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Trajectories of Teacher-Student Warmth and Conflict at the Transition to Middle School: Effects on Academic Engagement and Achievement

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Abstract

Using piece-wise longitudinal trajectory analysis, this study investigated trajectories of teacher-reported warmth and conflict in their relationships with students 4 years prior to and 3 years following the transition to middle school in a sample of 550 academically at-risk and ethnically diverse adolescents. At the transition to middle school, teacher reports of warmth showed a significant drop (shift in intercept), above age-related declines. Both warmth and conflict declined across the middle school years. Structural equation modeling (SEM) tested effects of the shifts in intercept and the post-transition slopes on reading and math achievement, teacher-rated engagement, and student-reported school belonging 3 years post-transition, above pre-transition levels of the outcome. For warmth, a drop in intercept predicted lower math scores and engagement, and a more positive slope predicted higher engagement. For conflict, an increase in intercept and a negative slope predicted lower engagement. Implications of findings for reducing normative declines in academic engagement in middle school are discussed.

Considerable research over the past two decades has demonstrated the benefits of an emotionally supportive teacher-student relationship during the elementary grades to students' academic and psychosocial adjustment (for reviews see Hughes, 2012; McGrath & Van Bergen, 2015; Sabol & Pianta, 2012). The majority of this research has investigated teacher-perceived teacher-student relationship quality (TSRQ). These studies document benefits of a supportive teacher-student relationship on diverse outcomes, including classroom engagement and achievement (Author, 2008; Roorda, Koomen, Spilt, & Oort, 2011), liking for school and academic self-efficacy (Author, 2011; Ladd, Birch, & Buhs, 1999), and peer acceptance (De Laet et al., 2014; Hughes & Im, 2016). Studies of changes in teacher-perceived TSRQ across the elementary grades document that average levels of TSRQ decrease from preschool through grade 5 (O'Connor, 2010). When teacher-perceived support (i.e., closeness) and conflict from kindergarten to Grade 6 were investigated

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separately, a consistent decrease in closeness was found, whereas conflict increased in the early grades before declining after grade 5 (Jerome, Hamre, & Pianta, 2009).

A paucity of research has examined changes in teacher-perceived TSRQ across the transition to elementary school. A study conducted with the same longitudinal sample as the current study found that teacher-perceived warmth and conflict declined from age 6 to 14 (Wu & Hughes, 2014). Because this study did not model the transition to middle school, and students transition at different ages and grades, it was not able to test whether the transition to middle school was associated with a drop in mean level of warmth and conflict above the effect of age-related declines, nor did the study investigate the effects of changes in teacher-perceived warmth and conflict at and following the transition to middle school on students' school adjustment.

In light of these gaps in knowledge of the course and consequences of teacher-perceived TSRQ as students move from elementary to middle school, the current study examines trajectories of teacher-perceived relationship warmth and conflict during the four years prior to and the three years following the transition to middle school. We then investigate effects of a shift in level of warmth and conflict at the point of transition (i.e., change in intercept) and the post-transition slope in warmth and conflict on students' academic engagement and achievement three years after the transition to middle school.

Theoretical Perspectives on Effects of TSRQ

Researchers have drawn from diverse theories in explaining an effect of an emotionally supportive relationship with one's teacher. Drawing from attachment theory (Bowlby, 1980), researchers have suggested that a close and supportive relationship with one's teacher promotes a child's emotional security and confidence, thereby serving as a resource that permits young students to actively explore their environment and to cope more effectively with academic and social stressors (Pianta & Steinberg, 1992; Verschueren & Koomen, 2012). Attachment perspectives on the effects of TSRQ are most common in studies of preschool and elementary students. Drawing from bio-ecological models of development (Bronfenbrenner & Morris, 2006), researchers have focused on the embedded nature of the teacher-student relationship in classrooms and the reciprocal influences of teacher-student relationships and peer relationships (De Laet et al., 2014; Hughes, Cavell, & Willson, 2001; Gest & Rodkin, 2011). Social motivation theorists (Connell & Wellborn, 1991; Furrer & Skinner, 2003; Hughes, Luo, Kwok, & Loyd, 2008, 2008) postulate that a supportive relationship with one's teacher provides a child with a sense of belonging and of being valued at school, which engenders effortful engagement in the classroom and conformity to school rules.

