachers for students in grades one through three, were good predictors of student performance on standardized tests, four to nine years later. An important difference of their study from previous ones is the use of an explicit structural model which was hitherto uncommon in these types of studies.

Another important finding of the study was that a child's social setting influences academic performance in later years and, parents and teachers have different relative influence on student outcomes depending on the social setting. Specifically, the study found that, for a student in a white middle class school, it was the parents' performance expectations for the child that had significant influence in the child's long-term performance and not the teacher's expectations. On the other hand, for a child in an integrated working-class school, it was the teacher's expectations that had significant influence while, for a child in a black working class school, it was both the parent's and teacher's expectations that were influential. The implication of the finding is that teacher-child relationships may have different impacts on students of different races and socio-economic backgrounds. Many researchers continue to focus on these relationships and their influences on academic achievement of different groups of students.

For example, Baker (2006) examined the contributions that teacher-child relationships have on school adjustment during elementary school. She found that positive teacher-child relationships were beneficial for children across all grade levels in school adjustment. But students with behavior problems adjusted poorly to school, and lagged behind academically. In contrast, well behaved students developed close teacher-student relationships, and performed significantly better than those without such relationships. Buyse, Verschueren, Doumen, Van Damme, & Maes (2008) also found a similar result for kindergarten students. Similarly, Burchinal, Peisner-Feinberg & Howes (2002) found that close teacher-student relationships were positively related to development of language skills and reading competency of children in preschool through second grade.

Pianta, Steinberg, & Rollins (1995) report too that students who had positive relationships with their kindergarten teachers adjusted better to classroom environments when they got to first and second grade. Their study followed a group of students in a small city school district from Kindergarten through second grade and used correlation analyses to investigate the link between teacher-child relationships and children's adaptation in school. In essence what the study revealed was that children in positive relationships with teachers displayed lower levels of behavior problems and higher levels of competence. That is, these children tended (or were more likely) to stay *out of trouble* and apply themselves more productively to school work than their counterparts who had conflictual relationships with their kindergarten teachers. The latter group of students exhibited higher levels of behavior problems and had lower levels of competence in first and second grade.

Further evidence in support of the notion that teacher-child relationships play a role in the academic success of the child is provided by Pianta & Stuhlman (2004). Their study found that teachers assigned higher achievement ratings to students with whom they shared close relationships than those with whom they experienced conflictual relationships. They used teachers' and parents' ratings of social and academic development of pre-school, kindergarten and first grade children to analyze the relationship between teacher-child relationships and the children's success. The study further revealed that students with higher ratings on teacher-child conflict were rated lower on social competence whereas those with close relationships were deemed more socially competent. This suggests that teachers may gravitate towards children with whom they relate well and away from those that they have conflict with.

Factors influencing the type of relationships established between teachers and their students are many and varied. For instance, Hughes, Cavell, & Willson (2001) highlight gender as one such factor in their study on the quality of teacher-student relationships among third and fourth grade students. Using sociometric peer ratings of students from an ethnically diverse school district, they found that girls were perceived as having received more support from teachers than boys. On the other hand, boys were perceived as having been in more conflictual teacher-student relationships than girls. This finding is consistent with similar previous studies which found evidence that teachers prefer and, relate positively with children who are cooperative, responsible, and courteous, as opposed to those that display disruptive and assertive behaviors (Sadker,

Sadker, & Klein, 1991; Wentzel, 1991). There is also literature which shows that students with caring and supportive interpersonal relationships in school are more positively predisposed in their attitudes and values towards their academic work and are more academically engaged and satisfied with school than their counterparts (Battistich, et al., 2004; Felner, et al., 1997). With higher levels of engagement in their work, such students tend to receive relatively more teacher support leading to higher academic performance (Klem & Connell, 2004). Apparently, these behavioral characteristics are more common in girls than in boys at the elementary school years, which would also explain the finding by Kesner (2000) that teachers rated their relationships with girls as being closer and less conflictual than their relationships with boys. In that study Kesner had interviewed a sample of pre-service teachers of K-5 students and found that the teachers perceived their relationships with boys to be more conflictual and less close than with girls.

The preceding studies underscore the importance of teacher-student relations in learning outcomes, especially, in early childhood. However, because this is a very broad topic many strands of the literature exist. These include, for example, impact of teacher-child relationships in early childhood education (Entwisle and Hayduk, 1988; Hamre and Pianta, 2001); impact of school environment and social structural factors on teacher-student relationships and performance (Alexander and Entwisle, 1988; Baker et al. 2003; Goodenow and Grady, 1993); and factors influencing teacher-student relationships (Baker, 1998; Baker et al., 2006; Ewing and Taylor, 2009; Goodenow and Grady, 1993; Pianta and Stuhlman, 2004). The current study makes a contribution to this literature by focusing on teacher-student relationships in the whole range of elementary school years, rather than focusing just on the segmented portions of either pre-school, kindergarten, K-3, middle school, or high school students.

2.3 Social environment, student characteristics and teacher-student relationship quality

Student characteristics such as behavior greatly influence the type of relationship that develops with their teachers and subsequently the level of support that these teachers offer. Indeed researchers have found that in general, students with good behavior tend to receive greater support from teachers which in turn, mediates their achievement (e.g. Caprara, Barbaranelli, Pastorelli, Bandura, & Zimbardo; 2000). In an extensive study, these authors used a longitudinal design and structural equation modeling to investigate the relative impact of early prosocial (e.g. cooperation, helping, sharing) and aggressive behaviors on performance and found these behaviors to be instrumental in the academic and social developmental trajectories of children five years later.

Because the behavior a student develops is greatly influenced by the social environment in which that student is brought up, there is an inevitable overlap in the way these two topics (social environment and student characteristics) have been presented in the literature. For instance, Baker (1998) who examined the impact of social infrastructure and the school environment on children's school satisfaction also examined student characteristics at the same time. The study focused on children from a large southeastern metropolitan school district that were considered 'at-risk' because of significant poverty rates and its consequences such as violence, substance abuse and disorderly conduct among adults in the community. In addition, the entire sample consisted of only African American children, all in grades three to five. Using the *Multidimensional Students Life Satisfaction Scale* (MSLSS; Huebner, 1994) and path analysis, Baker assessed the students' subjective feeling of well-being in order to assess their level of school satisfaction. She found that among the variables analyzed social climate in the classroom had the strongest direct effect on school satisfaction. It was also the only variable with significant indirect effect on school satisfaction by influencing other variables. This finding provides evidence that what goes on in the classroom greatly affects student outcomes. That is, the type of relationships that exist in the classroom among students as well as between students and their teachers are an important determinant of whether a student becomes satisfied with school or not. The study also found that the level of the student's self esteem was an important factor influencing school satisfaction. Clearly, students who are satisfied with school are more likely to have a sense of belonging and, hence, have greater academic success than those who are dissatisfied and have little or no sense of belonging (see also Goodenow and Grady, 1992).

In a subsequent study, Baker (1999) extended her study of this sample of students by explicitly measuring and analyzing teacher-student interactions and relations. Again, it is important to note that all the students and teachers in this study were African Americans. This is noteworthy because some studies have suggested that the teacher's race vis-à-vis that of the student is important in determining the nature and quality of teacher-student relationships established (e.g. Irvine, 1986; see also Section 2.4 below). Therefore, by design, this study controlled for effects of race on the research findings.

The study found that social context of the classroom, even as early as third grade, influences whether a student becomes satisfied with school or not. In particular, the study found that students who were dissatisfied with school sought academic help by as much as three times more than their colleagues who were satisfied with school. However, these students also received twice as many behavioral reprimands than their satisfied colleagues. Obviously, the reprimands are in most cases justified to keep order in the classroom but as these study findings suggest, they may have the unanticipated consequence of alienating the affected children from school. Hence, to some extent, the study confirms the conjecture that a caring and psychologically safe classroom environment enhances school satisfaction.

Based on these findings, Baker reiterated the need for ensuing research to pay attention to psychological and social outcomes in the early years of schooling rather than waiting until later years. Doing so would be expected to provide insights into early intervention strategies to manage and, hopefully reverse students' negative feelings about school.

In support of this line of research Baker, Dilly, Aupperlee & Patil (2003) proposed a framework to be used in studying psychosocial outcomes associated with school practices that lead to increased school satisfaction. This framework emphasized use of a positive psychology approach in which researchers focus on drivers of positive adjustment to school instead of focusing on developmental problem diagnosis. Hence, focus is on 'prevention' rather than 'cure'. They assert that when schools function as psychologically healthy environments for development, they contribute positively to children's adjustment in schools, often measured by school satisfaction.

In another study, Baker, Kamphaus, Horne, & Winsor, (2006) explored the association between children's behavior and educational outcomes. Restricting the study to general education students only, they found that students with the most significant behavioral problems had the lowest academic achievement scores. These students were also the least adjusted to classroom environments and scored lowest on teacher-reported work habits.

In a similar but variant strand of research, Pianta, Nimetz, & Bennett (1997) studied the association between mother-child relationship quality, subsequent teacher-student relationships, and outcomes for developmentally at-risk Kindergarten and first grade children. To be classified as being at-risk, a child had to fall in one or more of the following categories: come from a low income family; come from a family with low maternal educational level; be in a family with high level of stress; have low cognitive or language development level; and/or have poor behavioral adjustment. The results of that study revealed that children with close mother-child relationships developed relatively more secure teacher-child relationships than their counterparts. They also adjusted well to the school environment because they tolerated frustrations better, were less anxious and better behaved than children with negative mother-child relationships. On the other hand, children who had problematic relationships with their mothers formed teacher-child relationships that were wrought with conflict and insecurity. They exhibited poor work habits, poor social skills, less tolerance to frustrations, and were often more anxious with increased behavioral problems compared to their counterparts. The study reinforces the notion that a child's social environment influences that child's academic success. In this case the home environment in which parent-child relationships are formed influences the nature of teacher-student relationship formed which in turn, influences the student's success.

Aikens (2005) also focused on the student's socioeconomic status (SES) when she used an Early Childhood Longitudinal Study (ECLS) to investigate socio-economic factors responsible for differences in reading trajectories of students. She found that children from low SES backgrounds achieved lower reading scores and had slower learning growth rates over the K-3 period than students from more affluent backgrounds. Even though one would expect family income to be the most important factor responsible for the achievement gap between low and high SES students (Campbell, 2006), school and neighborhood contexts were found to be equally significant factors in that study. That is, low SES children attended lower quality schools and lived in poorer neighborhoods which negatively affected their performance. The reverse was true for the case of high SES students.

Several more other researchers have focused on student's social environment as well as their characteristics and how these factors impact students education (e.g. Danielsen, Samdal, Hetland, & Wold, 2009; Mantzicopoulos, 2005;Van den Oord & Van Rossem, 2002). For instance, Mantzicopoulos (2005) used a sample of economically disadvantaged kindergarten students to investigate, among other things, the associatons of conflictual relationships between teachers and students with child characteristics (e.g. behavior) and found that conflictual relationships were prevalent and associated with decreased academic achievement and higher ratings of behavior misconduct. The current study also contributes to this strand of literature by focussing on K-5 students from predominantly low socioeconomic status background. About 70% of the students in the participating schools were on free or subsidized lunch and a majority of them came from public housing dwellings.

2.4 Race and teacher-student relationship quality

Extant research has also focused on the impact of student race on academic achievement and documented the existing and persistent achievement gap, especially between White and Black students. For example, Broh (2003) uses seasonal comparisons (learning that occurs during summer and that which occurs during the school year), to investigate the effect of school factors vis-à-vis those pertaining to family background on the racial test score gap and reports that the gap grew during the school year while remaining constant over summer break. Such a finding implies that there are school factors within the school environment that may favor learning growth for White students while at the same time negatively affecting learning growth of Black students. Irvine (1986) argues that one such factor is the nature of teacher-student relationships established between teachers and students of different races. This suggests that White teachers, for example, are more likely to form positive relationships with White students than with Black students, leading to differential academic achievement of these two groups of students.

Oates (2003) explored this question of whether teacher-student racial congruence affected teachers' perceptions of student performance and found that White teachers rated Black students more negatively than they did White students. In contrast, Black teachers rated students of both races equivalently. The data used in that study came from a nationally representative sample of the National Educational Longitudinal Study (NELS) of 1988. In this way, Oates provides some evidence that supports the argument advanced by Irvine (1986).

In their study, Ladd and Burgess (1999) followed a group of kindergarten students, using a sample representative of children in American elementary schools, through second grade and investigated the relationship between students' behavioral characteristics and their adjustment in school environments. They found that children who were aggressive towards others had lower acceptance from their peers and more conflictual relationships with their teachers than more temperate students. That finding in itself was not new; especially in psychology literature. However, additional analyses by the authors showed that African American children were more likely to experience chronic peer rejection and were less likely to be afforded certain forms of support such as teacher-child closeness (Ladd & Burgess, 2001). If African American children are disproportionately accorded less teacher support because they do not have close teacher-child relationships then, based on the literature reviewed so far, one can infer that the academic success of such children is likely to be hindered.

A study by Hughes, Gleason, & Zhang (2005) focused on ethnically diverse and academically at-risk first grade students to examine how teacher perceptions of parent-teacher and student-teacher relationship quality influence teacher perceptions of the children's academic abilities. These were students who scored below the median of a state approved literacy test and for that reason were considered to be at-risk academically. The students were sampled from one urban school and two small city schools in order to make the study group as diverse as possible. After controlling for the parents' education level, these authors found that teachers rated their relationships with Hispanic and White students and their parents more positively than those with African American students and their parents. This suggests that race may be an important factor influencing the quality of teacher-child relationships and hence, student outcomes. It also suggests that the quality of these relationships may be relatively (more) compromised for the case of African American students. This is consistent with findings from other studies showing more negative teacher perceptions of African American children's competencies and personality traits (Horwitz, Bility, Plichta, Leaf, & Haynes, 1998)

To facilitate more understanding of the interaction of teacher and student demographics, Pigott & Cowen (2000) used closely matched race samples from several urban schools to examine the effects of teacher-child racial congruence on teacher ratings of school adjustment and performance in kindergarten through fifth-grade. Their study sample consisted mostly (75%) of students from low socio-economic backgrounds. Because there were very few male teachers in the sampled schools, the authors opted to have only female teachers in the study. Hence, teachers' gender was controlled for by default. Their results showed that both African American and White teachers judged African American children to have more serious school adjustment problems, fewer competencies, more negative stereotypic personalities, and poorer educational prognoses than White children. This is at variance with the findings of a recent study by Murray and Murray (2008) who found that teachers' ratings of their perceptions of students were always better for students with whom they shared race than with students from other races. They also reported that teachers gave more support to students of their race compared to those of other races. Note, however, that the latter study is one of the few that have reported such findings.

Decker, Dona & Christenson (2007) investigated the importance of student–teacher relationships for student outcomes, and specifically behaviorally at-risk African American students. Using a multi-rater, multi-method approach, they collected data from teachers and students. With increased positive teacher-student relationship quality, as reported by both teachers and students, there were increased social, behavioral and engagement outcomes for students. Although teachers viewed their relationships with students negatively, students viewed their relationships with teachers positively and wanted to be closer to them.

Focusing on remedial interventions, Murray & Malmgren (2005) investigated the effect of student-teacher relationships on students' academic performance and engagement in school using a teacher-student relationship improvement program in an all-African American high school. Specifically the intervention program was designed to improve the relationships of urban high school adolescents, who had emotional and behavioral problems, with at least one of their teachers. Although the student sample was small and purposefully selected, the researchers found that at the end of the intervention program, academic performance of program participants was significantly better than that of non-participants, suggesting that positive teacher-student relationships have a positive influence on students' academic achievement. Again, their study confirms the findings from other studies of a positive correlation between teacher-student relationships and academic achievement (e.g. Birch & Ladd, 1997; and Hamre & Pianta, 2001). Overall, the studies highlighted in this section provide evidence that supports the notion that race matters in determining the nature and quality of teacher-student relationships which ultimately impact the performance of, especially, ethnic minority students. The current study also contributes to this strand of literature by using a unique sample with a large ratio (72%) of ethnic minority students. However, the influence of teacher's race on student outcomes is not explored because not all teachers reported their race and, the majority of those that did (report) were White.

