

Examining Teacher–Child Relationships and Achievement as Part of an Ecological Model of Development

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The purpose of the present study is to examine associations between quality of teacher–child relationships from preschool through third grade and children’s third-grade achievement using Phases I, II, and III data from the National Institute of Child Health and Human Development Study of Early Care and Education, a prospective study of 1,364 children from birth through sixth grade. There are three main findings. First, positive associations were found between quality of teacher–child relationships and achievement. Second, high quality teacher–child relationships buffered children from the negative effects of insecure or other maternal attachment on achievement. Third, the effect of quality of teacher–child relationships on achievement was mediated through child and teacher behaviors in the classroom. In sum, high quality teacher–child relationships fostered children’s achievement. Implications for educational practice are discussed.

KEYWORDS: achievement, teacher–child relationships, third grade

The association between supportive relationships with parents, especially mothers, and children’s achievement is a robust finding in developmental psychology. There is a large body of literature demonstrating that high-quality maternal relationships support children’s achievement through maternal scaffolding and emotional support (e.g., Bornstein, 1994; Pianta & Egeland, 1994; Pianta & Harbers, 1996; Pianta, Smith, & Reeve, 1991). In addition, evidence exists that high-quality maternal relationships buffer children from the effects of risk factors, such as poverty, for lower levels of achievement (Birch & Ladd, 1997; National Institute of Child Health and Human Development [NICHD] Early Child Care Research Network [ECCRN], 2002; Pianta & Ball, 1993; Pianta, Nimetz, & Bennett, 1997; Pianta & Walsh, 1996). Not surprisingly, interventions targeted at children’s achievement have often focused on strengthening mother–child relationships.

Recently, however, teacher–child relationships have been recognized as important contributors to children’s achievement as well (Pianta, 1999). Children with higher quality relationships evidence greater levels of achievement than children with lower quality relationships (Birch & Ladd, 1997; Furrer & Skinner, 2003; Pianta, 1999; Pianta et al., 1997; Pianta & Stuhlman, 2004). High-quality teacher–child relationships may therefore serve as interventions for children at risk for lower levels of achievement (Birch & Ladd, 1996). Our understanding of teacher–child relationships and achievement, however, has been limited by methodological concerns, including little research that models change in quality of the relationship over time and that considers the effects of child, family, and classroom characteristics on the association between relationship quality and achievement. Therefore, it is unclear from previous work whether teacher–child relationships can serve as sources of support for children at risk for lower levels of achievement.

To better understand the influences of teacher–child relationships on achievement within the context of children’s lives, it is necessary to study the effects of these relationships using ecological-contextual models. Ecological-contextual models posit that children develop over time within interrelated systems that exist at levels proximal and distal to the child (Bronfenbrenner, 1977; Pianta & Walsh, 1996). According to these models, the influence of a factor in one system cannot be evaluated without consideration of factors in the other systems (Bronfenbrenner, 1977; Pianta & Walsh, 1996). Pianta and Walsh’s (1996) Contextual Systems Model (CSM), designed to explain the experiences of children in school, is a good example of an ecological-contextual model of development.

Contextual Systems Model

According to the CSM, children develop within various systems. Systems are “an organized set of interrelated components each of which serves a function in relation to the activity of the whole system” (Pianta & Walsh, 1996, p. 65). Factors in each of the systems interact with one another to influence child development. Therefore, the effects of a factor in one system may be influenced by factors in another system. Four of the systems, in order of proximity to the child, are the individual child, family, classroom, and culture.

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Relationships are central to this model. At the core of the family system are parent–child, relationships, and at the core of the classroom system are teacher–child and peer relationships. A brief review of relevant research on each of these systems and achievement follows.

The Child

Child cognitive ability, behavior problems, and gender are each associated with achievement. In particular, strong correlations exist between children's early cognitive ability and later performance on tests of achievement (Reynolds, 1991). This association is likely the result of both biological and environmental influences. Children who score higher on tests of achievement in early childhood may have greater innate ability. Additionally, they may receive more extensive cognitive stimulation from others, which is associated with higher levels of achievement. Behavior problems, on the other hand, are associated with lower levels of achievement in elementary school (Nelson, Benner, Lane, & Smith, 2004; Stormshank et al., 1998). Children with behavior problems likely evidence lower levels of achievement because of their difficulties interacting with others in the classroom, which results in their learning less from educational experiences than those without behavior problems (Pianta, 1999). The effects of behavior problems, however, have been found to vary as a function of quality of teacher–child relationships. In particular, behavior problems are negatively associated with achievement related work habits among children whose relationships with teachers are marked by high, but not low, levels of negativity (Hamre & Pianta, 2001).

In early childhood, females tend to outperform males on standardized assessments of achievement (Willingham & Cole, 1997). This association likely reflects females' higher levels of sustained attention during learning and testing tasks (McCabe, Cunnington, & Brooks-Gunn, 2004). Some research, however, suggests that the effect of gender varies as a function of relationship quality (Hamre & Pianta, 2001). In one study, males with lower quality relationships evidenced lower level test performance than males with higher quality relationships (Hamre & Pianta, 2001).

Mother–Child Relationships

Numerous studies demonstrate associations between children's relationships with their parents and achievement (e.g., Main, 1983; Spieker, Nelson, Petras, Jolley, & Barnard, 2003; van IJzendoorn & van Vliet-Visser, 1998; van IJzendoorn, Dijkstra, & Bus, 1995). Due to the greater amount of time children tend to spend with mothers than fathers, a stronger association is often found between mother–child than father–child relationships. Children develop specific types of caregiving relationships with their mothers. In particular, children form attachments with their mothers in the 1st year of life.

Attachments are powerful emotional relationships within which children seek comfort and safety. Children demonstrate varying styles of maternal attachment. In general, they develop either *secure* or *insecure* attachments. Secure attachments are marked by high levels of maternal sensitivity and child trust in maternal availability and support. Insecure attachments are characterized by relatively low levels of maternal sensitivity and child doubt regarding maternal availability and support. A small percentage of children develop *insecure-other* attachments (Cassidy & Marvin, 1992; Main & Cassidy, 1988). Insecure-other attachment is marked by maternal hostility and/or unavailability and child fear in regard to maternal behavior.

Secure children demonstrate higher levels of achievement than insecure children (Main, 1983; Matas, Arend, & Sroufe, 1978; Spieker et al., 2003; van IJzendoorn & van Vliet-Visser, 1998). This association between maternal attachment and achievement is likely the result of children's behaviors. Secure children's trust in their mother's availability and support results in their being better able than insecure children to concentrate in educational exchanges with their mothers, to explore their environments, and to solicit adult help when needed (Bretherton, 1985; Bretherton & Munholland, 1999; McCartney, Owen, & Booth, 2004). Insecure-other attachment may pose an extreme risk for achievement, as these children evidence difficulties in multiple developmental domains (Goldberg, 1997). Research demonstrates that insecure-other children perform significantly worse than their peers on tests of achievement (O'Connor & McCartney, 2005).