Research with adolescents often draws on self-determination theory (Deci & Ryan, 2000), a variant of social motivation theory, in explaining an effect of TSRQ on students' academic motivation and engagement (Allen, Pianta, Gregory, Mikami, & Lun, 2011; Danielsen, Wiium, Wilhelmsen, & Wold, 2010; Wang & Eccles, 2013). Self-determination theory posits that the more students' basic psychological needs for a sense of belonging (i.e., relatedness), autonomy, and competence are met in the classroom, the more students will identify with

school and its goals and put forth effort in the classroom (Wigfield, Eccles, Schiefele, Roeser, & Davis-Keane, 2006). Finally, according to social referencing theory (Hughes, Cavell, & Willson, 2001), classmates rely on their observations of teachers' interactions with classmates in forming perceptions of classmates' attributes and likability. Thus, positive teacher-student interactions may improve students' social standing in the classroom and classroom engagement (Hughes & Im, 2016). It is important to note that these various theoretical perspectives are complementary rather than exclusionary, and researchers often draw on more than one theory in explaining effects of TSRQ (Hughes, Cavell, & Jackson, 1999; McGrath & Van Bergen, 2015).

The Transition to Middle School and Teacher Support

The transition to middle school is difficult for many students and is often associated with a decline in students' academic motivation, psychosocial adjustment, and grades (Anderman, 2003; Barber & Olsen, 2004; Roeser, Eccles, & Sameroff, 1998). Importantly, if an adolescent has difficulty during the middle school transition, this trajectory often continues throughout adolescence (Blyth, Simmons, & Carlton-Ford, 1983; Cantin & Boivin, 2004).

According to the Stage-Environment Fit Theory (Eccles et al., 1993), the decline in student engagement at the transition to middle school is due to a mis-match between the psychological needs of adolescents and the structure of middle schools. At a developmental period characterized by an increased desire for autonomy and enhanced sensitivity to peers' reactions to them (Brown & Larson, 2009), early adolescents experience less choice over academic tasks and encounter a larger and more diverse peer context. Additionally, the transition to middle school brings increased demands on students' planning and organizational skills as they encounter a departmentalized curriculum. Furthermore, as students move from elementary to middle school they report less availability of adults to provide support and guidance in meeting these challenges (Bokhorst, Sumter, & Wetenberg, 2009; Furrer & Skinner, 2003). Teachers may have less close relationships with students due to the multiple classes each student attends.

Prior research has found that both student-report and teacher-report of teacher emotional support decline across early adolescence (Way, Reddy, & Rhodes, 2007; Wentzel, Battle, Russell, & Looney, 2010; Wu & Hughes, 2012). However, a normative decline in average level of teacher emotional support does not necessarily indicate that teacher support is less important to adolescents' school adjustment than it is to elementary students' adjustment. In adolescence, an emotionally supportive teacher-student relationship may communicate acceptance, confidence in a youth's ability, and respect for the youth's autonomy (Davis, 2006). Consistent with this view, middle school students who perceive supportive relationships with teachers report more positive changes in school adjustment (Way, Reddy, & Rhodes, 2007; Wang & Dishion, 2012; Wang & Holcombe, 2010).

In a cross-sectional sample of Slovenian students, both teacher- and child-perceived TSRQ declined from grade 4 to grade 7 (Košir & Tement, 2013). Interestingly, across grade groups, teacher reports were more consistently predictive of changes in achievement than were child reports. In a longitudinal study of urban youth from grades 7 to 11, Wang and Eccles

(2012b) found that, on average, teacher reports of support to students declined; however, smaller declines (or increases) in teacher support protected students from the normative decline from grade 7 to 11 in school compliance, school identification, and valuing of school.