CHAPTER THREE

DATA AND METHODS

3.1 Introduction

This chapter addresses several needs. First, data used in this study and how it was collected are described. Next, measures used for teacher-student interaction, students' academic achievement, school satisfaction, and classroom adjustment are discussed in detail. Specifically, seven different measures are discussed. Finally, a description of the data analysis procedure is provided. The model used for analysis is developed by beginning with a simple unconditional means model which is progressively upgraded to an unconditional growth model, and, eventually to a conditional growth model. The rest of the chapter is organized as follows. Data is described in Section 3.2 with subsections specific to students and teachers from whom the data were collected, and a subsection on the data collection procedure. Measures are discussed in Section 3.3 while data analysis procedures and the models to be estimated are presented in Section 3.4.

3.2 Data

The data used in this study were collected from students and their teachers in four elementary schools in a small city in Southeastern United States. This was carried out under a broader research project on *Addressing the Context of Teaching for Behaviorally At-Risk Young Students (ACT).* The aim of the project was to seek an understanding of the ecological contexts of risk in elementary schools and help teachers acquire the necessary and effective classroom skills and, strategies to intervene early in children's school careers. ACT is a panel study in which data were collected every fall and spring semesters over a three-year period; focusing on students in kindergarten through grade five and their teachers. Each group of participants in the study project is discussed in turn.

3.2.1 Students

The sample consists of 1,431 students of which 53% are female. Further, 56% of these students are African American, 28% Caucasian, 10% Hispanic, while 4% belong to other ethnicities. This is quite representative of the racial and ethnic composition of the participating schools whose student population consists of 58% African American, 27% Caucasian, 10% Hispanic, and 5% of other groups, mainly of Asian American descent.

During the entire study period of three years, the student sample consisted of an average of 15% Kindergarteners, 16% first graders, 18% second graders, 16% third graders, 16% fourth graders, and 19% fifth graders. More detailed discussions of the descriptive statistics and actual proportions of the students in each year of study are presented in Chapter 4.

Because students were moving one grade up at the end of each school year, not all students who started with the study project remained with it for the entire three years. Clearly, this was expected to occur although school dropouts contributed to missing outcomes as well. In all, a total of 242 students (19%) remained enrolled with the project for the entire duration of the study, with others participating for shorter periods. In particular, 28% of the students participated for two years while 53% participated for one year.

3.2.2 Teachers

A total of 68 teachers took part in the study. These teachers were predominantly of Caucasian descent (62%), with a 10% African American representation. Eighteen teachers (26%) did not indicate their race and two percent reported their race as other. The teachers were mainly women (96%) and many of them (42%) had been teaching for more than seven years at the time of recruitment to the project. Seventy three per cent of them reported their ages which were somewhat uniformly distributed and ranged from 20 years to 59 years. Further, one third of the teachers reported that they had a master's degree while another third said that a bachelor's degree was their highest level of education. Clearly, the sampled teachers are representative of a broad range of race, gender, age, level of education, and teaching experience.

3.2.3 Procedures

Students in Kindergarten through fifth grade in all the participating schools were recruited for the study. Consent forms in the children's native languages were sent to the homes of the children and returned at the beginning of the school year. For those students whose consent forms were not received after several weeks, teachers sent up to three reminders in a bid to increase response rates. Because of these efforts the response and participation rates were over 90% at each of the schools.

In order to take part in the study, teachers were asked to provide signed informed consent forms. As a token of appreciation for their participation, they received a stipend. The participating schools also received a stipend. Whenever teachers in the study took time off for study-related activities, the project paid for substitute teachers.

As stated earlier, data were collected from both teachers and students in the fall and spring semesters of each of the three years of study. Teachers responded to questionnaires regarding school and classroom environments as well as their students' abilities. The children were assessed on their satisfaction with school, classroom environments, and relationships with fellow students and teachers. Children in fourth and fifth grades completed the measures during regular seatwork while the younger ones, in K through third grade, were put in small groups in the classrooms, media rooms, and other available instructional spaces, to respond to the questionnaires. Their surveys were shortened and language was simplified to be easily understood. In addition, a larger font size was used with rebuses on three point response scales instead of the four or five point scales used with the older children. To control for students' reading readiness, measures were projected via overhead projectors and read aloud to them. Furthermore, the questions were administered to all students in a counter-balanced format to control for order effects.

3.3 Measures

The measures used in this study are part of a larger series of assessments that the teachers completed. In each of the three years of study, teachers were asked to rate themselves, rate their students, and rate their school environments on a variety of measures discussed in detail below. Teachers were also asked to assess and report students' academic performance. The students also carried out similar ratings, albeit on different measures from those of their teachers. These measures are discussed in turn.

3.3.1 Diagnostic Inventory of School Climate (DISC)

The Diagnostic Inventory of School Climate (DISC) is an instrument that asks teachers to describe their school setting based on their experiences (O'Neal, et al., 1987). The survey is composed of 84 questions, all on a four-point Likert scale (never, seldom, usually, and always). In this measure, school climate is operationalized as a combination of eight subscales:

(1) clear school mission (school philosophy and instructional goals and objectives);

(2) safe and well-ordered learning environment (facilities and discipline);

(3) expectations for success (well communicated to staff and students);

(4) high morale (of students and staff);

(5) effective instructional leadership (as perceived);

(6) quality classroom instruction (objectives, expectations, time on-task, and opportunities to learn);

(7) monitoring student progress (program modifications, student progress, and feedback); and

(8) positive home-school relations (parental support, parental involvement, and communication).

Both the scale and the subscales had high internal validity coefficients with Cronbach alphas of 0.96 for the scale and from 0.78 to 0.92 for the subscales.

3.3.2 Student-Teacher Relationship Scale (STRS)

To assess teacher-child relationship quality, a portion of the Student-Teacher Relationship Scale (STRS) (Pianta, 1992) was used. The STRS is based on attachment theory (Bowlby, 1982) and findings from teacher-child interaction research. The items in this scale are designed to measure the constructs of warmth/security, anger/dependence, and anxiety/insecurity between teachers and their students (see Appendix Table 14 for sample items). In order to capture the quality of teacher-student relationships (i.e. closeness and conflict), nine items from this scale were used. The choice to use a short form of the scale was to reduce the length of the teacher battery included in the larger study so as not to overburden the teachers. Even so, the items were carefully selected to ensure that they captured the two constructs, and the brief measure had an internal consistency of 0.87. Further, a principal components factor analysis with promax rotation was performed and this revealed that the measure comprised of two factors; a five-item subscale measuring closeness ($\alpha = 0.80$) and a four-item subscale measuring conflict ($\alpha = 0.86$).

3.3.3 Vessels School Climate Survey (VSCS)

The Vessels School Climate Survey (VSCS) (Vessels, 1998c) instrument was used to assess school climate. It is conceptualized as a combination of the principal's leadership style, general quality of interpersonal relationships (teacher-teacher, teacher-student and student-student), student discipline, character-building activities, the school's physical environment, and the school community (see Appendix Figure 3 for sample items). The nine subscales are captured in 112 items that teachers rated on a 5-point scale from strongly disagree to strongly agree. The scale had an alpha coefficient of 0.93.

3.3.4 The Behavior Assessment System for Children – Teacher Rating Scale (BASC-TRS)

The Behavior Assessment System for Children – Teacher Rating Scale (BASC-TRS)

(Reynolds & Kamphaus, 1992) is a multidimensional behavior rating scale commonly used to measure both adaptive and problem behaviors experienced by children in school. Through the administration of age appropriate versions of the instrument, BASC-TRS can be used for children from the age of two and a half years to 18 years. An earlier version of BASC was used in this study, and it spans ages four to 18 years (see Appendix Table 15 for sample items). Depending on the age of the child, respective teachers filled out the pre-school form (BASC-TRS-P) for four to five year olds, the child form (BASC-TRS-C) for six to 11 year olds or the adolescents form (BASC-TRS-A) for 12 to 18 year olds.

The instrument has two broad categories; clinical scales and adaptive skills. The clinical domain is comprised of an externalizing problems composite (hyperactivity, aggression, and conduct problems), an internalizing problems composite (anxiety, depression, and somatization), a school problems composite (attention problems and learning problems) and a final composite for other problems (atypicality and withdrawal). The adaptive skills scale is comprised of adaptability, leadership, social skills and study skills. In addition to the two broad domains, BASC-TRS gives a broad composite rating; the behavioral symptoms index, BSI. The BSI is an indicator of the overall level of problematic behavior in a child, with high scores indicating high levels of behavioral, academic, and emotional problems. The pre-school, child and adolescent forms had 109, 138 and 148 items, respectively. Each of the items was rated on a four point frequency scale ranging from *never* to *almost always*. In the study, students' BSI was used as an indicator of the level of behavioral problems.

3.3.5 Teachable Pupil Survey (TPS)

To assess the degree to which students adjusted to the classroom environment, norms and routines, the School-Appropriate Behavior scale from the Teachable Pupil Survey (TPS) (Kornblau, 1982) was used (see Appendix Figure 2 for sample items). This subscale has nine items on a 5-point Likert response format. The subscale is a valid measure of behavioral adjustment, with an alpha of 0.92.

3.3.6 Student Survey

The student survey was used to assess classroom climate, child's academic support (by the teacher and other students), student personal support, classroom teacher behavior, student's satisfaction with school, student's perception of self and the home-school relationship. Depending on the age of the child, a student filled out one of two forms. The items used for the constructs of interest were selected from a variety of established and commonly used instruments. This decision to use selective items from the parent instruments was made because the instruments cover a wide range of constructs, some of which were not relevant to this study. Fifteen items from the Vessels Classroom Climate Scale – Early Elementary (Vessels, 1998a) were used to measure the K-3 children's view of classroom climate. For the children in fourth and fifth grades, 34 questions from the Vessels Classroom Climate Scale – Late Elementary (Vessels, 1998b) were used. Sixteen and 21 items from the Classroom Life Instrument (Johnson, Johnson, & Anderson, 1983) were used for the constructs of teacher academic support, teacher personal support, peer academic support and peer personal support for the early and late elementary groups respectively. Students' satisfaction with school was measured using six subscale items from the Multidimensional Students' Life Satisfaction Scale (MSLSS)(Huebner, 1994). Included in the survey, there were questions concerning home-school relationships as well as parental relationship with the child (see Appendix Figure 1 and Table 13 for sample items).

3.3.7 Academic achievement

Students' academic achievement is measured using students' composite scores on reading and language arts, and mathematics obtained from either the Iowa Test of Basic Skill (ITBS) or the Stanford Achievement Test Series – Ninth Edition (SAT9), as well as their report card grades. Both ITBS and SAT9 are valid, nationally standardized tests which are widely used in large scale assessments for measuring student academic achievement in reading, language, mathematics, social studies, and science (Salvia, Ysseldyke, & Bolt, 2007).

3.4 Data Analysis

The data in this study is hierarchical and longitudinal in nature and was analyzed using multilevel analytic procedures. These techniques model nested sources of variability in data. They model contextual effects and thus examine how variables measured at one level affect relationships observed at another level. Specifically, I used the hierarchical linear modeling (HLM) technique (Raudenbush & Bryk, 2002) to address the research hypotheses. HLM has significant advantages compared to regular Ordinary Least Squares (OLS) regression that is commonly used in analyses. HLM does not require observations to be independent, a stringent assumption for OLS regression analysis. Nested data, by its very nature, violates this assumption. Consequently, if OLS is used, it produces small standard errors thereby overestimating significant levels. This problem is easily solved by using multilevel modeling. Also, HLM allows for the exploration of cross-level interactions. In this way, we are able to examine how variables measured at one level affect relationships occurring at another level (Hoffmann, 1997; Osborne, 2000; Raudenbush & Bryk, 2002).

Although nested, these data are not *strictly* hierarchical but rather cross-classified. In a *cross-classified data structure*, a unit is classified along more than one dimension (Goldstein, 1994; Hox, 2002; Rasbash & Goldstein, 1994; Raudenbush & Bryk, 2002). A common example in education is one in which students are classified by the schools they attend and by the neighborhoods they reside in. Not all students in a particular school live in the same neighborhood and similarly not all students from a particular neighborhood attend the same school. The students (first level units) are nested in the cross-classification of schools and neighborhoods (second level units). A similar situation is observed in this study. At the start of each academic year, students move to the next grade level and subsequently have a different classroom (grade) teacher. A student can therefore only have a maximum of two assessments per teacher i.e. during the fall and spring of the same year. The assessments (measurement occasions) then form the lower level units i.e. level-1 while teachers and students give the higher level units i.e. level-2. Specifically, measurement occasions are nested in the cells formed by the crossing of students and teachers. See Appendix Table 12 for an illustration of sample data.

The data were analyzed using a two-level cross-classified random effects model (HCM2). A two-level HCM2 is similar to a two-level HLM model with the exception that the latter deals with perfect hierarchy while the former handles cross-classified nesting. By using HCM2, correct model parameters for within-cell and between-cell differences were estimated. Changes in students' academic performance, their adjustment to classroom environments and their overall satisfaction with school, both within-year and across years were modeled.

Three sources of variation are investigated. These are (i) within-student variation (i.e. individual student growth), (ii) between-students variation, and (iii) between-teachers variation.[1] These variations are further partitioned into explained and unexplained components. Effects of student factors (such as race, gender and behavioral conduct) and those of teacher interactions with students (such as conflict, closeness and support) were examined.

I use a piece-wise linear growth approach to estimate learning trajectories of students between grades K and fall of third grade, and between fall of third grade to fifth

[1] Additional variation due to interaction between teachers and students could have been possible were it not for the very small within-cell sample sizes. Each student could only have a maximum of two ratings from the same teacher.

grade. Piecewise linear growth models estimate learning growth as a function of time (Singer & Willett, 2003) and are therefore appropriate for use in this study. The decision to 'break' the time into two learning periods was arrived at after close examination of the empirical growth plots of 20 randomly selected students. Even though a few of them exhibited quadratic growth trajectories, most had linear trajectories with a natural break occurring at fall of third grade.

Conceptually, the data can be thought of as a matrix of J rows (of students) and K columns (of teachers). The indices i, j and k are used respectively, to represent measurement occasions (i.e. repeated measurements of students' scores), students, and teachers. More specifically, i=1, 2 occasions within cell jk, for $j = 1,\ldots,J = 1431$ students, and $k = 1,\ldots,K = 68$ teachers.

I fitted and tested several models before finding the one that best explains the data. This included both linear and polynomial models. As is often the case with multilevel modeling, I started with the simple, unconditional (null) models and progressively built more complex conditional ones as discussed in the following three subsections.

3.4.1 Unconditional Means Model

This is the simplest model that is sometimes referred to as the intercept-only model. It is unconditional because it does not include predictor variables at any level. It describes and partitions the variation in the outcome variable into its components. In this case, it estimates the variation that lies between students, between teachers, and within cells. At level 1 there is a unique set of scores nested within each cell of the cross-classification of teachers and students. The within-cell model thus describes the variation among these scores and is expressed thus: $Y_{ijk} = \pi_{0jk} + e_{ijk}$,

.... (3.1)

where

Y_{ijk} is the outcome variable score for student j under teacher k at measurement occasion i;

π_{0jk} is the expected outcome score for student j under teacher k; and

e_{ijk} is the within cell random effect assumed normally distributed with mean 0 and variance σ^2.

At level 2, the between-cell model estimates the variation that is attributable to student effects and teacher effects. Ordinarily, we would expect student-by-teacher interaction effects; however, the within-cell sample sizes are too small to distinguish variances of the interaction effect from the within-cell error, σ^2. Consequently, such interactions are omitted from the model, resulting in the following equations:

$\pi_{0jk} = \gamma_{000} + u_{00j} + v_{00k}$, ... (3.2)

where

$u_{00j} \sim N\left(0,\ \tau_{u_{00}}\right)$,

$v_{00k} \sim N\left(0, \tau_{v_{00}}\right)$

γ_{000} is the grand mean score of all children

u_{00j} is the random main effect associated with child j i.e. contribution of child j averaged over all teachers, assumed normally distributed with mean 0 and variance $\tau_{u_{00}}$;

v_{00k} is a random teacher effect, i.e. the contribution of teacher k averaged over all students, assumed normally distributed with mean 0 and variance $\tau_{v_{00}}$.