Family Environment

Maternal education and poverty are often used to operationalize family environment. Children whose mothers have completed more years of education, especially beyond high school, perform better on tests of achievement than children whose mothers have completed fewer years (Bradley & Corwyn, 2002; Dollaghan et al., 1999). This association is likely rooted in higher levels of cognitive stimulation provided to children by mothers with more years of education. Children whose families are poor also tend to perform lower on tests of achievement than their nonpoor peers (Brooks-Gunn & Duncan, 1997; McLoyd, 1998). Furthermore, children who experience more episodes of poverty are at greater risk for lower levels of achievement than those who experience fewer episodes (Dearing, McCartney, & Taylor, 2001; Duncan, Brooks-Gunn, & Klebanov, 1994). Evidence exists that the negative correlation between poverty and achievement reflects increased parental stress associated with poverty (Dearing, McCartney, & Taylor, 2001; Duncan & Brooks-Gunn, 2000). Parenting stress is associated with lower levels of cognitive stimulation and less sensitive parent–child interactions.

Parenting beliefs are also strong predictors of child achievement and important elements of the family environment. Authoritarian parenting, defined by high levels of control and expectations and low levels of warmth

and responsiveness, is negatively associated with achievement (Taylor, Clayton, & Rowley, 2004). The effect of authoritarian parenting on achievement, however, varies as a function of quality of teacher–child relationships. For example, results from one study indicated that the negative effects of authoritarian parenting on children’s reading competence were less for children with higher quality relationships with teachers (Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002).

School Relationships

Children develop attachment relationships with teachers, which are associated with children’s long-term achievement (Anderson, Nagle, Roberts, & Smith, 1981; Birch & Ladd, 1996, 1997; Howes & Hamilton, 1992; Ladd & Burgess, 2001; Lynch & Cicchetti, 1992; Pianta, 1994; Pianta & Nimetz, 1991). Children with higher quality relationships evidence higher levels of achievement and cognitive skills in elementary school than those with lower quality relationships (Birch & Ladd, 1997; Hamre & Pianta, 2001; Peisner-Feinberg & Burchinal, 1997).

Recently, researchers have examined stability in quality of teacher–child relationships over time and across teachers. Research indicates some variation in quality of children’s relationships with different teachers (Pianta & Nimetz, 1991; Pianta, Steinberg, & Rollins, 1995). Few studies, though, have been conducted to examine the influence of this change in quality on achievement. Results from one study, however, indicated that increases in quality of teacher–child relationships during kindergarten were associated with higher levels of academic competence in first grade (Pianta & Nimetz, 1991).

Children’s peer relationships are also important predictors of achievement. Children with higher quality relationships evidence greater levels of achievement than those with lower quality relationships (Cauce, 1986). Results from a study in which the effects of both teacher and peer relationships were evaluated indicated independent associations between the quality of each of these relationships and achievement (Ladd, Birch, & Buhs, 1999).

As with maternal attachment, children’s relationships with peers influence their achievement through children’s learning experiences. Children take part in more exploration tasks, have more dynamic conversations, and remember more about tasks completed with peers with whom they have higher quality relationships (Azmitia & Montgomery, 1993; Hartup, 1996; Newcomb, Bukowski, & Pattee, 1993). In addition, friends demonstrate for each other academic behaviors and encourage prosocial behavior, which contributes to achievement (Bukowski, 2001; Harter, 1990; Schunk, 1987; Sieber, 1979; Wentzel & Caldwell, 1997).

Classroom Environment

There is a fairly extensive body of literature demonstrating associations between child achievement and classroom environment. Specifically, children

acquire skills and knowledge through participation in the classroom and engagement in activities (Buhs & Ladd, 2001; Diperna, 2006). Furthermore, teacher emotional support and academic guidance enhance children's achievement (Pianta, La Paro, Payne, Cox, & Bradley, 2002).

Researchers and theorists hypothesize that teacher–child relationships influence achievement through child and teacher behaviors. In particular, children who have higher quality relationships with teachers may be better able to connect and communicate effectively in instructional exchanges and to use teachers as secure bases from which to explore their surroundings (Birch & Ladd, 1996; Burchinal et al., 2002; Howes, 1999; Howes, Matheson, & Hamilton, 1994; Pianta, 1999). There is some empirical support for these hypotheses. Several studies demonstrate that children with higher quality relationships participate more and are more engaged in the classroom than those with lower quality relationships (Buhs et al., 2006; Ladd et al., 1999).

Culture

In previous research, associations have been found between children's culture and achievement. African American and Latino American children tend to perform lower than their European American peers on tests of achievement throughout childhood (e.g., Brooks-Yunn, Klebanov, & Duncan, 1996; Denbo, 2002). This association is likely the result of testing bias. Standardized assessments test knowledge that is central to European American, but not African American and Latino American, culture (Garcia Coll, Meyer, & Brillion, 1995; Washington, 2001). The effect of culture, however, appears to vary as a function of quality of teacher–child relationships. For example, in one study, African American children with higher quality relationships performed better on standardized tests of language skill than African American children with lower quality relationships (Burchinal et al., 2002).

The Present Study

Associations between quality of teacher–child relationships from preschool through third grade and third-grade achievement were examined in hierarchical multiple regression models with variables representing systems in the CSM. These analyses allowed for examination of the influence of teacher–child relationship quality on achievement within the contexts of children's lives. Third-grade achievement was studied because research indicates that children's achievement trajectories are fairly stable after this time period (e.g., Entwisle & Alexander, 1993). To extend previous work, we investigated the following four questions: (a) Does the quality of teacher–child relationships change from preschool through third grade and do differences exist among children in patterns of change? (b) Does the quality of teacher–child relationships from preschool through third grade predict children's achievement when examined as part of an ecological model of development?

(c) Does the effect of quality of teacher–child relationships on achievement vary as a function of other child, family, or cultural characteristics? (d) Is the effect of quality of the third-grade teacher–child relationship on achievement mediated through teacher and/or child behaviors in the classroom?

Method

Participants

This study was conducted using data from the first three phases of the NICHD Study of Early Child Care and Youth Development (SECCYD), a prospective study of children from birth through adolescence. The original sample consisted of 1,364 mothers and children from 10 different locations throughout the United States. Participants in the NICHD SECCYD were recruited through 1991 from 31 hospitals near the following sites: Little Rock, Arkansas; Orange County, California; Lawrence and Topeka, Kansas; Boston, Massachusetts; Philadelphia, Pennsylvania; Pittsburgh, Pennsylvania; Charlottesville, Virginia; Morganton and Hickory, North Carolina; Seattle, Washington; and Madison, Wisconsin. Potential participants were selected from 8,986 mothers who gave birth during selected 24-hour sampling periods. Participants were selected in accordance with a conditional random sampling plan that was designed to ensure that the recruited families reflected the demographic diversity (economic, educational, and ethnic) of the catchment area at each site. The demographic distribution of the entire sample is 24% ethnic minority (13% African American, 6% Latino American, 1.4% Asian American, and 3.4% of ethnic or racial backgrounds classified as Other), 11% of the mothers did not have a high school education, and 14% were single at the birth of the child (NICHD ECCRN, 1997).