Gender and TSRQ

Gender differences in teacher-student warmth and conflict are well-documented. In the elementary grades, relative to their relationships with boys, teachers rate their relationships with girls as higher in warmth and closeness and lower in conflict (Hamre & Pianta, 2001; Jerome et al., 2009; Saft & Pianta, 2001; Hughes et al., 2008). These findings are generally interpreted in terms of girls placing a higher value on close relationships than boys (Maccoby, 1990). A paucity of research has examined gender differences in teacher-report of TSRQ at the secondary school level. In a study of students from grade 7 to 11, Wang and Eccles (2012b) found no gender differences in teacher reports of social support to students. The lack of gender differences may be due to the brevity of the measure (4 items) and the nature of the items, which emphasize the provision of guidance and instrumental assistance rather than emotional support.

Researchers have drawn from different theoretical perspectives in hypothesizing gender differences in the effects of TSRQ. According to the vulnerability hypothesis, also referred to as the academic risk hypothesis (Ewing & Taylor, 2009; Hamre & Pianta, 2001), boys would be expected to benefit more from a supportive relationship, because they are more at-risk for school adjustment problems. Conversely, the gender socialization hypothesis (Ewing & Taylor, 2009) suggests that girls will be more affected by the level of support they receive from teachers, based on the finding that girls value close relationships more highly than do boys. The few studies on gender differences in the effects of teacher-perceived support and conflict on school adjustment in the elementary grades suggest that teacher warmth and conflict may affect boys and girls differently. Consistent with the academic risk hypothesis, low levels of teacher warmth are more detrimental to the academic achievement of elementary school boys than girls (Hamre & Pianta, 2001; Spilt, Hughes, Wu, & Kwok, 2012). Consistent with the gender socialization hypothesis, high levels of conflict may be more detrimental to the academic achievement of girls than of boys (Ewing, 2009; Spilt, Hughes, et al, 2012). For a more complete review of gender differences in the effects of teacher-student relationship quality, see McGrath and Van Bergen (2015).

Research Objectives

The present study has four primary objectives. First, we investigated developmental changes in teacher-perceived warmth and conflict in their relationships with students at and following the transition to middle school. Piece-wise latent growth models, an extension of latent growth models (Chou, Yang, Pentz, & Hser, 2004; Kohli & Haring, 2013), are a useful way to compare growth patterns at different stages of growth. The piece-wise latent growth models were applied in this study to capture different stages of growth in teacher-reported warmth and conflict, assuming different growth trajectories in teacher-reported warmth and conflict for the three years prior to students' transition to middle school (piece 1) and the

three years following students' transition from elementary to middle school (piece 2). Based on changes in the context of school as youth transition to middle school and prior research on decreases in teacher support in adolescence, we expected a negative (declining) shift in intercept for warmth as well as declining levels of warmth (i.e., negative slope) across the middle school grades. Based on prior research demonstrating declining levels of teacher-rated conflict after grade 4 (Jerome et al., 2009; Wu & Hughes, 2014), we expected negative pre-transition and post-transition slopes for teacher-rated conflict. However, due to limited research, no hypotheses were put forward regarding a shift in level of teacher-rated conflict at the transition to middle school.

Second, we tested for gender effects on two parameters from the piece-wise growth model. Specifically, we tested for gender effects on a change in level of warmth and conflict at the transition to middle school and for gender effects on the post-transition slopes for warmth and conflict. Given a lack of prior research on gender differences in teacher-rated warmth or conflict during the middle school years, these analyses are exploratory.

Third, we tested the effect of post-transition trajectories for warmth and conflict on students' school adjustment (i.e., tested reading and math achievement, teacher-rated behavioral engagement, and student perceived school belonging) 3 years post-transition. We expected an increase in warmth and a decrease in conflict at the transition to middle school (i.e., shift in intercept) would predict improved outcomes 3 years post-transition. We also expected a more positive rate of change (i.e., slope) for warmth and a more negative rate of change for conflict across the middle school grades would predict improved outcomes 3 years post-transition. In these outcome analyses, we controlled for students' performance on the outcomes in the year prior to their transition to middle school, in addition to other relevant covariates, thereby providing a more rigorous test of the effects of a change in warmth and conflict at the transition to middle school on student adjustment than has prior research.

Fourth, we tested gender moderation of the effects of a shift in intercept and post-transition slope on outcomes. Due to limited prior research, tests of gender moderation of effects of a shift in intercept or post-transition slope on student outcomes were exploratory.