Combining the two models (level 1 and level 2) yields a single combined model

$$Y_{ijk} = \gamma_{000} + u_{00j} + v_{00k} + e_{ijk} \quad \text{.........} (3.3)$$

3.4.2 Unconditional Growth Model

The unconditional growth model is next to the simplest model after the intercept-only model. It includes a *time* predictor in the level 1 model and consequently partitions variation in the outcome variable as well as n the change trajectory. Based on exploratory analyses and examination of empirical growth plots and residual plots of 20 randomly selected students in the sample, the level 1 model assumes a piecewise linear growth trajectory. As stated earlier, majority of the students had had linear growth trajectories. Given this observation and in the interest of parsimony, the resulting model has two pieces, each with its own linear growth rate. In the model, students' learning trajectories depend on learning that occurs between grades K to fall of third grade and fall of third grade to fifth grade. Thus, the conditional growth model to be estimated is expressed as:

$$Y_{ijk} = \pi_{0jk} + \pi_{1jk}(\text{Growth K-3fall}) + \pi_{2jk}(\text{Growth 3spring-5}) + e_{ijk}, \quad \text{..........} (3.4)$$

where

Y_{ijk} is the outcome variable for student j under teacher k at occasion i;

π_{0jk} is the third grade fall score for student j under teacher k, i.e. the expected outcome score for a student at the fall of third grade;

π_{1jk} is the rate of change for student j under teacher k during K-3fall period;

π_{2jk} is the rate of change for student j under teacher k during 3fall-5 period;

e_{ijk} is the within cell random effect assumed normally distributed with mean 0 and variance σ^2.

Similar to the case of the intercept-only model, the unconditional growth model also estimates the variation that is attributable to student effects and teacher effects. The representative level 2 equations are:

$$\pi_{0jk} = \gamma_{000} + u_{00j} + v_{00k},$$

$$\pi_{1jk} = \gamma_{100}$$

$$\pi_{2jk} = \gamma_{200} \quad \text{.......(3.5)}$$

where

$$u_{00j} \sim N\left(0,\ \tau_{u_{00}}\right),$$

$$v_{00k} \sim N\left(0, \tau_{v_{00}}\right)$$

γ_{000} is the expected outcome score at the fall of third grade;

γ_{100} is the average growth rate during K-3f period;

γ_{200} is the average growth rate during 3fall-5 period;

u_{00j} is the random main effect associated with child j i.e. contribution of child j averaged over all teachers, assumed normally distributed with mean 0 and variance $\tau_{u_{00}}$;

v_{00k} is a random teacher effect, i.e. the contribution of teacher k averaged over all students, assumed normally distributed with mean 0 and variance $\tau_{v_{00}}$.

Combining the two models (level 1 and level 2) yields a single combined model expressed as:

$$Y_{ijk} = \gamma_{000} + \gamma_{100}(\text{Growth K-3fall}) + \gamma_{200}(\text{Growth 3spring-5}) + u_{00j} + v_{00k} + e_{ijk} \quad \text{.....................} (3.6)$$

3.4.2 Conditional Growth Models

Conditional growth models include predictor variables beyond the time variables. The presence of non-zero variance in the unconditional models indicates that some of the variability in the outcome variable is due to some of the measured variables. These are student characteristics (i.e. race, gender, and behavioral conduct) and teacher characteristics (conflict, closeness, and support). Using the unconditional models as baseline models, I fitted several conditional models, by including student and teacher variables. However, because almost all the teachers were female (96%) and white (85%), the effect of teacher's gender or teacher's race on student attainment was not explored.

By examining significance levels of predictors and overall model fit indices, I determined the final models. For instance, in reading or language achievement on ITBS or SAT9 tests the final that best fit the data is as follows:

$$
\begin{aligned}
&\text{Reading/Language achievement} = \gamma_{000} + \gamma_{100}\left(\text{Growth K-3fall}_{ijk}\right) \\
&+\gamma_{200}\left(\text{Growth 3spring-5}_{ijk}\right) + \gamma_{300}\left(\text{BSI}_{ijk}\right) + \gamma_{010}\left(\text{White}_{j}\right) + \gamma_{020}\left(\text{Hispanic}_{j}\right) \\
&+\gamma_{030}\left(\text{Other}_{j}\right) + \gamma_{110}\left(\text{White}_{j}\right)*\left(\text{Growth K-3fall}_{ijk}\right) \\
&+\gamma_{120}\left(\text{Hispanic}_{j}\right)*\left(\text{Growth K-3fall}_{ijk}\right) + \gamma_{130}\left(\text{Other}_{j}\right)*\left(\text{Growth K-3fall}_{ijk}\right) \\
&+\gamma_{210}\left(\text{White}_{j}\right)*\left(\text{Growth 3spring-5}_{ijk}\right) + \gamma_{220}\left(\text{Hispanic}_{j}\right)*\left(\text{Growth 3spring-5}_{ijk}\right) \\
&+\gamma_{230}\left(\text{Other}_{j}\right)*\left(\text{Growth 3spring-5}_{ijk}\right) + u_{00j} + u_{10j}\left(\text{Growth K-3fall}_{ijk}\right) \\
&+u_{20j}\left(\text{Growth 3spring-5}_{ijk}\right) + v_{00k} + e_{ijk} \qquad \text{..(3.7)}
\end{aligned}
$$

where

γ_{000} is mean reading/language achievement in the fall of third grade of an African American student with behavior misconduct;

γ_{100} is the average growth rate in reading achievement during K-3fall;

γ_{200} is the average growth rate in reading achievement during 3fall-5;

γ_{300} is the rate of change in reading achievement due to student behavior;

γ_{010} is the difference in score in third grade fall between African American and White students;

γ_{020} is the difference in third grade fall between African American and Hispanic students;

γ_{030} is the difference in third grade fall between African American and Other students;

γ_{110} is the difference in growth rate during K-3fall between African American and White students;

γ_{120} is the difference in growth rate during K-3fall between African American and Hispanic students;

γ_{130} is the difference in growth rate during K-3fall between African American and Other students;

γ_{210} is the difference in growth rate during 3fall-5 between African American and White students;

γ_{220} is the difference in growth rate during 3fall-5 between African American and Hispanic students;

γ_{230} is the difference in growth rate during 3fall-5 between African American and Other students;

u_{00j} is the is the random effect associated with child j on reading/language achievement in fall of third grade, assumed normally distributed with mean 0 and variance $\tau_{u_{00}}$;

u_{10j} is the is the random effect associated with child j on reading/language growth rate during K-3fall, assumed normally distributed with mean 0 and variance $\tau_{u_{10}}$;

u_{20j} is the is the random effect associated with child j on reading/language growth rate during 3fall-5, assumed normally distributed with mean 0 and variance $\tau_{u_{20}}$;

v_{00k} is the is the cumulative random teachers' effect on a student's reading/language growth trajectory, assumed normally distributed with mean 0 and variance $\tau_{v_{00}}$;

e_{ijk} is the within cell random effect assumed normally distributed with mean 0 and variance σ^2.

3.4.3 Model Fit

In order to determine the best fitting model, I compared overall model fit statistics such as the Akaike Information Criterion (AIC) and the Bayes Information Criterion (BIC) statistics (West, Welch, & Galecki, 2007). Both criteria give an indication of the "better" or "worse" model from a group of models that fit the same observations. Lower values suggest that a given model fits the data better than the alternatives. The advantage of using the AIC and/ or BIC statistics compared to other fit statistics, such as the deviance statistic, is that the former do not require the models to be nested. Consequently, I was able to compare several models and find the 'best' model without the constraint of hierarchy.

3.4.4 Model Variables

Before nominal variables such as gender and race are included as predictor variables in estimation models, they have to be either dummy-coded or effect-coded. In dummy coding, variable categories take on values of 0 for the reference category or 1 for all other groups. In effect coding, variable categories take on values of -1 for the reference category or 1 or 0 for all other groups. The main difference in the two methods is the way in which the resulting coefficients are interpreted. In dummy coding, the intercept is the mean outcome value for the reference group, and the slope coefficients associated with the dummy variables indicate the difference in the mean outcome score between those categories and the reference group. When effect coding is used, the intercept value is the grand mean outcome score and the slope coefficients are the score deviations from that grand mean.

In these analyses, I use dummy coding because I am interested in looking at differences in student outcomes based on gender and race. While results based on effect coding would indicate how far each group of students' means (by race or gender) are from the grand mean, the results based on dummy coding go a step further. They give performance difference between the reference group and the other predicted groups. In the estimation results reported in chapter Four, gender is coded 1 if a student is male and 0 if a student is female while race is coded 1 is a student is White, Hispanic or 'Other' and 0 if African American.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter reports the results of modeling math and reading or language achievement, school satisfaction and classroom adjustment for K through fifth grade students in four elementary schools in a small city in Southeastern United States. Different models are examined in turn. First, an unconditional model is estimated to provide information on the average level of academic achievement and overall school satisfaction across all measurement occasions and across all student groups and, to examine variance components at each of the levels. Second, an unconditional growth model is estimated to reveal any significant learning growth trajectories experienced in K through fall of third grade and in fall of third grade through fifth grade. Third, a conditional growth model is estimated to examine the relationship between race, gender, and behavior of students and teacher-student relationships with academic achievement, classroom adjustment and school satisfaction.

Relationships between student outcomes and several variables are investigated. Achievement on reading or language competency and math is modeled using scores obtained in both standardized ITBS or SAT9 tests and student report cards.

The rest of the chapter is organized as follows. Section 4.2 provides the descriptive statistics of the variables in the analysis including demographic summaries of the students and teachers involved in the study. Correlations of independent variables are also reported there. Section 4.3 gives results on reading and language achievement in ITBS or SAT9 tests while Section 4.4 gives similar results from student report cards. Results on math achievement in ITBS or SAT9 tests and student report cards are presented in Sections 4.5 and 4.6, respectively. Section 4.7 has results on school satisfaction while classroom adjustment is covered in Section 4.8.

4.2 Descriptive Statistics

Table 4.1 shows the distribution of grade K-5 students involved in the study. As described earlier, the students were, to a large extent, evenly distributed across grades and across years of study. Representation ranged from 11% for Kindergarteners to 21% for fourth graders, both occurring in year 3. Hence, the study sample was deemed to have balanced representation for all the grade levels investigated. Similarly, Table 4.2 shows frequency distributions for these students and their teachers, categorized by gender and race. These statistics show that a majority of the students (56%) were of African American descent whereas teachers were primarily Caucasian (62%)[2]. Furthermore, 96% of the teachers were female.

[2] Eighteen teachers (26.5%) did not indicate their race.

Table 4.1

Frequencies and Percentages of Students by Grade Levels and Year of Study

Grade	Year 1		Year 2		Year 3	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Kindergarten	125	18.1	111	14.4	71	11.1
First grade	118	17.1	136	17.6	84	13.1
Second grade	131	19.0	128	16.6	116	18.2
Third grade	111	16.1	121	15.7	105	16.4
Fourth grade	86	12.5	127	16.4	132	20.7
Fifth grade	118	17.1	150	19.4	131	20.5

Table 4.2

Frequencies of Student and Teacher Demographics

	Students		Teachers	
	Frequency	Percent	Frequency	Percent
Gender				
Male	614	47.3	03	4.4
Female	684	52.7	65	95.6
Race				
African American	722	56.3	07	10.2
White	370	28.8	42	61.8
Hispanic	133	10.4	-	-
Other	58	4.5	01	1.5
No response	-		18	26.5

A total of six dependent and four independent variables are used in the study and their descriptive statistics are reported in Table 4.3 below. Four of the dependent variables are used to measure academic achievement while the other two measure level of school satisfaction and classroom adjustment, respectively. To measure academic achievement ITBS or SAT9 standardized test scores were used together with teacher report cards on math and reading or language competency. School satisfaction and classroom adjustment variables measure how much the students felt contented with school and how well they adjusted to the norms, routines, and expectations of the classroom environment, respectively.

The independent variables are teacher-student interactional variables, a student behavioral symptoms index, and students' gender and race. The teacher-student interactional variables measure level of conflict and level of closeness experienced between teachers and children as well as level of teacher support accorded to children. The behavioral symptoms index measures student behavior such as hyperactivity, externalizing and internalizing symptoms, and attentiveness.

With the exception of behavioral symptoms index and classroom adjustment, all the other variables are reported as z-scores. This is because the measures for these variables were on different metrics and needed to be standardized to a common metric to facilitate comparison of performance across different students and measurement occasions.

Table 4.3

Descriptive statistics of outcome and predictor variables

	M	SD	Min	Max	N
Independent variables					
Teacher-child closeness	0.00	1.00	-4.64	0.84	2968
Teacher-child conflict	0.00	1.00	-2.89	0.82	2968
Teacher overall support	0.00	1.00	-4.95	6.44	2981
Behavioral Symptoms Index (T-scores)	49.90	10.15	32.00	96.00	3178
Dependent variables					
Reading or language achievement (ITBS or SAT9)	0.00	1.00	-2.42	3.01	1407
Reading or language grade achievement	0.00	1.00	-2.82	1.29	2725
Math achievement (ITBS or SAT9)	0.00	1.00	-2.45	6.15	1720
Math grade achievement	0.00	1.00	-2.84	1.31	2998
School satisfaction	0.00	1.00	-3.99	1.57	2913
Classroom adjustment	35.94	8.63	9.00	45.00	2963

Because this study assumed an accelerated longitudinal design, students entered the study at different points and may have been assessed over a short time relative to the entire time span of the study. Similarly, due to maturation, some students exited the study before its completion. Also, some teachers failed to report ratings for students and some students missed assessments. As a result of these circumstances, we have different 'sample sizes' for the variables in table 4.3. Most of the variables were negatively skewed. For instance, teacher-child conflict had a skewness of -1.4 and teacher-child closeness had a value of -1. An examination of histograms pointed toward generally high levels of closeness and decreased levels of conflict between teachers and students.

Table 4.4 gives the correlation coefficients for the continuous predictor variables used. All the correlations between student behavior, teacher support, teacher-student closeness, and teacher-student conflict were statistically significant at an alpha level of

0.01. Close relationships were positively (even though moderately so) associated with a decrease in conflictual relationships between teachers and students (r = 0.58). Increases in student behavioral misconduct were associated with few close relationships (r = -0.45), less teacher support (r = -0.15) and increased conflict (r = -0.68) between students and their teachers.[3]

Table 4.4

Correlations of student and teacher interactional variables

	Behavioral Symptoms Index T-score	Teacher-child closeness	Teacher-child conflict
Teacher-child closeness	-0.446**		
Teacher-child conflict	-0.675**	0.581**	
Overall teacher support	-0.150**	0.166**	0.146**

***p<0.01.*

Even though the design of the study lends itself to multilevel analysis, I also calculated and examined intra-class correlation coefficients (ICC) to confirm the tenability of using multilevel models in analyzing these data. Intra-class correlation coefficients indicate the proportion of variance in the outcome variable that is accounted for by level 2 units. Alternately, ICC is the expected correlation between any two randomly chosen units that are in the same group (Hox, 2002; Luke, 2004). In this case, the level 2 units are students (which give intra-student correlation) and teachers (intra-teacher correlation). Both ICCs are calculated as follows:

[3] An increase in the z-score on teacher-child conflict means that there was a decrease in conflictual relationship between teacher and student because conflict was reverse coded.

Intra-student correlation, $\rho_{student} = \dfrac{\hat{\tau}_{u_{00}}}{\hat{\tau}_{u_{00}} + \hat{\tau}_{v_{00}} + \hat{\sigma}^2}$ where $\hat{\tau}_{u_{00}}$ is the estimate of student variance, $\hat{\tau}_{v_{00}}$ is the estimate of teacher variance, and $\hat{\sigma}^2$ is the estimate of the variance within each cell (between measurement occasions) obtained by fitting a null (i.e. intercept-only) model. Similarly,

Intra-teacher correlation, $\rho_{teacher} = \dfrac{\hat{\tau}_{v_{00}}}{\hat{\tau}_{u_{00}} + \hat{\tau}_{v_{00}} + \hat{\sigma}^2}$ with the variance estimates defined as above.