The current sample consisted of 880 children who had completed the 36-month modified Strange Situation (Cassidy & Marvin, 1992), were still in the study at third grade, and had been seen in their third-grade classrooms. The children included in the current analyses were compared with children from the original sample who were not included because of either having dropped out from the study or having incomplete data. In the sample not included, mothers had fewer years of education (when the child was 1 month old; 13.00 vs. 14.41; $F = 42.81$, $p < .001$), and children were more likely to be African American or Latino American than European American (chi-square = 30.51, $p < .001$).

Missing values for continuous variables were imputed using a Markov chain Monte Carlo (MCMC) method (Schafer, 1997). This was appropriate because the data were normally distributed (Graham & Donaldson, 1993; Kellum, Rebok, Ialongo, & Mayer, 1994) and appeared to be missing at random. “Missing at random” was determined because the probability of missing data at one time point, on variables collected at multiple time points, was unrelated to their values at other time points. The MCMC method uses simulation from a Bayesian prediction distribution. Rubin’s relative efficiency calculations were used to determine the appropriate number of imputations

(Rubin, 1978). Five imputations were performed with a burn-in period of 500. This burn-in period was used to prevent starting values for the imputation from effecting final parameter estimates (Pederson et al., 2003). SAS PROC MIANALYZE was then used to calculate final parameter estimates (Schafer, 1997). SAS PROC MIANALYZE aggregates the results of the analyses performed on the data sets to arrive at precise parameter estimates. Descriptive statistics and regression models estimated using only the original values were similar to those with the imputed values.

Overview of Data Collection

Participant families were seen when the children were 6, 15, 24, 36, and 54 months old; in kindergarten; and in first and third grades. Mother–child interactions were observed at laboratory visits when children were 36 months old. Teacher questionnaires were completed when the children were in preschool at 54 months, in kindergarten, and in first and third grades. Classroom observations were conducted at third grade.

Measures

Achievement. Children’s achievement at third grade was assessed using an Achievement subscale of the Woodcock Johnson Psycho-Educational Battery–Revised (WJR; Woodcock & Johnson, 1990). The NICHD SECCYD data set includes five Achievement subscales. The Achievement subscales are Applied Problems, Word Attack, Letter-Word Identification, Passage Comprehension, and Calculation. Applied Problems measures the child’s skill in analyzing and solving practical problems in mathematics. To solve the problems, the child must recognize the procedure to be followed and then perform relatively simple calculations. Word Attack measures the child’s ability to apply phonic and structural analysis skills to the pronunciation of unfamiliar printed words. The child reads aloud letter combinations that are linguistically logical in English but that do not form actual words (nonsense words) or words that constitute low-frequency words in the English language. The first five Letter-Word Identification items involve symbolic learning and the ability to match a pictographic representation of a word with an actual picture of the object. The remaining items assess the child’s reading identification skills in identifying isolated letters and words. The first four Passage Comprehension items are presented in multiple-choice format requiring the child to point to the picture represented by a phrase. The remaining items measure the child’s skill in reading a short passage and identifying a missing key word. The task requires the child to state a word that would be appropriate in the context of the passage. Calculation measures the child’s skill in performing mathematical calculations. Addition, subtraction, multiplication, division, and combinations of these basic operations as well as some geometric, trigonometric, logarithmic, and calculus operations are included. The calculations involve decimals, fractions, and whole numbers.

Scores were standardized with a mean of 100 and a standard deviation of 15. Values greater than 100 indicate that the raw score was greater than the mean. The items used to create the Achievement subscale had high internal reliability (Cronbach's $\alpha = .91$). The WJR has excellent test-retest reliability and predictive validity across the life span (McGrew & Kopnick, 1993).

Early cognitive abilities. At 15 months, the Bayley Mental Development Index (Bayley, 1969) was used to measure children's cognitive abilities. This index assesses infants' sensory-perceptual, memory, and problem-solving abilities. Higher scores indicate greater ability. The Bayley is the most frequently used assessment of cognitive ability for children 2 years of age and younger. It has very good reliability and predictive validity (Gagnon & Nagle, 2000).

Child behavior problems. Total behavior problems were assessed at 54 months, kindergarten, and first and third grades using the parent version of the Child Behavior Checklist (CBCL; Achenbach, 1991). The CBCL contains 118 items that describe a broad range of child behavioral and emotional problems. For each item, the respondent is asked to determine how well the item describes the child currently or within the last 6 months: 0 = not true, 1 = somewhat or sometimes true, and 2 = very true or often true. Higher scores indicate more overall problems. Scores higher than 50 indicate that the raw score was greater than the mean in the norming population. Scores from 54 months, kindergarten, and first and third grades were averaged to create a mean score for behavior problems. Research indicates that the CBCL has good test-retest reliability and concurrent and predictive validity (Achenbach, Edelbrock, & Howell, 1987).

Child gender. Gender was dummy coded such that male was assigned a value of 0 and female a value of 1.

Maternal attachment. A modified Strange Situation procedure, based on recommendations by Cassidy and Marvin (1992) and the MacArthur Working Group on Attachment, was used to assess attachment style at 36 months. In this procedure, designed to be moderately stressful for the child, the mother and child were invited to make themselves comfortable in a room. After 3 minutes, the mother was signaled to leave. The first separation lasted 3 minutes, unless the child was overly distressed. After a 3-minute reunion, the mother left again. The second separation lasted for 5 minutes. The children's behaviors during the assessment were classified according to the system developed by the MacArthur Working Group on Attachment (Cassidy & Marvin, 1992). With the MacArthur coding system, preschoolers were classified as secure, ambivalent, avoidant, controlling, and insecure-other on the basis of their reunion behaviors with their mothers. Secure children resume calm, comfortable interactions with the mother. Insecure-avoidant children maintain extreme neutrality toward the mother and rarely express positive

or negative emotion toward the mother, even after reunion. Insecure-ambivalent children show fussy, helpless, whiny, and/or resistant behavior toward the mother. They may seek contact but find it unsatisfactory. Controlling children take charge of the reunion, usually in either a caregiving (role-reversal) or punitive manner. Secure, avoidant, ambivalent, and controlling children all demonstrate organized attachment strategies. Insecure-other children, on the other hand, do not demonstrate a coherent attachment behavioral strategy during reunion. Intercoder agreement (before conferencing) was 75.7% ($\kappa = .58$; McCartney et al., 2004).

In the current analyses, dummy codes to represent insecure and insecure-other attachment were created. Children were assigned a value of 1 for insecure if they demonstrated either of the organized, insecure attachment patterns: avoidant, ambivalent, or controlling. Children were assigned a value of 1 for insecure-other if they exhibited an insecure-other attachment pattern. Secure attachment served as the comparison group.

Maternal education. Level of maternal education was obtained during interviews and scored as follows: less than 12 = number of years in school, 12 = high school graduate or GED, 14 = some college, 16 = a bachelor's degree, 17 = some graduate school experience, 18 = a master's degree, 19 = a law school graduate, and 21 = more than one master's degree or a doctoral degree.

Episodes of family poverty. At 6, 15, 24, 36, and 54 months; kindergarten; and first and third grades; the ratio of family income to needs was computed by dividing total family income by the poverty threshold for the appropriate family size (U.S. Bureau of the Census, 1999). Income-to-needs ratios less than 2 indicate poverty status. The number of episodes of income-to-needs ratios less than 2, from 6 months through third grade, was calculated to obtain an index of episodes of poverty.

Authoritarian parenting. At 1 month, mothers completed the Modernity Scale (Schaefer & Edgerton, 1985). Items assess parenting attitudes and beliefs that reflect authoritarian parenting (e.g., "When my baby is well behaved, it is because he/she responds to my efforts"). Items are rated on a scale from 1 = strongly disagree to 5 = strongly agree. The scale contains 30 items. Higher scores indicate more authoritarian parenting beliefs. Cronbach's alpha in the NICHD SECCYD sample was .90.

Quality of teacher-child relationships. A 15-item subscale of the Student Teacher Relationship Scale (STRS; Pianta, 1992) was used to assess teacher perceptions of the teacher-child relationship in preschool at 54 months, kindergarten, and first and third grades. The items are based on attachment theory and the Attachment Q-Set (Waters & Deane, 1985). The STRS evaluates the teacher's feelings and beliefs about the student's actions toward him or her.

Using a 5-point Likert-type scale that ranges from 1 = *definitely does not apply* to 5 = *definitely applies*, teachers rated how applicable each statement is to their current relationship with a particular child. Two features of the relationship were studied: conflict and closeness. The Conflict subscale taps the extent to which the teacher–child relationship is marked by antagonistic, disharmonious interactions (e.g., “This child and I always seem to be struggling with each other”; $\alpha = .94$ at all three time points). The Closeness subscale is an index of the amount of warmth and open communication present in the relationship (e.g., “I share an affectionate, warm relationship with this child”; α s ranged from .88 to .91). The overall quality of the relationship is determined by the amount of closeness and conflict (reflected) in the relationship. Higher scores indicate more positive, higher quality teacher–child relationships. In the current study, teachers completed the STRS in the spring of each year.

The STRS has been widely used in studies with preschool and elementary school children. It is associated with children’s and teachers’ classroom behaviors and correlates with observational measures of quality of the teacher–child relationship (e.g., Birch & Ladd, 1997; Howes & Hamilton, 1992; Howes & Ritchie, 1999). Additionally, STRS scores correlate with Attachment Q-Set ratings of teachers and students such that higher STRS scores are associated with more secure relationships (Howes & Ritchie, 1999).

Quality of peer relationships. At 54 months, kindergarten, and first and third grades, mothers completed an adaptation of the Quality of Classroom Friends (Clark & Ladd, 2000) questionnaire. This questionnaire evaluates the quality of the child’s friendship with a primary playmate. Scale items assess how well the study child and his or her friend interact with each other (e.g., “When these two children are playing together they take turns during conversations”). The questionnaire includes the same 17 items at 54 months, kindergarten, and first grade. In order to be age appropriate at third grade, three new items were added from the version used at previous time points. Items are scored on a 4-point Likert-type scale where 1 = strongly disagree to 5 = strongly agree. Items were averaged to create a mean score. The possible range of scores is from 1 to 4. Higher scores indicate a more positive relationship. Confirmatory factor analysis indicates that these scores represent positive peer relationships. The estimated Cronbach’s α in the NICHD SECCYD sample was .80 at 54 months, .79 at kindergarten, .88 at first grade, and .88 at third grade. Total scores from the 54-month, kindergarten, and first and third grade assessments were averaged to create a mean friendship quality score.

Classroom environment. Teacher and child behaviors in the classroom were measured at third grade through observational ratings from the Classroom Observational System (COS; NICHD ECCRN, 1999). Specifically, child classroom engagement, teacher academic instruction, and teacher

attention to the study child were assessed. During the COS, the study child was observed in the classroom for two 44-minute cycles. In each cycle, observers made time-sampled recording for three 10-minute periods of 30-second “observe” and 30-second “record” intervals. Thus, there were 30 different minutes in which discrete behaviors were sampled across each of the two observation cycles for a total of 60 different minutes (i.e., 60 intervals) in which codes were sampled.

Classroom engagement is the sum of two individual child behavior scales: Engaged in Learning and Highly Engaged in Classroom. Scores range from 0 to 100, with higher scores indicating greater child engagement in the classroom. In the NICHD SECCYD sample, scores ranged from 7.50 to 57.75. Teacher academic instruction is computed as the sum of five individual teacher behavior scales: Teaches Literacy/Language Arts, Teaches Mathematics, Teaches Science, Teaches Social Studies, and Teaches Computers/Technology. The possible range of scores is 0 to 100, with higher scores indicating a greater number of academic activities involving the study child. Scores in the NICHD SECCYD sample ranged from 18.75 to 81.00. Teacher attention is rated as the number of times, on average, the teacher attends to the study child during the 60 segments. Values range from 0 to 10. Gold standard reliability data were obtained from each coder’s scoring of four to eight tapes during two reliability testing rounds. Reliability was .93, .96, and .89 for the engagement, academic instruction, and teacher-attention-to-child codes, respectively.

Ethnicity. Two dichotomous variables were created for race-ethnicity. One variable represented African American versus European American and one represented Latino American versus European American.

Results

Descriptive Statistics

Means and standard deviations for continuous variables and percentages for dichotomous variables are presented in Table 1. The sample was heterogeneous and average. The children were of average intelligence. The distribution of attachment classifications was similar to those in a meta-analysis of attachment studies (van IJzendoorn, Goldberg, Kroonenberg, & Frenkel, 1992). Most mothers had several years of college education. The mean scores for mothers’ ratings of children on the CBCL approximated the normed mean of 50.

Individual Growth Modeling

Individual growth modeling was performed to examine change in quality of the teacher–child relationship from preschool through third grade. Analyses were conducted with SAS PROC MIXED (see Singer, 1998). In growth modeling, ordinary least squares (OLS) estimates of initial status and change are computed for each individual and the population. In the current study, individual growth modeling provided an estimate of true initial status

Table 1

Descriptive Statistics for Predictor and Outcome Variables (N = 880)

Variable	Mean	Standard Deviation	Percentage of Sample
Woodcock Johnson achievement score, third grade	112.32	13.43	
Bayley Mental Development Index, 15 months	108.48	14.15	
Child Behavior Checklist, average preschool, kindergarten, and first and third grades	48.81	8.78	
Female			48.21
Secure attachment, 36 months			61.76
Insecure attachment, 36 months			31.03
Insecure-other attachment, 36 months			7.21%
Maternal education	14.40	2.48	
Number of episodes of poverty, average 6, 15, 24, 36 months; preschool; kindergarten; first and third grades	3.69	4.53	
Authoritarian parenting beliefs, 1 month	74.03	16.88	
Teacher–Child Relationship Scale slope	-.05	.32	
Teacher–Child Relationship Scale intercept	63.38	10.31	
Quality of Classroom Friends, average preschool, kindergarten, and first and third grades	3.14	.34	
Child classroom engagement, third grade	39.89	8.38	
Teacher academic instruction, third grade	50.67	7.45	
Teacher attention to study child, third grade	6.36	3.58	
European American			81.01%
African American			13.00%
Latino American			5.99%