Using these equations and variance estimates obtained from fitting an intercept only model for each of the outcome variables, I obtained ICCs presented in table 4.5. According to these coefficients, between-student factors would account for 50% - 75% of the variation in outcome variables while up to 28% would be accounted for by teacher variables. This means that intra-class correlation exists in these data and therefore, the traditional linear model is not appropriate. This is because the assumption of independent observations is violated (Kreft & de Leeuw, 1998).

Table 4.5

Intra-class correlation coefficients

	$\rho_{student}$	$\rho_{teacher}$	ρ_{cell}
ITBS or SAT9 reading/language	0.72	0.17	0.11
ITBS or SAT9 math	0.57	0.24	0.20
Report card reading/language	0.78	0.02	0.20
Report card math	0.47	0.28	0.25
School satisfaction	0.50	0.02	0.48
Classroom adjustment	0.68	0.05	0.28

4.3 Reading and language achievement in ITBS or SAT9 tests

Beginning with this section onwards, I present results obtained after fitting several multilevel models to the data. The results in this section pertain to reading and language achievement in ITBS or SAT9 tests while those in subsequent sections pertain to the remaining dependent variables. In each case, I present at least three models and label them in ascending order as follows:

i) *Model 1*: the unconditional means i.e. intercept only model discussed in Chapter three section, 3.4.1;

ii) *Model 2*: the unconditional growth model discussed in Chapter three, section 3.4.2; and

iii) *Model 3*: the conditional model also discussed in Chapter three, section 3.4.3.

In cases where more than three models are presented, the additional models are simply a variant of the conditional growth model. The specific differences between these models are highlighted in the sections in which their results are reported.

Models 1 and 2 are both unconditional models (i.e. do not include predictor variables) and therefore each is expressed the same way mathematically for all the outcome variables. The equations presented in Chapter three (equations 3.1 - 3.5) and repeated here (but renumbered) to make it easier for one to follow the results reported here:

Model 1: unconditional means model

Level 1:

$$Y_{ijk} = \pi_{0jk} + e_{ijk}, \qquad \text{(4.1)}$$

where

Y_{ijk} is the ITBS/SAT reading/language score for student j under teacher k at measurement occasion i;

π_{0jk} is the mean ITBS/SAT reading/language score for student j under teacher k;

e_{ijk} is within student random effect assumed normally distributed with mean 0 and variance σ^2.

Level 2:

$$\pi_{0jk} = \gamma_{000} + u_{00j} + v_{00k}, \qquad \text{(4.2)}$$

$$u_{00j} \sim N\left(0,\ \tau_{u_{00}}\right),$$

$$v_{00k} \sim N\left(0, \tau_{v_{00}}\right)$$

where

γ_{000} is the grand mean ITBS/SAT reading/language score for all children

u_{00j} is the random main effect associated with child j i.e. contribution of child j averaged over all teachers, assumed normally distributed with mean 0 and variance $\tau_{u_{00}}$;

v_{00k} is a random teacher effect, i.e. the contribution of teacher k averaged over all students, assumed normally distributed with mean 0 and variance $\tau_{v_{00}}$.

Combined model:

$$Y_{ijk} = \gamma_{000} + u_{00j} + v_{00k} + e_{ijk} \quad \text{...} \quad (4.3)$$

Model 2: Unconditional growth model

Level 1:

$$Y_{ijk} = \pi_{0jk} + \pi_{1jk}(\text{Growth K-3fall}) + \pi_{2jk}(\text{Growth 3spring-5}) + e_{ijk}$$
,...................... (4.4)

where

Y_{ijk} is the ITBS/SAT reading/language score for student j under teacher k at occasion i;

π_{0jk} is the ITBS/SAT reading/language score for student j under teacher k, i.e. the expected ITBS/SAT reading/language score for a student at the fall of third grade;

π_{1jk} is the rate of change (i.e. growth rate) for student j under teacher k during K-3fall period;

π_{2jk} is the rate of change (i.e. growth rate) for student j under teacher k during 3fall-5 period;

e_{ijk} is the within student random effect assumed normally distributed with mean 0 and variance σ^2.

Level 2:

$$\pi_{0jk} = \gamma_{000} + u_{00j} + v_{00k},$$

$$\pi_{1jk} = \gamma_{100}$$

$$\pi_{2jk} = \gamma_{200} \qquad \text{..........} \qquad (4.5)$$

where

$$u_{00j} \sim N\left(0,\ \tau_{u_{00}}\right),$$

$$v_{00k} \sim N\left(0, \tau_{v_{00}}\right)$$

γ_{000} is the mean ITBS/SAT reading/language score at the fall of third grade;

γ_{100} is the average growth rate during K-3fall period;

γ_{200} is the average growth rate during 3fall-5 period;

u_{00j} is the random main effect associated with child j i.e. contribution of child j averaged over all teachers, assumed normally distributed with mean 0 and variance $\tau_{u_{00}}$;

v_{00k} is a random teacher effect, i.e. the contribution of teacher k averaged over all students, assumed normally distributed with mean 0 and variance $\tau_{v_{00}}$.

Combined model:

$$Y_{ijk} = \gamma_{000} + \gamma_{100}(\text{Growth K-3fall}) + \gamma_{200}(\text{Growth 3spring-5})$$

$$+u_{00j} + v_{00k} + e_{ijk} \quad \text{...}(4.6)$$

Model 3: Conditional growth model

Level 1:

$$\text{ITBS/SAT Reading / language achievement}_{ijk} = \pi_{0jk} + \pi_{1jk}\left(\text{Growth K-3fall}_{ijk}\right)$$

$$+\pi_{2jk}\left(\text{Growth 3spring-5}_{ijk}\right) + \pi_{3jk}\left(\text{BSI}_{ijk}\right) + e_{ijk} \quad \text{..............................}(4.7)$$

where

π_{0jk} is the mean ITBS/SAT reading/language score for student j categorized as one with behavior misconduct, under teacher k, at the fall of third grade;

π_{1jk} is the rate of change (i.e. growth rate) for student j under teacher k during K-3fall period;

π_{2jk} is the rate of change (i.e. growth rate) for student j under teacher k during 3fall-5 period;

π_{3jk} is the average increase (or decrease) in ITBS/SAT reading/language score for student j under teacher k accompanying a one unit change in BSI score;

e_{ijk} is the within student random effect assumed normally distributed with mean 0 and

variance σ^2.

Level 2:

$$\pi_{0jk} = \gamma_{000} + u_{00j} + v_{00k} + \gamma_{010}\left(\text{White}_j\right) + \gamma_{020}\left(\text{Hispanic}_j\right) + \gamma_{030}\left(\text{Other}_j\right)$$

$$\pi_{1jk} = \gamma_{100}\left(\text{Growth K-3fall}_{ijk}\right) + \gamma_{110}\left(\text{White}_j\right) * \left(\text{Growth K-3fall}_{ijk}\right) +$$

$$\gamma_{120}\left(\text{Hispanic}_j\right) * \left(\text{Growth K-3fall}_{ijk}\right) + \gamma_{130}\left(\text{Other}_j\right) * \left(\text{Growth K-3fall}_{ijk}\right) +$$

$$u_{10j}\left(\text{Growth K-3fall}_{ijk}\right)$$

$$\pi_{2jk} = \gamma_{200}\left(\text{Growth 3spring-5}_{ijk}\right) + \gamma_{210}\left(\text{White}_j\right) * \left(\text{Growth 3spring-5}_{ijk}\right)$$

$$+\gamma_{220}\left(\text{Hispanic}_j\right) * \left(\text{Growth 3spring-5}_{ijk}\right) + \gamma_{230}\left(\text{Other}_j\right) * \left(\text{Growth 3spring-5}_{ijk}\right)$$

$$+u_{20j}\left(\text{Growth 3spring-5}_{ijk}\right)$$

$$\pi_{3jk} = \gamma_{300}\left(\text{BSI}_{ijk}\right) \quad \text{(4.8)}$$

where

γ_{000} is mean reading/language achievement in the fall of third grade of an African American student with behavior misconduct;

γ_{100} is the average growth rate in reading achievement during K-3fall;

γ_{200} is the average growth rate in reading achievement during 3fall-5;

γ_{300} is the rate of change in reading achievement due to behavior;

γ_{010} is the difference in third grade fall between African American and White students;

γ_{020} is the difference in third grade fall between African American and Hispanic students;

γ_{030} is the difference in third grade fall between African American and Other students;

γ_{110} is the difference in growth rate during K-3fall between African American and White students;

γ_{120} is the difference in growth rate during K-3fall between African American and Hispanic students;

γ_{130} is the difference in growth rate during K-3fall between African American and Other students;

γ_{210} is the difference in growth rate during 3fall-5 between African American and White students;

γ_{220} is the difference in growth rate during 3fall-5 between African American and Hispanic students;

γ_{230} is the difference in growth rate during 3fall-5 between African American and Other students;

u_{00j} is the random effect associated with child j on reading/language achievement in fall of third grade, assumed normally distributed with mean 0 and variance $\tau_{u_{00}}$;

u_{10j} is the is the random effect associated with child j on reading/language growth rate during K-3fall, assumed normally distributed with mean 0 and variance $\tau_{u_{10}}$;

u_{20j} is the random effect associated with child j on reading/language growth rate during 3fall-5, assumed normally distributed with mean 0 and variance $\tau_{u_{20}}$;

v_{00k} is the cumulative random teachers' effect on a student's reading/language growth trajectory, assumed normally distributed with mean 0 and variance $\tau_{v_{00}}$;

Combined model:

$$\text{ITBS/SAT Reading / language achievement}_{ijk} = \gamma_{000} + \gamma_{100}\left(\text{Growth K-3fall}_{ijk}\right)$$

$$+\gamma_{200}\left(\text{Growth 3spring-5}_{ijk}\right) + \gamma_{300}\left(\text{BSI}_{ijk}\right) + \gamma_{010}\left(\text{White}_{j}\right) + \gamma_{020}\left(\text{Hispanic}_{j}\right) +$$

$$\gamma_{030}\left(\text{Other}_{j}\right) + \gamma_{110}\left(\text{White}_{j}\right)*\left(\text{Growth K-3fall}_{ijk}\right) + \gamma_{120}\left(\text{Hispanic}_{j}\right)*\left(\text{Growth K-3fall}_{ijk}\right)$$

$$+\gamma_{130}\left(\text{Other}_{j}\right)*\left(\text{Growth K-3fall}_{ijk}\right) + \gamma_{210}\left(\text{White}_{j}\right)*\left(\text{Growth 3spring-5}_{ijk}\right)$$

$$+\gamma_{220}\left(\text{Hispanic}_{j}\right)*\left(\text{Growth 3spring-5}_{ijk}\right) + \gamma_{230}\left(\text{Other}_{j}\right)*\left(\text{Growth 3spring-5}_{ijk}\right) + u_{00j} +$$

$$u_{10j}\left(\text{Growth K-3fall}_{ijk}\right) + u_{20j}\left(\text{Growth 3spring-5}_{ijk}\right) + v_{00k} + e_{ijk} \quad \text{......................................(4.9)}$$

Tables 4.6(a) and 4.6(b) show the fixed effects and variance component estimates for reading and language in ITBS or SAT9 achievement, respectively. Based on the likelihood ratio tests and the information criteria of AIC and BIC, model 3 best fits the data and is therefore preferred over models 1 and 2.

The results from model 1 show that during the fall of third grade overall average reading and language achievement in ITBS or SAT9 tests are significantly different from zero. This result simply means that if all possible predictors are ignored, the mean reading achievement of all students across all measurement occasions is statistically significant. However, once a time variable is included as an explanatory variable, as in model 2, the conditional mean of achievement becomes statistically insignificant suggesting that reading achievement scores are time-dependent. Specifically, model 2 includes two time variables which capture the effects of learning trajectories during K through fall of third grade (K-3fall) and fall of third grade through fifth grade (3fall-5). Model 2 results suggest that learning that occurs between K-3fall and between 3fall-5 accounts for 27% of the variability in reading achievement initially attributed to within-student characteristics. Model 3 explains an additional 47% of the within-student variance and 14% of the teacher variance[4].

Model 3 builds upon model 2 by including a behavioral symptoms index (BSI) variable and taking into account the student's race. I investigated the role of students' gender, and teacher related variables (teacher-student closeness, teacher-student conflict

---

[4] The figures of 27% and 14% represent the percentage change in the within-student variance between models 1 and 2 computed as $\left(\frac{0.081 - 0.059}{0.081}\right) \times 100\%$ and teacher variance between models 2 and 3 computed as $\left(\frac{0.029 - 0.025}{0.029}\right) \times 100\%$, respectively.

and teacher support) in reading achievement on the ITBS or SAT9 tests by including them as predictors. Also, I investigated student-teacher interactions, such as student gender by teacher support, to examine any influence they might have on student achievement. Their coefficients were not statistically significant. Therefore, these variables are not included in Model 3.

As discussed in Chapter three, race was dummy-coded with the African American students' dummy variable used as the reference group in analyses. Results from model 3 reveal that there were significant differences in the mean reading achievement associated with students' race and behavior. Specifically, these results show that in the fall of third grade, African American students had a lower average reading score (γ_{000} = -0.39) than their White counterparts whose average score was 0.59 (i.e. 0.98-0.39).[5] Similarly, students whose race is classified as 'Other' had a higher average score than African American students. The performance of Hispanic students in reading was, however, not significantly different from that of African American students.

After controlling for behavioral conduct and learning growth during fall of third grade – fifth grade, results indicate that African American, White and Hispanic students improved while Other students declined in their performance during K-fall of third grade. The growth rates were significantly different. White students exhibited a considerably higher growth rate (γ_{110} = 0.10, $p<0.001$) than their African American counterparts. No significant differences were evident between the growth rates for Hispanics or Other students relative to African Americans. During fall of third grade – fifth grade, learning growth rates for White and Hispanic students declined while that of African American

[5] The coefficients of each dummy variable is equal to the difference between the mean of the group coded 1 and the mean of the reference group.

and Other students increased. Relative to African American students, the decrease for White students was significant, γ_{210} = -0.17, p<0.001. There was a moderate positive correlation (r = 0.67) between achievement at third grade fall and growth rate during K-third grade fall indicating that students with faster growing rates in the early grades attained higher levels of achievement by the beginning of third grade than those with slower growth rates. But, this trend was reversed during the fall of third –to fifth grade period, resulting in a negative correlation with the score at fall of third grade. Furthermore, students who exhibited faster learning rates in K-third grade fall experienced a remarkable decline in their growth rate between fall of third grade and fifth grade, r = -0.89. The behavioral symptoms index coefficient is negative and statistically significant (γ_{300} = -0.01). This suggests that students with elevated behavioral problems experienced a decrease in their reading achievement.