(intercept) and rate of change (slope) for quality of teacher–child relationships. Time was centered at 96 months, average child age at third grade, so that the intercept would reflect the quality of the third-grade teacher–child relationship. In individual growth modeling, model fit is evaluated with a deviance statistic. Alternative models are compared using the difference between model deviance statistics and corresponding χ^2 values. In the current study, a model in which linear slope was used provided the best fit, $p < .01$, relative to models that included nonlinear slopes. Table 2 presents descriptive statistics for the random effects for the individual growth model. The intercept and slope were moderately associated ($\tau = .50$) such that children who experienced increases in quality of the teacher–child relationship from preschool through third grade tended to have higher quality relationships at third grade. The mean value of the OLS estimate for change was $-.05$. There was, however, significant variability across children in the slope. The mean value of the OLS estimate for the intercept was 63.38. There was also significant variability across children in terms of intercept values.

Table 2
Descriptive Statistics for the Random Effects of Intercept and Change in Teacher–Child Relationships (N = 880)

Random Effect	τ^a	<i>M</i>	<i>SE</i>	<i>t</i> ^b
Slope	.50	–.05	.01	–8.16***
Intercept	—	63.38	.25	280.21***

a. Kendall's rank coefficient for the estimated association between true initial status and true change.

b. The *t* statistic tests the null hypothesis of homogeneity (that there is variation among individuals). A significant *t* statistic indicates that the variance component is not zero and therefore worthy of interpretation.

****p* < .001.

Clusters of Individuals

Nagin cluster analysis was performed to examine whether children could be classified into representative groups based on patterns of linear change and level for quality of teacher–child relationships. Nagin cluster analysis uses a multinomial modeling strategy to identify clusters of individuals based on developmental trajectories (see Nagin, 1999, for a complete description of Nagin cluster analysis). These analyses establish the number of groups that best fit the data based on both patterns of individual change and probability of group membership (Nagin, 1999).

Results from the Nagin cluster analysis are presented in Table 3. Cluster 1, labeled *stable-moderate*, constituted 25% of the sample. Children in this cluster demonstrated nonsignificant change in quality of their relationships with teachers over time and moderate quality relationships at third grade. The second cluster, named *declining-low*, was evident in approximately 13% of the population. Children in this cluster demonstrated the least optimal pattern. Specifically, they had declining scores over time and relatively low scores at third grade. The third cluster, titled *inclining-high*, represented approximately 62% of the population. These children evidenced the most favorable pattern in that quality of their relationships increased from 54 months to third grade, and they had relatively high-quality relationships at third grade. Cluster analyses were also performed using hierarchical cluster analysis. Similar results were obtained. In sum, the cluster analyses indicated substantial variation in patterns of change in relationship quality from preschool to third grade.

Hierarchical Regression With Continuous Slope and Intercept

Individual estimates for change in quality of the teacher–child relationship and quality at third grade, obtained from the individual growth models, were entered into a model predicting achievement at third grade. Specifically, achievement was regressed on sets of predictor variables identified from the

Table 3
Means for Children in Each Nagin Cluster (N = 880)

	Stable-Moderate (25%)	Declining-Low (13%)	Inclining-High (62%)
Slope	<i>ns</i>	-1.52	.82
Intercept	65.36	44.34	70.00

achievement literature, located within each system of the child's ecology. The sets of predictors were tested hierarchically. Sets of variables were entered into the model in order from most proximal to most distal systems. Using this strategy, the stability of sets of variables across specifications could be examined. A decrease in the β value for a variable with the addition of a block of variables suggests mediation of the initial variable through one or more of the added variables (Baron & Kenny, 1986). In cases where mediation was indicated, Sobel's z tests were conducted with individual variables in the added block to determine which variables mediated the association between the initial variable and the outcome.

Results from these analyses are presented in Table 4. Table 4 includes zero-order correlations between the predictors and the outcomes, β s for each predictor, structure coefficients for each predictor and ΔR^2 s between the models. It is interesting that both change in quality of the teacher-child relationship (slope) and quality of the teacher-child relationship at third grade (intercept) were significant predictors of achievement, controlling for child and family factors. These results indicate that teacher-child relationships have a substantial, independent effect on achievement.

Examination of the β s from the regression models suggested that the association between quality of teacher-child relationships (intercept) and achievement may have been mediated statistically by child and teacher behaviors in the classroom. Note that the β s for most variables were fairly consistent across model specifications. However, the effect of teacher-child relationships (intercept) was influenced by the classroom environment block such that the inclusion of this block reduced the β for teacher-child relationships (intercept). Conceptually, one would expect child and teacher behaviors in the classroom at one time point to mediate the association between concurrent relationship quality and achievement rather than to mediate the association between change in relationship quality over time and achievement. For this reason, no formal tests of mediation were conducted to elucidate mediated effects between change in relationship quality and achievement through child and teacher behaviors. There was evidence of mediation. Child classroom engagement ($z = 2.88, p < .01$) partially mediated the association between quality of teacher-child relationships at third grade and achievement. Children with higher quality relationships demonstrated higher levels of classroom engagement than children with lower quality relationships. Higher levels of engagement were in turn associated with

Table 4
**Hierarchical Regression Analysis for Achievement at Third Grade (N = 880),
 Continuous Slope and Intercept as Predictor**

<i>r</i>	Model 1 (<i>r</i> ₁)	Model 2 (<i>r</i> ₂)	Model 3 (<i>r</i> ₃)	Model 4 (<i>r</i> ₄)	Model 5 (<i>r</i> ₅)	Model 6 (<i>r</i> ₆)
Set 1: Individual constitution						
Early cognitive ability	.29***	.27*** (.76)	.19*** (.54)	.19*** (.54)	.18*** (.51)	.16*** (.50)
Child behavior problems	-.16***	-.12*** (.42)	-.03 (.30)	-.01 (.30)	-.01 (.28)	-.01 (.28)
Child gender	.02	-.01 (.05)	-.02 (.04)	-.03 (.04)	-.05~ (.03)	-.05~ (.03)
Set 2: Maternal attachment						
Insecure attachment	-.11***	-.11*** (.29)	-.08** (.21)	-.07* (.21)	-.05~ (.19)	-.05~ (.19)
Insecure-other attachment	-.14***	-.13*** (.27)	-.09** (.26)	-.09** (.26)	-.08** (.25)	-.08** (.24)
Set 3: Family environment						
Maternal education	.38***		.18*** (.72)	.18*** (.72)	.16*** (.67)	.17*** (.66)
Episodes of poverty	-.39***		-.18*** (.74)	-.17*** (.73)	-.14*** (.52)	-.10** (.51)
Authoritarian parenting	-.36***		-.13*** (.68)	-.13*** (.68)	-.14*** (.63)	-.12*** (.62)
Set 4: School relationships						
Teacher-child relationships slope	.06*			.24* (.11)	.17 (.11)	.10 (.10)
Teacher-child relationship intercept						
Quality of peer relationships	.16***			.25** (.26)	.14 (.28)	.13 (.28)
Classroom environment	.07*			.01 (.13)	.01 (.12)	.01 (.12)
Set 5: Classroom engagement						
Academic instruction	.19***				.09* (.33)	.07* (.33)
Attention to study child	.11***				.10* (.19)	.08* (.19)
Attention to study child	-.14***				-.21*** (.25)	-.21*** (.24)
Set 6: Culture						
African American	-.32***					-.11*** (.55)
Latino American	-.06~					-.02 (.10)
<i>R</i> ²	.12***	.15**	.28***	.29***	.33***	.34***
ΔR^2		.03*	.15***	.01*	.04**	.01*

Note. Structure coefficients shown in parentheses.
 *****p* < .001. ****p* < .01. ***p* < .05.

higher levels of achievement. The effect of quality of teacher–child relationships at third grade was also partially mediated by amount of time the teacher attended to the child ($z = -1.90, p = .05$). Teachers attended to children with whom they had higher quality relationships less often than to those with whom they had lower quality relationships. Teacher attention was in turn negatively associated with achievement.

The structure coefficients (r_s) in Table 4 provide additional information. Structure coefficients demonstrate the relative predictive strength of each variable included in the analysis model, as they do not account for shared variance among the variables (Courville & Thompson, 2001). The structure coefficient is the zero-order correlation between a predictor and the outcome divided by the square root of the multiple correlation. Coefficients are evaluated within a specific model (i.e., within each column in Table 4). As such, the structure coefficients indicate the specific, unique strength of a predictor within a given model. Only by examining both the structure coefficients and β weights is it possible to determine if a variable contributes directly or indirectly to predicting the outcome (Courville & Thompson, 2001). A predictor may have a zero β weight yet be the best predictor in the model, which occurs when variation in the outcome attributable to the predictor is also explained by other correlated predictors. In this case, the variable would have a relatively large structure coefficient but zero or small β weight (Thompson, 2006). Furthermore, a variable that is not correlated with the outcome may have a large β weight, as it may contribute to the predictive power of the model by acting as a suppressor (Thompson, 2006). A suppressor variable improves the predictive power of one or more variables in the model by eliminating the contaminating effect of another factor (Horst, 1966; Thompson, 2006). A suppressor variable may have a zero structure coefficient but a relatively large β weight.

The structure coefficients in Table 4 demonstrate an analogous pattern of association between the predictor variables and achievement as the standardized coefficients. However, for most variables, the structure coefficients show a stronger association with achievement than the standardized coefficients because of the variables' shared variance. For example, the structure coefficients for the family environment variables are much greater in relative magnitude than the β weights and show that these variables were among the strongest predictors of achievement. The structure coefficients indicate that in the β weights, family environment variables were denied some of their predictive ability for achievement, which was explained by correlated predictors. Similarly, the structure coefficients demonstrate that child behavior problems was a moderate predictor of achievement despite its small β weight in Models 3 through 6. These results indicate that child behavior problems explained variation in achievement also attributable to other correlated variables. Last, the structure coefficients show that peer relationships were likely associated with achievement. However, in the β weights, peer relationships were denied some of their predictive ability for achievement. Examination

of both the structure and β coefficients, however, does not indicate the presence of suppressor variables.

Interactions between both quality of the teacher-child relationship slope and intercept and each of the child, family, classroom, and cultural variables were tested to determine whether the influence of either varied as a function of other factors in the child's ecology. Thus, 21 interactions were examined. There were two significant interactions: a slope by insecure-other interaction ($\beta = .05$, $r_s = .10$, $p < .05$) and an intercept by insecure-other interaction ($\beta = .25$, $r_s = .49$, $p < .05$). The interaction between slope and insecure-other attachment is represented in Figure 1. The slope of the line for insecure-other children is much steeper than that for secure children, demonstrating the greater magnitude of effect of linear change in relationship quality on achievement for insecure-other than secure children. The interaction between intercept and insecure-other attachment is demonstrated in Figure 2. The slope of the line for insecure-other children is substantially steeper than that for secure children, indicating the greater magnitude of effect of the teacher-child relationship at third grade on achievement for insecure-other versus secure children.

The hierarchical regression analyses were then recomputed using the Nagin clusters, as opposed to estimates for true rate of change and quality of the relationship at third grade, as predictors to determine whether cluster membership was associated with third-grade achievement. Results from these analyses are presented in Table 5. Dummy variables were used for cluster membership with the inclining-high group serving as the comparison group. Table 5 demonstrates that children in the declining-low cluster scored significantly lower on achievement tests at third grade than children in the inclining-high cluster. Children in the stable-moderate group, however, did not demonstrate significantly different levels of achievement than children in the inclining-high group.

Examination of the β s across model specifications indicated that the effect of membership in the declining-low group on achievement may have been mediated statistically by child and teacher behaviors in the classroom. Specifically, the inclusion of the classroom environment block reduced the β for membership in the declining-low group. Sobel's z tests indicated that there was mediation. Child classroom engagement ($z = -2.20$, $p < .05$) partially mediated the association between membership in the declining-low group and achievement. Children in the declining-low group evidenced lower levels of classroom engagement than children in the inclining-high group. The effect of membership in the declining-low group was also partially mediated by amount of time the teacher attended to the child ($z = -1.92$, $p < .05$). Teachers attended to children in the declining-low group more often than to those in the inclining-high group.

In most cases, the structure coefficients in Table 5 are greater than the standardized coefficients. Similar to the model with continuous slope and intercept, the strongest associations were between achievement and each of the family system variables. The structure coefficients demonstrate that family,



Figure 1. Illustration of the interaction between teacher-child relationships (slope) and insecure-other attachment.

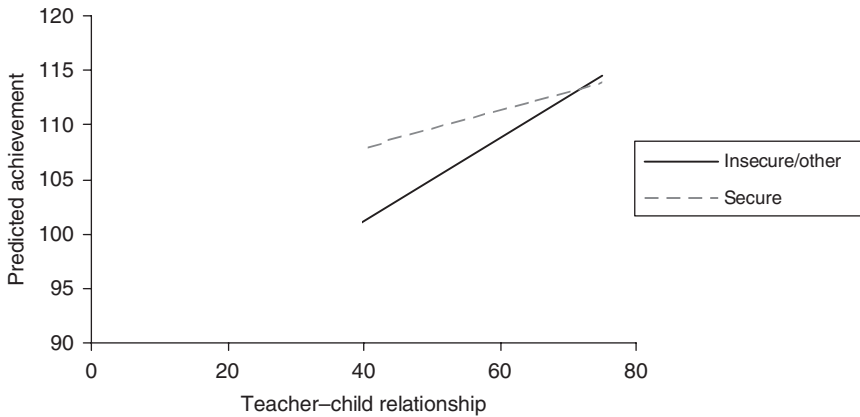


Figure 2. Illustration of the interaction between teacher-child relationships (intercept) and insecure-other attachment.

child behavior problems, and peer relationship variables are not given credit in the β weights for variability in achievement, which is attributable to these predictors as well as other correlated predictors. Comparisons of the structure and β coefficients do not indicate the presence of any suppressor variables.