Table 4.6(a)

ITBS/SAT9 reading, language achievement

Fixed effects		Model 1		Model 2		Model 3	
		Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
Third grade fall, π_{0jk}	Intercept, γ_{000}	-0.11** (0.04)	-2.77	0.05 (0.04)	1.19	-0.39*** (0.06)	-6.77
	White, γ_{010}					0.98*** (0.08)	11.96
	Hispanic, γ_{020}					0.02 (0.16)	0.13
	Other, γ_{030}					0.41* (0.17)	2.49
Growth K-third grade fall, π_{1jk}	Intercept, γ_{100}			0.20*** (0.02)	13.41	0.17*** (0.02)	9.43
	White, γ_{110}					0.10*** (0.03)	3.55
	Hispanic, γ_{120}					0.05 (0.06)	0.83
	Other, γ_{130}					-0.02 (0.06)	-0.35
Growth third grade fall - fifth grade, π_{2jk}	Intercept, γ_{200}			-0.06* (0.03)	-2.18	0.02 (0.03)	0.67
	White, γ_{210}					-0.17*** (0.04)	-3.80
	Hispanic, γ_{220}					-0.08 (0.09)	-0.86
	Other, γ_{230}					0.04 (0.09)	0.44
Rate of change, BSI, π_{3jk}	Intercept, γ_{300}					-0.01*** (0.002)	-5.08

Model 1: Unconditional means Model 2: Unconditional growth Model 3: Time, Race and BSI predictors

*$p<.05$; ** $p<.01$; **$p<.001$

Table 4.6(b)

ITBS/SAT9 reading, language achievement

Variance components	Model 1	Model 2	Model 3
	Estimates	Estimates	Estimates
Within-student, σ^2	0.081	0.059	0.021
Between-student, $\mathrm{var}\left(u_{00j}\right), \tau_{u00}$	0.528***	0.444***	0.475***
Growth rate, K-3fall, $\mathrm{var}\left(u_{10j}\right), \tau_{u10}$			0.023***
Growth rate, 3fall-5, $\mathrm{var}\left(u_{20j}\right), \tau_{u20}$			0.065***
Teacher effect, $\mathrm{var}\left(v_{00k}\right), \tau_{v00}$	0.123***	0.029***	0.025***
Correlations			
Third grade fall and growth rate K-3fall, $\mathrm{corr}\left(\pi_{0jk}, \pi_{1jk}\right)$			0.672
Third grade fall and growth rate 3fall-5, $\mathrm{corr}\left(\pi_{0jk}, \pi_{2jk}\right)$			-0.708
Growth rate K-3fall and growth rate 3fall-5, $\mathrm{corr}\left(\pi_{1jk}, \pi_{2jk}\right)$			-0.89
Model deviance	1868.69	1565.26	1197.69
Model AIC	1876.69	1577.26	1239.69
Model BIC	1896.56	1607.08	1344.04
Model df	4	6	21

Model 1: Unconditional means Model 2: Unconditional growth Model 3: Time, Race and BSI predictors; **p<.05; ** p<.01; ***p<.001*

4.4 Student report card reading achievement

This section presents results from four models on the fixed effects and variance component estimates for reading achievement as measured by students' report card scores. The results are summarized in Table 4.7. Models 1 and 2 are similar to those presented in section 4.3 except for the dependent variable which has changed to student report card reading scores. In addition to a time variable, both models 3 and 4 include students' gender, race, and behavioral symptoms as predictors. Additionally, model 4 has a teacher-child conflict variable as a predictor. Teacher-child closeness and teacher support were considered and dropped as predictors because they were not statistically significant. Similarly, interactions between teacher and student variables were considered. These were found to be statistically insignificant, and dropped as predictors. Based on the likelihood ratio tests and the information criteria of AIC and BIC, model 4 best fits the data and is therefore preferred over models 1, 2 and 3. Level 1 and level 2 model equations are similarly expressed as outlined by equations 4.7 and 4.8. Similar to equation 4.9, the combined model equation for the final model is expressed thus:

$$\text{Report card reading achievement}_{ijk} = \gamma_{000} + \gamma_{100}\left(\text{Growth K-3fall}_{ijk}\right)$$

$$+\gamma_{200}\left(\text{Growth 3spring-5}_{ijk}\right) + \gamma_{300}\left(\text{BSI}_{ijk}\right) + \gamma_{400}\left(\text{Conflict}_{ijk}\right) + \gamma_{010}\left(\text{Male}_{j}\right)$$

$$+\gamma_{020}\left(\text{White}_{j}\right) + \gamma_{030}\left(\text{Hispanic}_{j}\right) + \gamma_{040}\left(\text{Other}_{j}\right) + u_{00j} + v_{00k} + e_{ijk} \qquad (4.10)$$

where

γ_{000} is the mean reading/language achievement in the fall of third grade of an African American female student with behavior misconduct;

γ_{100} is the average growth rate in reading achievement during K-3fall;

γ_{200} is the average growth rate in reading achievement during 3fall-5;

γ_{300} is the rate of change in reading achievement due to behavior;

γ_{400} is the rate of change in reading achievement due to student-teacher conflict;

γ_{010} is the difference in third grade fall between male and female students;

γ_{020} is the difference in third grade fall between African American and White students;

γ_{030} is the difference in third grade fall between African American and Hispanic students;

γ_{040} is the difference in third grade fall between African American and Other students;

u_{00j} is the random effect associated with child j on reading/language achievement, assumed normally distributed with mean 0 and variance $\tau_{u_{00}}$;

v_{00k} is the cumulative random teachers' effect on a student's reading/language growth trajectory, assumed normally distributed with mean 0 and variance $\tau_{v_{00}}$;

e_{ijk} is the within student random effect assumed normally distributed with mean 0 and variance σ^2.

As more variables were progressively added in models 2, 3, and 4, they explained increasingly more and more of the variability in reading achievement previously attributed only to student and teacher factors. The unconditional means only model (in this case model 1) is the baseline for level 1 variance comparisons, while the unconditional growth model (model2) is the baseline for level 2 variance comparisons. For instance, 78% of the variability observed in student reading achievement under model 2 was attributed to between-student factors. By including behavioral conduct, students' race and gender (model 3), the between student variance decreased by causes the between-student effect to decrease by 48% i.e. from 0.78 to 0.37. Similarly, variability attributed to teacher factors decreased by 35%. .

Coefficient estimates of models 3 and 4 are relatively similar in both magnitude and statistical significance. Consequently, only those of model 4, the better fitting model, are discussed because similar inferences would apply to those of model 3. The results show that reading scores on student report cards differ significantly by race and by gender. Specifically, the results show that White female students outperform all other categories of students. Their z-score is 0.52 (0.82-0.30)[6] compared to 0.28 for White male, 0.02 for 'Other' female, -0.04 for 'Other' male, -0.3 for African American female, and -0.54 for African American male students. Hispanic students' reading scores were not statistically different from those of their African American counterparts. Clearly, regardless of race, female students outperform their male counterparts. It is encouraging to note that decreased conflictual relationships between teachers and students were accompanied by increased reading achievement, $\gamma_{400} = -0.08$, $p<0.01$. Even so, an increase in student misbehavior was positively related to decreased achievement in reading, $\gamma_{300} = -0.02$, $p<0.001$.

[6] African American female students are the reference group.

Table 4.7

Report Card Reading Achievement

Fixed effects		Model 1		Model 2		Model 3		Model 4	
		Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Third grade fall, π_{0jk}	Intercept, γ_{000}	0.12** (0.04)	2.82	0.14* (0.06)	2.28	-0.38*** (0.07)	-5.25	-0.30*** (0.08)	-4.04
	Male, γ_{010}					-0.26*** (0.06)	-4.31	-0.24*** (0.06)	-4.00
	White, γ_{020}					0.83*** (0.07)	12.04	0.82*** (0.07)	11.74
	Hispanic, γ_{030}					-0.02 (0.12)	-0.15	-0.02 (0.12)	-0.17
	Other, γ_{040}					0.53** (0.15)	3.54	0.5** (0.15)	3.35
Growth K- third grade fall, π_{1jk}	Intercept, γ_{100}			-0.02 (0.02)	-0.77	-0.03 (0.02)	-1.55	-0.02 (0.02)	-1.22
Growth third grade fall - fifth grade, π_{2jk}	Intercept, γ_{200}			-0.02 (0.04)	-0.55	0.003 (0.03)	0.09	-0.01 (0.03)	-0.21
Rate of change, BSI π_{3jk}	Intercept, γ_{300}					-0.03*** (0.002)	-9.87	-0.02*** (0.003)	-6.66
Rate of change, conflict π_{4jk}	Intercept, γ_{400}							0.08** (0.03)	2.91
Variance components		Estimates		Estimates		Estimates		Estimates	
Within-student, σ^2		0.184		0.182		0.195		0.191	
Between-student, $\mathrm{var}\left(u_{00j}\right), \tau_{u00}$		0.711***		0.710***		0.372***		0.374***	
Teacher effect, $\mathrm{var}\left(v_{00k}\right), \tau_{v00}$		0.015***		0.017***		0.011***		0.012***	
Model deviance		2393.86		2388.47		2127.76		2119.38	
Model AIC		2401.86		2400.47		2149.76		2143.38	
Model BIC		2421.74		2430.28		2204.41		2203.00	
Model df		4		6		11		12	

Model 1: Unconditional means;Mod 2: Unconditional growth; Mod 3: Time, BSI, closeness and conflict; Mod4: Time, BSI and conflict as predictors *$p<.05$; ** $p<.01$; ***$p<.001$

4.5 Math achievement in ITBS or SAT9 tests

Models 1, 2, 3, 4 and 5 in tables 4.8(a), 4.8(b) and 4.8(c) give the estimates of the fixed effects and variance components and correlation coefficients for math achievement in ITBS or SAT9 tests. Similar to the models discussed above, models 1 and 2 are the unconditional means and unconditional growth models, respectively. Models 3, 4, and 5 all have a time variable as well as race as predictors. In addition, model 3 has a behavioral symptoms index as a predictor while model 4 has teacher-conflict instead; model 5 has teacher-child closeness.

Based on the likelihood ratio tests and the information criteria of AIC and BIC, model 3 best fits the data and is therefore preferred over models 1, 2, 4 and 5.Even though the teacher-child conflict variable in model 4 is statistically significant, the model has a slightly worse fit than model 3. Furthermore, when the behavioral symptoms index was included as an additional predictor, the AIC and BIC values increased. Consequently, the final results discussed in this analysis are for model 3. It is noteworthy however, that the parameter estimates in both models are relatively similar in magnitude and statistical significance. Level 1 and level 2 model equations are similarly expressed as outlined by equations 4.7 and 4.8. Similar to equation 4.9, the combined model equation for the final model is expressed thus:

$$\text{ITBS/SAT math achievement}_{ijk} = \gamma_{000} + \gamma_{100}\left(\text{Growth K-3fall}_{ijk}\right) + \gamma_{200}\left(\text{Growth 3spring-5}_{ijk}\right)$$

$$+\gamma_{300}\left(\text{BSI}_{ijk}\right) + \gamma_{010}\left(\text{White}_{j}\right) + \gamma_{020}\left(\text{Hispanic}_{j}\right) + \gamma_{030}\left(\text{Other}_{j}\right)$$

$$+\gamma_{110}\left(\text{White}_{j}\right)*\left(\text{Growth K-3fall}_{ijk}\right) + \gamma_{120}\left(\text{Hispanic}_{j}\right)*\left(\text{Growth K-3fall}_{ijk}\right)$$

$$+\gamma_{130}\left(\text{Other}_{j}\right)*\left(\text{Growth K-3fall}_{ijk}\right) + \gamma_{210}\left(\text{White}_{j}\right)*\left(\text{Growth 3spring-5}_{ijk}\right)$$

$$+\gamma_{220}\left(\text{Hispanic}_{j}\right)*\left(\text{Growth 3spring-5}_{ijk}\right) + \gamma_{230}\left(\text{Other}_{j}\right)*\left(\text{Growth 3spring-5}_{ijk}\right)$$

$$+u_{00j} + u_{10j}\left(\text{Growth K-3fall}_{ijk}\right) + u_{20j}\left(\text{Growth 3spring-5}_{ijk}\right) + v_{00k} + e_{ijk} \quad \text{(4.11)}$$

where

γ_{000} is mean ITBS/SAT math achievement in the fall of third grade of an African American student with behavior misconduct;

γ_{100} is the average growth rate in ITBS/SAT math achievement during K-3fall;

γ_{200} is the average growth rate in ITBS/SAT math achievement during 3fall-5;

γ_{300} is the rate of change in ITBS/SAT math achievement due to behavior;

γ_{010} is the difference in third grade fall between African American and White students;

γ_{020} is the difference in third grade fall between African American and Hispanic students;

γ_{030} is the difference in third grade fall between African American and Other students;

γ_{110} is the difference in growth rate during K-3fall between African American and White students;

γ_{120} is the difference in growth rate during K-3fall between African American and Hispanic students;

γ_{130} is the difference in growth rate during K-3fall between African American and Other students;

γ_{210} is the difference in growth rate during 3fall-5 between African American and White students;

γ_{220} is the difference in growth rate during 3fall-5 between African American and Hispanic students;

γ_{230} is the difference in growth rate during 3fall-5 between African American and Other students;

u_{00j} is the random effect associated with child j on ITBS/SAT math achievement in fall of third grade, assumed normally distributed with mean 0 and variance $\tau_{u_{00}}$;

u_{10j} is the is the random effect associated with child j on ITBS/SAT math growth rate during K-3fall, assumed normally distributed with mean 0 and variance $\tau_{u_{10}}$;

u_{20j} is the random effect associated with child j on ITBS/SAT math growth rate during 3fall-5, assumed normally distributed with mean 0 and variance $\tau_{u_{20}}$;

v_{00k} is the cumulative random teachers' effect on a student's ITBS/SAT math growth trajectory, assumed normally distributed with mean 0 and variance $\tau_{v_{00}}$;

e_{ijk} is the within student random effect assumed normally distributed with mean 0 and variance σ^2.

The results show that at the fall of third grade, mean math scores in ITBS or SAT9 tests were statistically different from zero (γ_{000} = -0.28, p<0.001), with significant differences associated with race. African American students' mean score was lower compared to White and 'Other' students, although their performance was not significantly different from that of Hispanic students. During K-3fall period, students' performance improved considerably with variations observed by race. During the 3fall-5 period, students' learning rates declined, varying by race. In particular, White students exhibited faster learning rates (γ_{110} = 0.15, p<0.001) during the early years of schooling (K-3fall) but lower rates (γ_{210} = -0.19, p<0.001) in later years (3fall-5) relative to African American students. Overall, elevated behavioral problems among students were accompanied by a decrease in math performance, even though the decrease was relatively small (γ_{300} = -0.01).

After controlling for student variables, the results show that teacher-student closeness, teacher-student conflict and teacher support had no significant effect on students' ITBS or SAT9 math achievement. Also, none of the interactions between student variables (i.e. gender and race) and teacher factors (i.e. support, conflict, and closeness) were statistically significant. Consequently, they were dropped from the models.

By including time and BSI as predictors, 65% of variability in math achievement initially attributed to within-student factors, and 17% to teacher factors, were explained. There was a high positive correlation between performance at fall of third grade and growth rate during the K- fall of third grade period ($r = 0.85$), suggesting that students with faster growing rates in the early grades attained higher levels of achievement by the fall of third grade. Again, this trend was reversed during the fall of third to fifth grade period, resulting in a negative correlation with the third grade fall ($r = -0.77$).