Table 5
Hierarchical Regression Analysis for Achievement at Third Grade (N = 880), Nagin Clusters as Predictors

	<i>r</i>	Model 1 (<i>r</i> _s)	Model 2 (<i>r</i> _s)	Model 3 (<i>r</i> _s)	Model 4 (<i>r</i> _s)	Model 5 (<i>r</i> _s)	Model 6 (<i>r</i> _s)
Set 1: Individual constitution							
Early cognitive ability	.29***	.28*** (.83)	.27*** (.76)	.19*** (.54)	.19*** (.54)	.17*** (.51)	.16*** (.50)
Child behavior problems	-.16***	-.14*** (.46)	-.12*** (.42)	-.03 (.30)	-.01 (.30)	-.01 (.28)	-.01 (.28)
Child gender	.02	-.02 (.06)	-.01 (.05)	-.02 (.04)	-.03 (.04)	-.05~ (.03)	-.05~ (.03)
Set 2: Maternal attachment							
Insecure attachment	-.11***		-.11*** (.29)	-.08** (.21)	-.07* (.21)	-.05~ (.19)	-.05~ (.19)
Insecure/other attachment	-.14***		-.13*** (.27)	-.09** (.26)	-.09** (.26)	-.08** (.25)	-.08** (.24)
Set 3: Family environment							
Maternal education	.38***			.18*** (.72)	.18*** (.72)	.16*** (.67)	.17*** (.66)
Episodes of poverty	-.39***			-.18*** (.74)	-.17*** (.73)	-.14*** (.52)	-.10*** (.51)
Authoritarian parenting	-.36***			-.13*** (.68)	-.13*** (.68)	-.14*** (.63)	-.12*** (.62)
Set 4: School relationships							
Stable-moderate teacher-child relationships	-.11**				-.02 (.21)	.01 (.19)	-.04 (.19)
Declining-low teacher-child relationships	-.13***				-.07* (.25)	-.05 (.23)	-.04 (.22)
Set 5: Classroom environment							
Quality of peer relationships	.07*				.01 (.13)	.01 (.12)	.01 (.12)
Classroom engagement	.19**					.09** (.33)	.09** (.33)
Academic instruction	.11***					.10** (.19)	.08** (.19)
Attention to study child	-.14***					-.20*** (.25)	-.20*** (.24)
Set 6: Culture							
African American	-.32***						-.12*** (.55)
Latino American	-.06~						-.02 (.10)
<i>R</i> ²		.12***	.15**	.28***	.29***	.33***	.34***
ΔR^2			.03*	.15***	.01*	.04**	.01*

Note. Structure coefficients shown in parentheses.
****p* < .001. ***p* < .01. **p* < .05.

Interaction terms between group membership and each of the other variables in the model were examined to determine whether the effect of group membership varied as a function of other child, family, school, or cultural characteristics. There was one significant interaction: a Declining-Low \times Insecure-Other interaction ($\beta = -.06$, $r_s = .21$, $p < .05$). Insecure-other children in the declining-low group scored significantly lower than insecure-other children in the inclining-high group.

Discussion

The overall purpose of this study was to examine associations between quality of teacher-child relationships from preschool through third grade and children's achievement at third grade. The literature indicates that high-quality teacher-child relationships are associated with achievement; however, in the majority of previous research, change in relationship quality has not been considered a predictor, and the effects of other environmental factors on the association between relationship quality and achievement have not been evaluated. To understand more fully the impact of quality of teacher-child relationships on children's achievement, relationships must be studied using ecological-contextual models of development (Pianta & Walsh, 1996). The NICHD SECCYD data set allows for such analyses.

The Dynamic Quality of Teacher-Child Relationships

Results from this investigation indicate significant change in quality of children's relationships with teachers from preschool through third grade. Consistent with previous research, we found that the average quality of children's relationships decreased slightly from preschool through early elementary school. We speculate that such decreases reflect a greater emphasis on instructional, rather than relational, interactions between teachers and students during the elementary rather than preschool years. Additionally, larger classes, characteristic of the later elementary school years, place pressure on teachers who are forced to attend to many students. These stressors often result in lower quality relationships with students (Pianta, 1999). Substantial variation, however, was evident in change in quality of children's relationships such that most children evidenced increases in relationship quality.

Cluster analyses, in which patterns of relationships were studied, demonstrated groups of children with relatively homogenous trajectories of change and relationship quality at third grade. Specifically, three groups were identified. Children demonstrated either stable-moderate, declining-low, or inclining-high quality relationships. Children in the stable-moderate cluster showed no significant change in quality of their relationships with teachers over time and average quality relationships at third grade. Children in the declining-low cluster evidenced suboptimal patterns of relationships with teachers. The quality of their relationships decreased over time, and they demonstrated low-quality relationships at third grade. Children in the inclining-high cluster showed significant but minimal increases in quality of

their relationships over time and had high quality relationships at third grade. The majority of children were in the inclining-high group (62%) and the minority in the declining-low group (13%). The relatively small percentage of children in the stable-moderate group (25%) indicates the volatility of quality of teacher–child relationships over time.

Results from the cluster analyses show the need to assess individual variation in quality of teacher–child relationships over time. Even though the average quality of teacher–child relationships declined over time, the majority of children demonstrated increases in relationship quality. Therefore, the overall average decrease in quality reflects the minority of students who evidenced substantial decreases. These results suggest that in contrast to previous hypotheses, elementary school teachers place a great emphasis on relational aspects of interactions with students. However, an alternative hypothesis to explain the large percentage of children for whom the quality of the relationship increased also exists. Specifically, the gradual increase in quality of the teacher–child relationship evidenced by most children may reflect the influence of children’s socialization into school behaviors over time rather than teachers’ continued emphasis on relational aspects of interactions. In other words, as students learn more appropriate behaviors for school, teachers may find it easier to interact with them and thus report higher quality relationships with them. Additional research with observational measures of relationship quality and teacher reports of classroom behavior is needed.

Teacher–Child Relationships and Achievement

To investigate the effects of teacher–child relationships on achievement within the context of children’s lives, teacher–child relationships were examined among a set of contextual variables. The findings demonstrate that high-quality teacher–child relationships foster children’s achievement. Controlling for factors within other systems of children’s ecologies, significant associations were found between relationship quality and achievement. Specifically, positive associations were evident between children’s third-grade achievement and both change in quality of teacher–child relationships and quality at third grade. Furthermore, children in the declining-low cluster had the lowest achievement scores at third grade. The significant effect of change in quality of teacher–child relationships on achievement indicates the importance of considering the dynamic quality of these relationships. An increasing trajectory of relationship quality beginning in preschool appears to support children’s achievement, whereas a decreasing trajectory is a risk factor.