Table 4.8(a)

ITBS/SAT9 Math Achievement

Fixed effects		Model 1		Model 2		Model 3		Model 4		Model 5	
		Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Third grade fall, π_{0jk}	Intercept, γ_{000}	-0.03 (0.04)	-0.81	0.15** (0.05)	3.32	-0.28*** (0.06)	-4.41	-0.14* (0.06)	-2.28	-0.16* (0.06)	-2.64
	White, γ_{010}					0.87*** (0.09)	9.37	0.87*** (0.09)	9.29	0.90*** (0.09)	9.65
	Hispanic, γ_{020}					0.004 (0.18)	0.02	0.05 (0.18)	0.26	0.08 (0.18)	0.47
	Other, γ_{030}					0.65*** (0.18)	3.52	0.65** (0.19)	3.47	0.69** (0.19)	3.69
Growth K- third grade fall, π_{1jk}	Intercept, γ_{100}			0.25*** (0.02)	14.25	0.19*** (0.02)	9.35	0.21*** (0.02)	10.01	0.20*** (0.02)	9.68
	White, γ_{110}					0.15*** (0.03)	4.53	0.14*** (0.03)	4.24	0.14*** (0.03)	4.45
	Hispanic, γ_{120}					0.03 (0.06)	0.51	0.04 (0.06)	0.62	0.04 (0.06)	0.70
	Other, γ_{130}					0.06 (0.07)	0.91	0.05 (0.07)	0.78	0.06 (0.07)	0.92
Growth third grade fall - fifth grade, π_{2jk}	Intercept, γ_{200}			-0.11*** (0.03)	-3.77	-0.03 (0.04)	-0.90	-0.05 (0.04)	-1.46	-0.04 (0.04)	-1.08
	White, γ_{210}					-0.19*** (0.05)	-3.48	-0.17** (0.05)	-3.15	-0.18** (0.05)	-3.31
	Hispanic, γ_{220}					-0.07 (0.11)	-0.63	-0.08 (0.11)	-0.69	-0.09 (0.11)	-0.79
	Other, γ_{230}					-0.06 (0.11)	-0.48	-0.03 (0.11)	-0.27	-0.04 (0.12)	-0.33

Model 1: Unconditional means Model 2: Unconditional growth Model 3: Time and BSI as predictors
Model 4: Time and conflict as predictors Model 5: Time and closeness as predictors; *$p<.05$; ** $p<.01$; **$p<.001$

Table 4.8(b)

ITBS/SAT9 Math Achievement

Fixed effects		Model 1		Model 2		Model 3		Model 4		Model 5	
		Coeff	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Rate of change, BSI π_{3jk}	Intercept, γ_{300}					-0.01*** (0.002)	-5.65				
Rate of change, conflict, π_{3jk}	Intercept, γ_{300}							0.06*** (0.01)	4.17		
Rate of change, closeness, π_{3jk}	Intercept, γ_{300}									0.04** (0.01)	2.87
Variance components		Estimates		Estimates		Estimates		Estimates		Estimates	
Within-student, σ^2		0.139		0.103		0.048		0.047		0.045	
Between-student, $\mathrm{var}\left(u_{00j}\right), \tau_{u00}$		0.400***		0.366***		0.521***		0.135***		0.546***	
Growth rate, K-3fall, $\mathrm{var}\left(u_{10j}\right), \tau_{u10}$						0.042***		0.042***		0.042***	
Growth rate, 3fall-5, $\mathrm{var}\left(u_{20j}\right), \tau_{u20}$						0.136***		0.542***		0.137***	
Teacher effect, $\mathrm{var}\left(v_{00k}\right), \tau_{v00}$		0.167***		0.024***		0.020***		0.020***		0.022***	
Model deviance		2041.16		1759.58		1397.73		1410.03		1418.79	
Model AIC		2049.16		1771.58		1439.73		1452.03		1460.79	
Model BIC		2069.03		1801.40		1544.08		1556.38		1565.13	
Model df		4		6		21		21		21	

Model 1: Unconditional means Model 2: Unconditional growth Model 3: Time and BSI as predictors
Model 4: Time and conflict as predictors Model 5: Time and closeness as predictors; *$p<.05$; ** $p<.01$; **$p<.001$

Table 4.8(c)

ITBS/SAT9 Math Achievement

Correlations	**Model 3**	**Model 4**	**Model 5**
Third grade fall and growth rate K-3fall, corr$\left(\pi_{0jk}, \pi_{1jk}\right)$	0.85	0.85	0.85
Third grade fall and growth rate 3fall-5, corr$\left(\pi_{0jk}, \pi_{2jk}\right)$	-0.77	-0.77	-0.77
Growth rate K-3fall and growth rate 3fall-5, corr$\left(\pi_{1jk}, \pi_{2jk}\right)$	-0.99	-0.99	-0.99

Model 1: Unconditional means Model 2: Unconditional growth Model 3: Time and BSI as predictors
Model 4: Time and conflict as predictors Model 5: Time and closeness as predictors; **p<.05;* ** *p<.01;* ***p<.001*

4.6 Student report card math achievement

Table 4.9 shows the estimates of the fixed effects and variance components for math achievement as reported in student report cards. Based on the likelihood ratio tests and the information criteria of AIC and BIC, model 3 best fits the data and is therefore preferred over models 1, and 2. While the level 1 and level 2 model equations are similar to equations 4.7 and 4.8., the combined equation for the model is as follows:

$$\text{Report card math achievement}_{ijk} = \gamma_{000} + \gamma_{100}\left(\text{Growth K-3fall}_{ijk}\right)$$

$$+\gamma_{200}\left(\text{Growth 3spring-5}_{ijk}\right)+\gamma_{300}\left(\text{BSI}_{ijk}\right)+\gamma_{400}\left(\text{Supprt}_{ijk}\right)+\gamma_{010}\left(\text{White}_{j}\right)$$

$$+\gamma_{020}\left(\text{Hispanic}_{j}\right)+\gamma_{030}\left(\text{Other}_{j}\right)+u_{00j}+u_{20j}*\left(\text{Growth 3spring-5}_{ijk}\right)$$

$$+v_{00k}+e_{ijk} \quad \text{...}(4.12)$$

where

γ_{000} is mean report card math achievement in the fall of third grade of an African American student with behavior misconduct;

γ_{100} is the average growth rate in report card math achievement during K-3fall;

γ_{200} is the average growth rate in report card math achievement during 3fall-5;

γ_{300} is the rate of change in report card math achievement due to behavior;

γ_{400} is the rate of change in report card math achievement due to teacher support;

γ_{010} is the difference in third grade fall between African American and White students;

γ_{020} is the difference in third grade fall between African American and Hispanic students;

γ_{030} is the difference in third grade fall between African American and Other students;

u_{00j} is the random effect associated with child j on report card math achievement, assumed normally distributed with mean 0 and variance $\tau_{u_{00}}$;

u_{20j} is the random effect associated with child j on math growth rate during 3fall-5 period, assumed normally distributed with mean 0 and variance $\tau_{u_{20}}$;

v_{00k} is the cumulative random teachers' effect on a student's report card math growth trajectory, assumed normally distributed with mean 0 and variance $\tau_{v_{00}}$;

e_{ijk} is the within student random effect assumed normally distributed with mean 0 and variance σ^2.

Model 1 appears to have underestimated the average math achievement of students, $\gamma_{000} = 0.35$ relative to model 3, $\gamma_{000} = 1.12$. The results in model 3 show that there were significant mean differences in math achievement associated with students' race. White and 'Other' students had higher scores than African American students but there were no significant differences in performance between African American and Hispanic students. This is the same order in performance evident in the standardized math achievement.

There were notable declines in students' learning rates during K-3fall (γ_{100} = -0.05, p<0.001) and fall of third and fifth grade, γ_{200} = -0.24, p<0.001. And, after taking into account growth rates and third grade fall, there were significant, albeit small, positive influences of teacher support while student behavioral conduct had a negative influence on report card math performance.

As predictors, time, BSI and teacher support explained considerable variance in students' report card math achievement. Time alone explained 21% of variance initially attributed to within-student factors i.e. the difference between models 1 and 2. By including BSI and teacher support (model 3), an additional 7%, 47%, and 18% of initial within student, between student teacher variance was explained.

Table 4.9

Student Report Card Math Achievement

Fixed effects		Model 1		Model 2		Model 3	
		Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Third grade fall, π_{0jk}	Intercept, γ_{000}	0.35*** (0.05)	6.92	0.52*** (0.06)	8.14	1.12*** (0.15)	7.40
	White, γ_{010}					0.6*** (0.06)	9.44
	Hispanic, γ_{020}					0.02 (0.11)	0.19
	Other, γ_{030}					0.57*** (0.13)	4.30
Growth K-third grade fall, π_{1jk}	Intercept, γ_{100}			-0.04 (0.02)	-1.54	-0.05* (0.02)	-2.32
Growth third fall - fifth grade, π_{2jk}	Intercept, γ_{200}			-0.27*** (0.04)	-6.26	-0.24*** (0.04)	-5.84
Rate of change, BSI, π_{3jk}	Intercept, γ_{300}					-0.02*** (0.003)	-6.59
Rate of change, support, π_{4jk}	Intercept, γ_{400}					0.06** (0.02)	2.67

Table 4.9 continued

Variance components	Estimates	Estimates	Estimates
Within-student, σ^2	0.234	0.184	0.171
Between-student, $\mathrm{var}\left(u_{00j}\right), \tau_{u00}$	0.449***	0.476***	0.252***
Growth rate, 3fall-5, $\mathrm{var}\left(u_{20j}\right), \tau_{u20}$			0.017***
Teacher effect, $\mathrm{var}\left(v_{00k}\right), \tau_{v00}$	0.265***	0.185***	0.152***
Model deviance	2418.31	2286.77	2082.44
Model AIC	2426.31	2298.77	2110.44
Model BIC	2446.18	2328.59	2180.00
Model df	4	6	14

Model 1: Unconditional means Model 2: Unconditional growth Model 3: Time, BSI and support as predictors; *$p<.05$;** $p<.01$; **$p<.001$

4.7 School satisfaction

Models 1, 2, and 3 in tables 4.10(a) and 4.10(b) give the fixed effects, variance components estimates and correlation coefficients for students' overall satisfaction with school. Based on the likelihood ratio tests and the information criteria of AIC and BIC, model 3 best fits the data and is therefore preferred over models 1, and 2. Level 1 and level 2 model equations are similar to equations 4.7 and 4.8. The combined equation for model 3 is as follows:

$$\text{School satisfaction}_{ijk} = \gamma_{000} + \gamma_{100}\left(\text{Growth K-3fall}_{ijk}\right) + \gamma_{200}\left(\text{Growth 3spring-5}_{ijk}\right)$$

$$+\gamma_{300}\left(\text{Support}_{ijk}\right) + u_{00j} + u_{10j} * \left(\text{Growth K-3fall}_{ijk}\right) +$$

$$u_{20j} * \left(\text{Growth 3spring-5}_{ijk}\right) + u_{30j} * \left(\text{Support}_{ijk}\right) + v_{00k} + e_{ijk} \text{......................(4.13)}$$

where

γ_{000} is mean school satisfaction in the fall of third grade of an African American

student with behavior misconduct;

γ_{100} is the average growth rate in school satisfaction during K-3fall;

γ_{200} is the average growth rate in school satisfaction during 3fall-5;

γ_{300} is the rate of change in school satisfaction due to behavior;

γ_{300} is the rate of change in school satisfaction due to teacher support;

u_{00j} is the random effect associated with child j on school satisfaction, assumed normally distributed with mean 0 and variance $\tau_{u_{00}}$;

u_{10j} is the random effect associated with child j on school satisfaction growth rate during K-3fall period, assumed normally distributed with mean 0 and variance $\tau_{u_{10}}$;

u_{20j} is the random effect associated with child j on school satisfaction growth rate during 3fall-5 period, assumed normally distributed with mean 0 and variance $\tau_{u_{20}}$;

u_{30j} is the random effect associated with child j on school satisfaction growth rate due to teacher support, assumed normally distributed with mean 0 and variance $\tau_{u_{30}}$;

v_{00k} is the cumulative random teachers' effect on a student's school satisfaction growth trajectory, assumed normally distributed with mean 0 and variance $\tau_{v_{00}}$;

e_{ijk} is the within student random effect assumed normally distributed with mean 0 and variance σ^2.

The results show that students' mean school satisfaction is not significantly different from zero. Also, there was no evidence of significant change in school satisfaction during the early years of schooling ($\gamma_{100} = 0.02$, $p>0.05$). However, later years were characterized with a significant, albeit small, decline in school satisfaction, $\gamma_{200} = -0.09$, $p<0.05$.

School satisfaction does not vary with race or gender of student, nor the interaction of student variables (race and gender) and teacher variables (conflict, closeness and support). Also, students' behavior did not influence it. The main factor that seems to be influential is teacher support. That is, the greater the level of teacher support, the greater the level of school satisfaction, holding all other things constant, $\gamma_{300} = -0.38$, $p<0.001$.

By including time and teacher support as predictors considerable variance in school satisfaction initially attributed to within student, between student, and teacher factors was explained. Model 3 resulted in the explanation of an additional 21% within student variance, 16% between student variance, and 67% teacher variance. Although growth rate during K-3fall was not statistically significant, significant variance components ($\tau_{u_{00}} = 0.40$, $p<0.001$ and $\tau_{u_{10}} = 0.03$, $p<0.05$) suggest that individual student growth trajectories vary. In addition, students' growth trajectories are different during later years of schooling, as well as due to varying levels of teacher support.

Correlation coefficients in table 4.8(b) indicate a moderate to strong positive correlation between third grade fall and growth rate during K-3fall period, $r = 0.75$. This means that students with faster growth rates during K-3fall period attained higher levels of school satisfaction by the fall of third grade compared to their counterparts. However, higher levels of school satisfaction at the fall of third grade were moderately associated with declining growth rates during fall-5 period, $r = 0.60$. While increased teacher support was positively (albeit small correlation coefficients) related to high levels of school satisfaction at third grade fall ($r = 0.27$), and improvement in school satisfaction during K-3fall period (r = 0.28), it was associated with a decline in satisfaction growth rated during 3fall-5 period.

Table 4.10(a)

School Satisfaction

Fixed effects		Model 1		Model 2		Model 3	
		Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Third grade fall, π_{0jk}	Intercept, γ_{000}	-0.04 (0.05)	-0.91	0.06 (0.07)	0.93	0.06 (0.06)	1.08
Growth K- third grade fall, π_{1jk}	Intercept, γ_{100}			0.03 (0.03)	1.04	0.02 (0.02)	1.04
Growth third grade fall - fifth grade, π_{2jk}	Intercept, γ_{200}			-0.09* (0.04)	-2.03	-0.09* (0.04)	-2.28
Teacher support, π_{3jk}	Intercept, γ_{300}					0.38*** (0.03)	11.80
Variance components		Estimates		Estimates		Estimates	
Within-student, σ^2		0.459		0.458		0.364	
Between-student, $\mathrm{var}\left(u_{00j}\right), \tau_{u00}$		0.474^{***}		0.478^{***}		0.401^{***}	
Growth rate, K-3fall, $\mathrm{var}\left(u_{10j}\right), \tau_{u10}$						0.031^{*}	
Growth rate, 3fall-5, $\mathrm{var}\left(u_{20j}\right), \tau_{u20}$						0.062^{**}	
Growth rate, support, $\mathrm{var}\left(u_{30j}\right), \tau_{u30}$						0.071^{*}	
Teacher effect, $\mathrm{var}\left(v_{00k}\right), \tau_{v00}$		0.022^{***}		0.015^{**}		0.005	

Model 1: Unconditional means Model 2: Unconditional growth Model 3: Time and support as predictors

*$p<.05$; ** $p<.01$; **$p<.001$

Table 4.10(b)

School Satisfaction

Correlations			Estimates
Third grade fall and growth rate K-3fall, corr$\left(\pi_{0jk}, \pi_{1jk}\right)$			0.75
Third grade fall and growth rate 3fall-5, corr$\left(\pi_{0jk}, \pi_{2jk}\right)$			-0.60
Third grade fall and teacher support, corr$\left(\pi_{0jk}, \pi_{3jk}\right)$			0.27
Growth rate K-3fall and growth rate 3fall-5, corr$\left(\pi_{1jk}, \pi_{2jk}\right)$			-0.96
Growth rate K-3fall and support, corr$\left(\pi_{1jk}, \pi_{3jk}\right)$			0.28
Growth rate 3fall-5 and support, corr$\left(\pi_{2jk}, \pi_{3jk}\right)$			-0.18
Model deviance	2799.79	2794.09	2588.72
Model AIC	2807.79	2806.09	2620.72
Model BIC	2827.67	2835.90	2700.22
Model df	4	6	16

Model 1: Unconditional means Model 2: Unconditional growth Model 3: Time and support as predictors

4.8 Classroom adjustment

Models 1, 2, 3, 4 and 5 in tables 4.11(a) and 4.11(b) show the fixed effects and variance component estimates on modeling students' classroom adjustment. Of the five, models 4 and 5 fit the data equally well, based on likelihood ratio tests and information criteria of AIC and BIC statistics. However, slightly more variability in classroom adjustment is explained in model 4 although there are no substantive differences in the magnitudes of parameter estimates as well as their statistical significance. Nonetheless, the results from model 3 are used in the discussion that follows, since it fits the data better.

Level 1 and level 2 equations for modeling classroom adjustment are expressed as outlined by equations 4.7 and 4.8. Similar to equation 4.9, the combined equation for the final model is expressed as follows:

$$\text{Classroom adjustment}_{ijk} = \gamma_{000} + \gamma_{100}\left(\text{Growth K-3fall}_{ijk}\right) + \gamma_{200}\left(\text{Growth 3spring-5}_{ijk}\right)$$

$$+\gamma_{300}\left(\text{BSI}_{ijk}\right) + \gamma_{010}\left(\text{Male}_{j}\right) + \gamma_{020}\left(\text{White}_{j}\right) + \gamma_{030}\left(\text{Hispanic}_{j}\right) + \gamma_{040}\left(\text{Other}_{j}\right)$$

$$+u_{00j} + v_{00k} + e_{ijk} \quad \text{(4.14)}$$

where

γ_{000} is mean classroom adjustment score in the fall of third grade of an African American female student with behavior misconduct;

γ_{100} is the average growth rate classroom adjustment during K-3fall;

γ_{200} is the average growth rate in classroom adjustment during 3fall-5;

γ_{300} is the rate of change in classroom adjustment due to behavior;

γ_{010} is the difference in third grade fall between male and female students;

γ_{020} is the difference in third grade fall between African American and White students;

γ_{030} is the difference in third grade fall between African American and Hispanic students;

γ_{040} is the difference in third grade fall between African American and Other students;

u_{00j} is the random effect associated with child j on classroom adjustment, assumed normally distributed with mean 0 and variance $\tau_{u_{00}}$;

v_{00k} is the cumulative random teachers' effect on a student's classroom adjustment growth trajectory, assumed normally distributed with mean 0 and variance $\tau_{v_{00}}$;

e_{ijk} is the within student random effect assumed normally distributed with mean 0 and variance σ^2.

The results show that mean classroom adjustment scores at the fall of third grade were significantly different from zero, and that there were significant differences due to student race and gender. Compared to African American students, White and Other students had considerably higher average scores of classroom adjustment. There were no significant differences in adjustment between African American and Hispanic students. The results also show that in general male students have higher classroom adjustment scores than their female counterparts, $\gamma_{010}=1.28$, $p<0.01$.

By adding time, student race, student gender and student behavior as predictors of classroom adjustment (model 3), there were notable decreases in the model variance components. While within student variance decreased by 19%, between student variance decreased by 65%, and teacher variance decreased by 17%.

Table 4.11(a)

Classroom Adjustment

Fixed effects		Model 1		Model 2		Model 3		Model 4		Model 5	
		Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
Third grade fall, π_{0jk}	Intercept, γ_{000}	5.49*** (0.06)	28.16	5.80*** (0.08)	21.03	11.48*** (0.09)	26.43	13.31*** (0.09)	29.10	11.49*** (0.09)	26.00
	Male, γ_{010}					1.24** (0.06)	3.34	1.28** (0.07)	3.84	1.24** (0.07)	3.29
	White, γ_{020}					0.56*** (0.08)	-7.82	0.54*** (0.08)	-8.13	0.55*** (0.08)	-7.97
	Hispanic, γ_{030}					1.06 (0.13)	0.48	1.05 (0.13)	0.39	1.07 (0.13)	0.51
	Other, γ_{040}					0.71** (0.16)	-2.16	0.67** (0.16)	-2.51	0.72* (0.16)	-2.08
Growth K- third grade fall, π_{1jk}	Intercept, γ_{100}			1.03 (0.03)	0.93	1.04 (0.03)	1.54	1.06* (0.03)	2.07	1.04 (0.03)	1.50
Growth third grade fall - fifth grade, π_{2jk}	Intercept, γ_{200}			0.95 (0.05)	-0.89	0.94 (0.05)	-1.45	0.91* (0.05)	-2.01	0.95 (0.05)	-1.20
Rate of change, BSI, π_{3jk}	Intercept, γ_{300}					1.05*** (0.004)	11.66	1.06*** (0.003)	16.19	1.05*** (0.004)	11.83

Model 1: Unconditional means Model 2: Unconditional growth Model 3: Time, BSI, closeness and conflict as predictors
Model 4: Time, BSI and closeness as predictors Model 5: Time, BSI and conflict as predictors
*$p<.05$; ** $p<.01$; **$p<.001$

Table 4.11(b)

Classroom Adjustment

Fixed effects		**Model 1**		**Model 2**		**Model 3**		**Model 4**		**Model 5**	
		Coeff	t-ratio	Coeff	t-ratio	Coeff	t-ratio	Coeff	t-ratio	Coeff	t-ratio
Rate of change, closeness, π_{4jk}	Intercept, γ_{400}					0.84*** (0.03)	-5.20	0.78*** (0.03)	-8.28		
Rate of change, conflict, π_{5jk}	Intercept, γ_{500}					0.82*** (0.04)	-5.13			0.75*** (0.03)	-8.24
Variance components		Estimates		Estimates		Estimates		Estimates		Estimates	
Within-student, σ^2		0.400		0.399		0.326		0.338		0.335	
Between-student, var $\left(u_{00j}\right), \tau_{u00}$		0.984^{***}		0.985^{***}		0.347^{***}		0.346^{***}		0.349^{***}	
Teacher effect, var $\left(v_{00k}\right), \tau_{v00}$		0.070^{***}		0.070^{**}		0.058^{***}		0.061^{***}		0.067^{***}	
Model deviance		3027.54		3026.63		2480.17		2506.07		2506.64	
Model AIC		3035.54		3038.64		2506.17		2530.07		2530.64	
Model BIC		3055.42		3068.45		2570.76		2589.70		2590.27	
Model df		4		6		13		12		12	

Model 1: Unconditional means Model 2: Unconditional growth Model 3: Time, BSI, closeness and conflict as predictors
Model 4: Time, BSI and closeness as predictors Model 5: Time, BSI and conflict as predictors
*$p<.05$; ** $p<.01$; **$p<.001$

CHAPTER FIVE

DISCUSSION AND CONCLUSION

5.1 Introduction

This chapter synthesizes the study's findings in light of existing literature, discusses its limitations and gives implications for practice and suggestions for possible future research. The discussion is organized broadly under the performance measures topics of academic achievement on one hand and classroom room adjustment and school adjustment on the other. These topics are covered in Section 5.2 and 5.3, respectively, while Section 5.4 highlights the limitations of the study and Section 5.5 presents suggestions for future research.

5.2 Academic achievement

Students' academic achievement was influenced by both student factors and teacher factors. For reading/language and mathematics, irrespective of whether it was standardized (ITBS/SAT9) testing or report card scores, student's race was an important predictor of performance. This finding is in line with what other researchers have found (Cheadle, 2005; Irvine, 1986; Newell, 2007; Perez-Johnson, 2008; Riordan, 2002; Rippeyoung, 2006). By the fall of third grade, African American and Hispanic students performed equivalently in reading/language and mathematics. However, White and Other students consistently outperformed African American students in both subjects. Other students were primarily of Asian American descent. Existing research suggests that most

Asian American parents, relative to other races, instill in their children the traditional ethic of hard work and a clear sense of the association between success and hard work (Begum, 2007; Cheadle, 2005; Kim, 2008; Sy, 2002). It is possible then that these children come to class more prepared and employ themselves in their work more than students of other races. Consequently, such disposition to academic work results in high academic achievement. The attainment gap between White and African American students is one that has received considerable attention. Several researchers have suggested possible reasons for these differences. Some explanations put forth for the differences include differences in family structure and socio-economic status (Brooks-Gunn & Duncan, 1997; Mayer, 1997), differential teacher's perceptions and/ or racial bias in testing (Delpit, 1995; Ferguson, 1998), and differences in socialization, culture or behavior (Fordham & Ogbu, 1986). Any of these reasons are plausible explanations for the achievement gaps in this study.

Student gender proved an influential factor only for report card reading/language attainment at the fall of third grade. Female students performed significantly better than their male counterparts. Some researchers have suggested that this is the case because often times boys have tended to learn to read at an older age than girls. Also, boys have been thought to take longer to learn, with greater difficulties in comprehending narrative texts (Simpson, 1996; Smith & Wilhelm, 2002).

Over time, students' academic growth trajectories were varied. In general, students' performance improved during the early years of schooling (K-3fall) but declined during the later years, i.e. 3fall-5 period. From the ITBS/SAT results in reading/language and mathematics, students' rates of improvement varied by race during

K-3fall period. Although all students exhibited an overall improvement in learning, the rates for White students were significantly higher than those of African American students. This is possibly due to the oft advanced notion that the mainstream culture in schools is very similar to what most White students are exposed to at home and quite different from the live experiences of most African American students (Delpit, 1995; Kohl, 1994; Ogbu, 1983).

During the 3fall-5 period, there was a general decline in the students' growth trajectories in both reading/language and mathematics. Although there were no racial differences on report card scores, there were significant ones in standardized reading/language and math scores. In both subjects, the decline for White students was much higher than that of African American students. A possible explanation for the decreased performance is that during this period, possibly the *fourth-grade slump* in reading may have occurred (Chall, October, 1988; Chall & Jacobs, Spring, 2003). The reading slump is premised on the change in academic language needed for reading grade-level content material. From around fourth grade, there is a shift in reading from *learning to read* to *reading to learn* often characterized by more extensive vocabulary and heavier content load (Coles, October 23, 2007). As such, this shift often leads to decreased performance since most students are unprepared for the cognitive demands of the work. Another possible explanation for such a decline is that, during third to fifth grade, children are becoming older and beginning to have behavioral problems that have a negative impact on their learning.

Teacher-student relationships and teacher support had small effects on students' performance. None of them explained academic attainment in standardized reading/language or mathematics. However, decreased conflictual relationships with teachers led to increased performance in report card reading achievement, while increased teacher support was linked to increased report card math attainment. This is not surprising. It is in agreement with what other researchers have found, i.e. that students who get support from their teachers perform better than those that do not (Baker, 1999; Hughes, Cavell, & Willson, 2001; Meehan, Hughes, & Cavell, 2003). Also, students with high levels of behavioral misconduct tended to perform poorly. Again, this is not out of the norm. Conventional wisdom would lead to the conclusion that children who exhibit disruptive behavior and are socially maladjusted often have a difficult time benefitting from instructional processes. This then results in poor student outcomes, and in this case, decreased achievement in reading/language and mathematics.

5.3 Classroom adjustment and school satisfaction

The results show that there were significant differences in classroom adjustment among students of different races and gender, at the fall of third grade. Overall, White and Other students had higher classroom adjustment scores relative to their African American counterparts. Also, male students had higher classroom adjustment scores than their female counterparts. Over time, levels of adjustment increased. This suggests that the longer students spent time in school, the better adjusted they became with classroom routines. It was surprising though that teacher support, teacher-student closeness or teacher-student conflict did not impact student's sense of adjustment. This is especially so given that some studies have found these relationships significant (Pianta, Steinberg, & Rollins, 1995; Van den Oord & Van Rossem, 2002).

From the results there were no significant differences in school satisfaction among the students. Also, unlike in reading and math achievement or classroom adjustment, school satisfaction does not vary with race or gender of the students. The main factor that seems to influence school satisfaction is teacher support. That is, the greater the level of teacher support, the greater the level of school satisfaction, holding all other things constant. This finding is logical. Because students' main interaction with school is with their teachers, if they feel well supported by these teachers then they can be expected to be generally content with their school experiences and consequently report that they are satisfied. Although students' satisfaction increased during K-3fall period, it significantly declined during 3fall-5 period. The decline is possibly due to the fact that as students mature into their adolescence, they face newer challenges that may cause them to be disgruntled with school. For instance, increased peer pressure and need for peer and adult acceptance are heightened (Hughes & Kwok, 2006; Kohl, 1994). Along with these, students experience increased isolation and feelings of inadequacy (Kohl, 1994). Taken together, these two situations would easily create an environment of dissatisfaction.

5.4 Limitations of the study

This study had some limitations. First, the measures used did not collect information on student's home/family variables such as level of education of parents, whether or not a child came from a single or two parent family background, level of parental involvement, parenting practices and a child's involvement in enrichment activities in and out of the home environment. Among others, these factors have been found to be important predictors and contributors to a child's academic achievement and social adjustment (Begum, 2007; Cheadle, 2005; Lareau, 2003).

Second, the student sample is a purposive sample; schools with large percentages of racial minority students, large proportions of students on free or reduced lunch, and low on-time and overall graduation rates. While this sample helps us study an important population of students, inferences cannot be generalized to the population of students in US schools.

Third, a majority of the students (56%) were of African American descent whereas teachers were primarily Caucasian (62%)[7]. Furthermore, 96% of the teachers were female. Previous studies have suggested that the race and gender of a teacher vis-à-vis that of the student is an important factor in explaining variability in student performance (Irvine, 1986; Pigott & Cowen, 2000). This study was unable to test this hypothesis.

Fourth, the study used data from teacher and student self-reports, with no data from other sources, such as independent observers in the classrooms, to corroborate the self-reported information. Self-reports are potentially susceptible to social desirability response bias (Arnold & Feldman, 1981). In this case, teachers and/ or students may have, for instance, overstated the quality of their relationships in order to present themselves in favorable light. This begs the need for caution in interpreting the results.

Fifth, several studies have linked student performance to school factors besides teachers. Characteristics such as school culture and climate, student-teacher ratios and leadership styles of administrators have been found to influence student performance (Baker et al., 2003; Danielsen, Samdal, Hetland, & Wold, 2009; Sweetland & Wayne,

[7] Eighteen teachers (26.5%) did not indicate their race

2000; Tian & Gilman 2009). Additionally, these factors may influence the nature and quality of teacher – student relationships, one of the foci of this study. Unfortunately, the study did not collect data on such school variables and were therefore not included in the analyses.

5.5 Implications for practice and future research

Teacher support and decreased conflictual relationships between teachers and students was related to students' academic performance. This finding has implications in the practice of teaching and also in the preparation of student teachers for their profession. Ideally, since teachers are the adults in schools, students look to them for guidance, and often times view them as role models. Consequently, it is important that they (teachers) are conscious of this power that they wield and use it in ways that are beneficial to their students. One such manner, in light of the study's finding, would be for the teachers to be aware of the nature of the relationships they have with their students and be deliberate at cultivating positive, less conflictual and supportive relationships with them. Several studies document that (most) teachers and student teachers care about their students and their work, an aspect manifested in myriad ways. However, one way that such 'caring' could be translated into meaningful and tangible outcomes would be for teachers to actively and deliberately pursue positive relationships with their students thus affecting students' performance.

Results from this study showed differential learning rates in math and reading/language achievement associated with student race. This finding of White-Black achievement gap is not new, and has received considerable attention. However, further research needs to be done to examine specifically the reasons for positive trajectories during K-3fall period, which are followed by negative trajectories during 3fall-5 period. Also, race and socio-economic status were confounded in this study, and thus it would be worthwhile to situate a similar study in more economically diverse schools.

APPENDIX

Table 12

Illustration of data i.e. measurements nested in cross-classification of teachers and students

	Student 1: Complete data						**Student 2: Incomplete data, dropped out**						**Student 3: Incomplete data , matured**					
Measurement occasion	*1*	*2*	*3*	*4*	*5*	*6*	*1*	*2*	*3*	*4*	*5*	*6*	*1*	*2*	*3*	*4*	*5*	*6*
Kindergarten Teacher	X	X																
First Grade Teacher			X	X														
Second Grade Teacher					X	X	X	X										
Third Grade Teacher									X	X								
Fourth Grade Teacher													X	X				
Fifth Grade Teacher															X	X		

Table 13

Sample questions from students' survey, fourth and fifth grade.

	Never	**Sometimes**	**Often**	**Almost always**
We have worked together in my class to help others who really need help like the homeless	a	b	c	d
Our teacher is always joking with us and having fun with us	a	b	c	d
I can talk to my classmates and teacher about my family and my feelings	a	b	c	d
It is easy to make friends in my classroom, and everyone seems to have friends	a	b	c	d

Table 14

Sample questions from Student-Teacher Relationship Scale.

Please reflect on the degree to which each of the following statements currently applies to your relationship with this student. Please "bubble in" one response for each item on the scantron sheet.

	Definitely not	*Not really*	*Neutral*	*Applies somewhat*	*Definitely does*
I share an affectionate relationship with this child	1	2	3	4	5
This child and I seem to frequently struggle with each other	1	2	3	4	5
This child feels that I treat him/her fairly	1	2	3	4	5
I often feel myself becoming frustrated with this child	1	2	3	4	5
This child accepts help from me when I offer it	1	2	3	4	5
It is easy to joke and have fun with this child	1	2	3	4	5
Dealing with this child drains my energy	1	2	3	4	5
Despite my best efforts, I am uncomfortable with how this child and I have gotten along	1	2	3	4	5
This child openly shares his/her feelings and experiences with me	1	2	3	4	5

Table 15

Sample questions from Behavior Assessment System for Children.