Examination of the structure coefficients also indicates the importance of teacher–child relationships for children’s achievement. Structure coefficients demonstrate the unique strength of a given predictor in a model, as they do not account for shared variance among the variables (Courville & Thompson, 2001). The structure coefficients show that teacher–child relationships in third grade are stronger predictors of achievement than insecure maternal attachments and peer relationships. These findings suggest that

interventions focused on improving children's academic achievement through relationships should focus on children's relationships with their teachers. Investigation of the structure coefficients also indicates that the effect of change in relationship quality is less than that of quality of the third-grade relationship. However, the strength of change in relationship quality is similar to that of American status and greater than that of child gender. The structure coefficients associated with membership in the stable-moderate and declining-low groups also demonstrate the predictive strength of teacher-child relationships for achievement. The structure coefficients for group membership were approximately the same value as those for insecure and insecure-other maternal attachment and substantially greater than that for classroom peer relationships. These findings indicate the importance of focusing on the quality of children's relationships with teachers throughout elementary school and working toward preventing decreases in relationship quality.

The findings regarding teacher-child relationships and achievement are particularly robust given the number of variables included in the regression models, which makes it difficult to argue that significant associations between teacher-child relationships and achievement were the result of omitted variables. Omitted variables could be responsible for these associations only if they influenced both quality of teacher-child relationships and achievement but were unrelated to early cognitive ability, behavior problems, gender, maternal attachment, episodes of poverty, maternal education, authoritarian parenting, quality of peer relationships, and ethnicity. The significant effect of quality of teacher-child relationships, controlling for powerful child and family influences, demonstrates that children's relationships with teachers are additional sources of variability in children's achievement.

Classroom Behaviors as Mediators

Researchers and theorists hypothesize that the impact of teacher-child relationship quality on achievement operates indirectly through its effects on child and teacher behaviors in the classroom (Pianta, 1999). Our analyses support this assertion. The effect of teacher-child relationship quality on achievement occurred through children's classroom engagement. Children with higher quality relationships were more engaged in the classroom. Child engagement was in turn positively associated with achievement. Children with higher quality relationships appear to use the teacher as a secure base from which to explore the environment. The effect of quality of teacher-child relationships on achievement occurred through teacher behaviors as well. Specifically, teacher attention to the study child mediated the association between relationship quality and achievement. Teachers attended less often to children with whom they had higher quality relationships. In turn, teacher attendance was negatively associated with achievement. This finding is consistent with previous research in which teachers reported spending more time with children who were dependent and/or exhibited disruptive classroom behaviors (Pianta, 1999).

An Ecological Model of Development

The current findings support a central tenet of the CSM, that child outcomes are the result of factors at each level of the child's ecology. In particular, children's achievement at third grade was influenced by early cognitive ability, gender, maternal attachment, maternal education, episodes of poverty, authoritarian parenting beliefs, teacher–child relationships (slope and intercept), child classroom engagement, teachers' academic instruction, teachers' attention to the child, and the child's race-ethnicity. In accord with previous research, the structure coefficients indicate that early cognitive ability and family ecology variables had the largest effects on achievement. This is not surprising, as these effects demonstrate both genetic and environmental influences (NICHD ECCRN, 2002).

Also in accord with the CSM, the effects of quality of teacher–child relationships varied as a function of quality of children's maternal relationships. In particular, the effects of change in relationship quality and relationship quality at third grade were greater for children with insecure-other versus secure attachments. Insecure-other children who experienced gains in the quality of teacher–child relationships and/or who had high-quality relationships with teachers at third grade scored similarly to their secure peers. The effects of cluster membership also varied as a function of insecure-other attachment. Specifically, insecure-other children in the declining-low group evidenced significantly lower levels of achievement than insecure-other children in the inclining-high group. In this study, a higher quality teacher–child relationship appeared to be a protective factor for children with lower quality relationships with their mothers; however, the relative magnitude of the effect was moderate. To conclude that higher quality teacher–child relationships do indeed buffer children from the negative effects of insecure-other attachment, it is necessary to replicate these findings with a different sample.

Educational Implications

In 2001, 61% of children from birth through age 5 attended child care on a regular basis, 98% of children from 5 to 6 years of age were enrolled in kindergarten, and more than 99% of children attended elementary school (U.S. Department of Education, National Center for Education Statistics, 2004). Teacher–child relationships are central to children's development beginning in the preschool years. These results point to the value of identifying the quality of children's relationships with teachers and working toward improving low-quality relationships.

The current findings also have implications for teacher education programs. Early-education teachers are often instructed as to ways to foster high-quality relationships with students. Elementary school teachers, in comparison, are often educated as to how to promote effective instructional interactions, rather than relationships, with students (Howes & Hamilton, 1993). Results from this study, however, demonstrate the importance of educating elementary school teachers as to how to foster high-quality relationships.

Furthermore, results from this and other studies indicate protective effects of high-quality teacher–child relationships (e.g., Birch & Ladd, 1996; Howes & Ritchie, 1999). Educating teachers as to how to develop high-quality relationships with children may provide strategies for teachers working with children who are at risk for lower levels of achievement. In addition, this research demonstrates that relationships influence achievement through child and teacher behaviors in the classroom. Informing teachers as to the influence of relationship quality on classroom behavior may increase teacher awareness and in turn prevent children with low-quality relationships from engaging in harmful behaviors in the classroom.

Future Directions

These findings provide an indication that there are important associations between quality of teacher–child relationships and children’s achievement. Additional work, however, is needed. First, it is necessary to examine associations between teacher–child relationships and achievement among higher risk samples. The current sample is a product of the recruitment and enrollment methods of the NICHD SECCYD study. Specifically, children who had disabilities or lived in dangerous areas or whose mothers did not speak English were excluded. Furthermore, those children who remained in the study at third grade were more likely to be European American and to have mothers with more years of education. The current sample may contain relatively few high-risk children, thus reducing effects of teacher–child relationship quality on achievement. Research with higher risk samples could provide more information on the protective effects of high-quality teacher–child relationships for children at risk for lower levels of achievement. Second, it is important to examine associations between changes in achievement and changes in relationship quality to determine direction of effects. It is possible that increases in relationship quality result from increases in achievement. Third, it is essential to examine child, teacher, and classroom factors associated with relationship quality by investigating between- and within-teacher variance in relationship quality.

Note

This project was funded by a grant from the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development to Kathleen McCartney (HD25451). We would like to thank the investigators in the NICHD Early Child Care Research Network for the data set. We would also like to thank Paul Harris and Catherine Ayoub for their assistance in conceptualizing the analyses, the site coordinators and research assistants who collected data, and the families and teachers who continue to participate in this longitudinal study.

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Manuscript received October 13, 2005

Revision received July 7, 2006

Accepted September 9, 2006