Please mark every item. If you don't know or are unsure, give your best estimate, based on your observations. A "Never" response does not mean that a child "never" engages in the behavior, only that you have not observed the child to behave that way. If you wish to change an answer, erase the first answer completely, then mark your new answer. **(N=Never, S=Sometimes, O=Often, A=Always)**

Adjusts well to new teachers	N	S	O	A
Argues when denied own way	N	S	O	A
Bites nails	N	S	O	A
Gives up easily when learning something new	N	S	O	A
Stares blankly	N	S	O	A
Shows a lack of concern for others' feelings	N	S	O	A
Stays disappointed a long time if a favorite activity is cancelled	N	S	O	A

1.	**Yes**	**Sometimes**	**No**	The kids in my class help each other.
2.	Yes	Sometimes	No	My teacher listens to me.
3.	Yes	Sometimes	No	Kids in my class laugh when I mess up.
4.	Yes	Sometimes	No	There are mean kids in my class.
5.	Yes	Sometimes	No	Kids say "thank you" in my room.
6.	Yes	Sometimes	No	My class is a really fun place to be.

Figure 1. Sample questions from students' survey, grades K-3.

Items 1-19 are scored as follows

	1	Never
	2	Not Usually
	3	Sometimes
	4	Often
	5	Always
1	Academic achievement for this student is appropriate for age	
2	This student is able to begin and complete classroom tasks	
3	This student is alert and attentive to classroom proceedings	
4	This attention span for this student is appropriate for age	
5	This student completes his/her work on time	
6	This student is eager and enthusiastic about classroom activities	
7	This student enjoys schoolwork	
8	This student follows directions	
9	This student willingly participates in classroom activities	

Figure 2. Sample items from the Teachable Pupil Survey.

Teachers are patient with students who progress slowly due to a disability or lack of discipline

Cooperative learning is routinely used to build character and social skills, and to promote learning.

There is a free exchange of ideas and opinions among teachers.

Teachers are encouraged by fellow teachers to develop their knowledge and skills.

Teachers are friendly and affectionate toward students.

Students respectfully correct peers who are unfair, impatient, selfish, destructive, or hurtful.

Teachers and counselors encourage students to think about and plan for their future.

Figure 3. Sample questions from Vessels School Climate Survey.

REFRENCES

Alexander, K. L., Entwisle, D. R., Blyth, D. A., & McAdoo, H. P. (1988). Achievement in the first 2 Years of school: Patterns and processes. *Monographs of the Society for Research in Child Development, 53*(2), i-157.

Arnold, H. J., & Feldman, D. C. (1981). Social desirability response bias in self-report choice situations. *Academy of Management Journal, 24*, 377-385.

Baker, J. A. (1998). The social context of school satisfaction among urban, low-income, African-American students. *School Psychology Quarterly, 13*(1), 25-44.

Baker, J. A. (1999). Teacher-student interaction in urban at-risk classrooms: differential behavior, relationship quality, and student satisfaction with school. *The Elementary School Journal, 100*(1), 57-70.

Baker, J. A., Dilly, L. J., Aupperlee, J. L., & Patil, S. A. (2003). The developmental context of school satisfaction: Schools as psychologically healthy environments. *School Psychology Quarterly, 18*(2), 206-221.

Battistich, V., Schaps, E., & Wilson, N. (2004). Effects of an elementary school intervention on students' "connectedness" to school and social adjustment during middle school. *Journal of Primary Prevention, 24*(3), 242-262.

Begum, N. N. (2007). *Effect of parent involvement on math and reading achievement of young children: Evidence from the Early Childhood Longitudinal Study.* Unpublished Ed.D., Indiana University of Pennsylvania, United States -- Pennsylvania.

Birch, S. H., & Ladd, G. W. (1997). The teacher-child relationship and children's early school adjustment. *Journal of School Psychology, 35*(1), 61-79.

Birch, S. H., & Ladd, G. W. (1998). Children's interpersonal behaviors and the teacher-child relationship. *Developmental Psychology, 34*(5), 934-946.

Bowlby, J. (1982). *Attachment and loss* (Vol. 1). New York, NY: Basic Books.

Brooks-Gunn, J., & Duncan, G. J. (1997). *The consequences of growing up poor*. New York, NY: Russell Sage.

Campbell, B. V. (2006). *Parental involvement as an explanation of mathematics and reading achievement in kindergartners.* Unpublished Ph.D., North Carolina State University, United States -- North Carolina.

Chall, J. S. (October, 1988). Climbing out of the fourth grade reading slump. *Instructor*, 15-16.

Chall, J. S., & Jacobs, V. A. (Spring, 2003). Poor children's fourth-grade slump. *American Educator*. Retrieved from http://www.aft.org/pubs-reports/american_educator/spring2003/chall.html

Cheadle, J. E. (2005). *The role of "concerted cultivation" in childhood academic achievement growth processes: Class and race differences from kindergarten through third grade.* Unpublished Ph.D., The Pennsylvania State University, United States -- Pennsylvania.

Coles, G. (October 23, 2007). The 4th grade slump: What's wrong with the brains of slumping children. *District Administration*

Danielsen, A. G., Samdal, O., Hetland, J., & Wold, B. (2009). School-related social support and students' perceived life satisfaction. *The Journal of Educational Research, 102*(4), 303(316).

Delpit, L. D. (1988). The silenced dialogue: Power and pedagogy in educating other people's children. *Harvard Educational Review, 58*(3), 280-298.

Delpit, L. D. (1995). *Other people's children: Cultural conflict in the classroom.* New York, NY: The New Press.

Entwisle, D. R., & Hayduk, L. A. (1988). Lasting effects of elementary school. *Sociology of Education, 61*(3), 147-159.

Felner, R. D., Jackson, A. W., Kasak, D., Mulhall, P., Brand, S., & Flowers, N. (1997). The impact of school reform for the middle years: longitudinal study of a network engaged in Turning Points-based comprehensive school transformation. *Phi Delta Kappan, 78*, 528-532.

Ferguson, R. F. (1998). Teachers' perceptions and expectations and the Black-White test score gap. In C. Jencks & M. Phillips (Eds.), *The Black-White test score gap.* Washington, DC: The Brookings Institute.

Fordham, S., & Ogbu, J. (1986). Black students' school successes: Coping with the burden of acting white. *The Urban Review, 18*(3), 176–206.

Goldstein, H. (1994). Multilevel cross-classified models. *Sociological Methods Research, 22*(3), 364-375.

Goodenow, C., & Grady, K. E. (1993). The relationship of school belonging and friends' values to academic motivation among urban adolescent students. *Journal of Experimental Education, 62*.

Hamre, B. K., & Pianta, R. C. (2001). Early teacher-child relationships and the trajectory of children's school outcomes through eighth grade. *Child Development, 72*(2), 625-638.

Henricsson, L., & Rydell, A.-M. (2004). Elementary school children with behavior problems: Teacher-child relations and self-perception. A prospective study. *Merrill-Palmer Quarterly, 50*(2), 111(128).

Hoffmann, D. A. (1997). An overview of the logic and rationale of hierarchical linear models. *Journal of Management, 23*(6), 723-744.

Horwitz, S. M., Bility, K. M., Plichta, S. B., Leaf, P. J., & Haynes, N. (1998). Teacher assessments of children's behavioral disorders: Demographic correlates. *American Journal of Orthopsychiatry, 68*, 117-125.

Hox, J. (2002). *Multilevel analysis: Techniques and applications*. Mahwah, NJ: Lawrence Erlbaum Associates.

Huebner, S. E. (1994). Preliminary development and validation of a multidimensional life satisfaction scale for children. *Psychological Assessment, 6*, 149-158.

Hughes, J. N., Cavell, T. A., & Jackson, T. (1999). Influence of the teacher-student relationship on childhood conduct problems: A prospective study. *Journal of Clinical Child & Adolescent Psychology, 28*(2), 173 - 184.

Hughes, J. N., Cavell, T. A., & Willson, V. (2001). Further support for the developmental significance of the quality of the teacher–student relationship *Journal of School Psychology, 39*(4), 289-301.

Hughes, J. N., Gleason, K. A., & Zhang, D. (2005). Relationship influences on teachers' perceptions of academic competence in academically at-risk minority and majority first grade students. *Journal of School Psychology, 43*(4), 303-320.

Hughes, J. N., & Kwok, O. (2006). Classroom engagement mediates the effect of teacher–student support on elementary students' peer acceptance: A prospective analysis. *Journal of School Psychology, 43*, 465-480.

Irvine, J. J. (1986). Teacher-student interactions: Effect of student race, sex, and grade level. *Journal of Educational Psychology, 78*, 14-21.

Johnson, D. W., Johnson, R. T., & Anderson, D. (1983). Social interdependence and classroom climate. *Journal of Psychology, 114*, 435-442.

Kim, J.-Y. (2008). *The academic achievement and social emotional development of third grade Asian-American children: An exploratory study.* Unpublished Psy.D., Azusa Pacific University, United States -- California.

Klem, A. M., & Connell, J. P. (2004). Relationships matter: Linking teacher support to student engagement and achievement. *Journal of School Health, 74*(7), 262-273.

Kohl, H. (1994). *I won't learn from you: And other thoughts on creative maladjustment*. New York, NY: The New Press.

Kornblau, B. (1982). The teachable pupil survey: A technique for assessing teachers' perceptions of pupil attributes. *Psychology in the Schools, 19*(2), 170-174.

Ladd, G. W., & Burgess, K. B. (2001). Do relational risks and protective factors moderate the linkages between childhood aggression and early psychological and school adjustment? *Child Development, 72*(5), 1579-1601.

Lareau, A. (2003). *Unequal childhoods: Class, race, and family life*. Berkeley and Los Angeles, CA: University of California Press.

Luke, D. A. (2004). *Multilevel modeling*. Thousand Oaks, CA: Sage Publications, Inc.

Mayer, S. E. (1997). *What money can't buy: Family income and children's life chances*. Boston, MA: Harvard University Press.

Meehan, B. T., Hughes, J. N., & Cavell, T. A. (2003). Teacher-student relationships as compensatory resources for aggressive children. *Child Development, 74*(4), 1145-1157.

Midgley, C., Feldlaufer, H., & Eccles, J. S. (1989). Student/teacher relations and attitudes toward mathematics before and after the transition to junior high school. *Child Development, 60*, 981-992.

Newell, S. A. (2007). *Factors associated with reading achievement of fifth grade special education students in a regional and a national setting*. Unpublished Ed.D., The University of Southern Mississippi, United States -- Mississippi.

O'Neal, D. H., O'Neal, M. S., Short, M. L., Holmes, C. T., Brown, C. L., DeWeese, L. S., et al. (1987). *Monographs in education: Improving school climate* (Vol. 3). Athens: The University of Georgia.

Ogbu, J. U. (1983). Minority status and schooling in plural societies. *Comparative Education Review, 27*(2), 168-190.

Osborne, J. W. (2000). Advantages of hierarchical linear modeling. *Practical Assessment, Research & Evaluation, 7*(1).

Perez-Johnson, I. L. (2008). *Parsing Hispanic-White achievement gaps: The influence of individual, family, and school factors on Mathematics achievement differences in* *the elementary grades.* Unpublished Ph.D., University of Pennsylvania, United States -- Pennsylvania.

Pianta, R. C. (1992). Student-Teacher Relationship Scale. University of Virginia.

Pianta, R. C. (1994). Patterns of relationships between children and kindergarten teachers. *Journal of School Psychology, 32*(1), 15-31.

Pianta, R. C. (1999). *Enhancing relationships between children and teachers* (1 ed.). Washington, DC: American Psychological Association.

Pianta, R. C., & Nimetz, S. L. (1991). Relationships between children and teachers: Associations with classroom and home behavior. *Journal of Applied Developmental Psychology, 12*(3), 379-393.

Pianta, R. C., Steinberg, M. S., & Rollins, K. B. (1995). The first two years of school: Teacher-child relationships and deflections in children's classroom adjustment. *Development and Psychopathology, 7*(02), 295-312.

Pianta, R. C., & Stuhlman, M. W. (2004). Teacher-child relationships and children's success in the first years of school. *School Psychology Review, 33*(3), 444-458.

Pigott, R. L., & Cowen, E. L. (2000). Teacher race, child race, racial congruence, and teacher ratings of children's school adjustment. *Journal of School Psychology, 38*(2), 177-196.

Rasbash, J., & Goldstein, H. (1994). Efficient analysis of mixed hierarchical and cross-classified random structures using a multilevel model. *Journal of Educational and Behavioral Statistics, 19*(4), 337-350.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2 ed.). Thousand Oaks, CA: Sage Publications.

Raudenbush, S. W., Bryk, A. S., Cheong, Y. F., Congdon, R., & Toit, M. d. (2004). HLM6: Hierarchical linear and nonlinear modeling. Lincolnwood, IL: Scientific Software International, Inc.

Reynolds, C. R., & Kamphaus, R. W. (1992). *Behaviour Assessment System for Children Manual.* Circle Pines, MN: American Guidance Service.

Riordan, K. E. (2002). *Racial and socioeconomic gaps in children's school readiness.* Unpublished Ph.D., The Pennsylvania State University, United States -- Pennsylvania.

Rippeyoung, P. L. F. (2006). *Is it too late baby? Pinpointing the emergence of a Black-White test score gap in infancy.* Unpublished Ph.D., The University of Iowa, United States -- Iowa.

Roeser, R. W., Midgley, C., & Urdan, T. C. (1996). Perceptions of the school psychological environment and early adolescents' psychological and behavioral functioning in schools: The mediating role of goals and belonging. *Journal of Educational Psychology, 88*, 408-422.

Sadker, M., Sadker, D., & Klein, S. (1991). The issue of gender in elementary and secondary education. In G. Grant (Ed.), *Review of research in education* (Vol. 17, pp. 269-334): American Educational Research Association.

Salvia, J., Ysseldyke, J. E., & Bolt, S. (2007). *Assessment in special and inclusive education* (10 ed.). Boston, MA: Houghton Mifflin Company.

Simpson, A. (1996). Fiction and facts: An investigation of the reading practices of girls and boys. *English Education, 28*(4), 268-279.

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal analysis: Modeling change and event occurrence*. New York, NY: Oxford University Press.

Smith, M. W., & Wilhelm, J. D. (2002). Reading don't fix no chevy's: Literacy in the lives of young men. Portsmouth, NH: Heinemann.

Sweetland, S., & Wayne, H. (2000). School characteristics and educational outcomes: Toward an organizational model of student achievement in middle schools. *Educational Administration Quarterly, 36*, 703-729.

Sy, S. R. (2002). *Parent involvement and children's transition to school in Asian American and European American families.* Unpublished Ph.D., University of Michigan, United States -- Michigan.

Tian, L. L., & Gilman, R. (2009). School satisfaction among Chinese mainland adolescents. *Social Behavior and Personality, 37*(8), 1095(1096).

Van den Oord, E. J. C. G., & Van Rossem, R. (2002). Differences in first graders' school adjustment: The role of classroom characteristics and social structure of the group. *Journal of School Psychology, 40*(5), 371-394.

Vessels, G. G. (1998a). The Vessels' Classroom Climate Survey - Early Elementary *Character and community development: A school planning and teacher training handbook.* Westport, CT: Praeger.

Vessels, G. G. (1998b). The Vessels' Classroom Climate Survey - Late Elementary *Character and community development: A school planning and teacher training handbook*. Westport, CT: Praeger.

Vessels, G. G. (1998c). The Vessels' School Climate Survey *Character and community development: A school planning and teacher training handbook*. Westport, CT: Praeger.

Wentzel, K. R. (1991). Social competence at school: Relation between social responsibility and academic achievement. *Review of Educational Research, 61*, 1-24.

Wentzel, K. R. (1998). Social relationships and motivation in middle school: the role of parents, teachers, and peers. *Journal of Educational Psychology, 90*(2), 202-209.

West, B. T., Welch, K. B., & Galecki, A. T. (2007). *Linear mixed models: A practical guide using statistical software*: Chapman & Hall.