We pursued these research objectives in a multi-ethnic, predominantly low SES sample of youth who were at elevated risk of low school achievement at entrance to first grade. Ethnic minority and lower-achieving students are at greater risk for declining academic engagement and achievement in the middle school grades (National Center for Education Statistics, 2007). Yet, consistent with the compensatory model of relationship support (Hamre & Pianta, 2005), students at-risk for poor school adjustment appear to benefit more from supportive teacher relationships than do low-risk youth (Meehan, Hughes, & Cavell, 2003; Wang, Brinkworth, & Eccles, 2012). Thus the current sample represents a population of considerable concern to educators interested in narrowing ethnic/racial and income achievement gaps and preventing school failure. The provision of a supportive teacher-student relationship may protect these youth from poor school engagement and low achievement during middle school. Such a finding would suggest the potential impact of interventions to improve TSRQ in the middle school grades on improving the educational attainment of academically at-risk youth.

Methods

Sample

Participants were 550 students recruited in the fall of 2000 or 2001 into a larger longitudinal study ($N = 784$) when they were in grade 1. Students in the larger longitudinal sample were enrolled in one of three school districts (one urban and two small city districts) in Texas and were selected into the study on the basis of scoring below the median on a district-administered test of literacy administered in the spring of kindergarten or the fall of grade 1. Based on school records, School District A (student population = 13,558) had an ethnic distribution of 38% White, 37% Hispanic, 25% African American, and less than 1% other. District B (student population = 24,429) had an ethnic distribution of 35% White/Euro-American, 30% Latino/Hispanic, 30% African American, and 5% other. District C (student population = 7,424) had an ethnic distribution of 67% White, 12% Hispanic, 12% African American, and 9% other. Additional inclusionary criteria for the larger study included speaking English or Spanish and, not receiving special education services other than speech and language services, and not having been previously retained in grade 1.

At the end of the 5th year of participation in the study, parents of 569 (72.58%) children provided written consent for continued participation. Of the 215 children without consent, only 18 actively declined, whereas 157 did not return the consent form, 9 had moved to Mexico, 1 was deceased, 25 had previously withdrawn from the study, and 5 were not able to be located. Of these 569 who re-consented at Year 5, 550 met criteria for inclusion in the current study: the student had a minimum of two years of data on teacher-rated relationship warmth and conflict, the year the student transitioned to middle school was known, and the student was either continuously promoted or was retained in grade no more than once across the elementary grades.

Attrition analysis investigated differences between the 550 participants in the analysis sample and the 234 attrited children on a wide range of variables assessed when students were in first grade, including gender, parent education level, literacy scores, reading and math achievement, IQ, and ethnicity. Participants and attrited children differed only on bilingual status: attrited children were more likely to have been in bilingual classroom (14.2%) than were participants in the analysis sample (11.5%). The 550 participants (54% male) were 6.57 years of age ($SD = .38$) at grade 1, 56.4% were economically disadvantaged based on income eligibility for free or reduced lunch, and 50.0% of parents' highest level of educational attainment was a high school diploma or less. The ethnic composition of the sample was 35.3% Euro-American, 24.2% African American, 36.4% Hispanic (of whom 30.5% were enrolled in bilingual education at grade 1), and 4.1% Other. At first year post-transition, these 550 participants were grouped into 170 different classrooms in 77 different schools in 6 different school districts. The average school cluster size is 7.14 (range from 1 to 81).

Assessment Procedures

Teachers' ratings of their relationships with students and ratings of student classroom engagement and conduct problems were obtained via questionnaires that were mailed to

teachers in the Spring of the year. During the elementary grades, the student's home room teacher completed the teacher questionnaire. In middle school, the student's language arts teacher was asked to complete the teacher questionnaire or to name another teacher who was more familiar with the student to whom researchers could send the questionnaire. Although it would have been preferable to have all of a student's teachers complete the questionnaire, the financial resources to do so were not available. Because all students in middle school take a language arts course, selecting the language arts teacher as the respondent increased the probability that students were evaluated in a similar instructional context. In 7% of the cases, the questionnaire was completed by another teacher named by the language arts teacher as having greater knowledge of the student. Table 1 provides descriptive information on characteristics of elementary teachers and middle school teachers, separately. Not surprisingly, middle school teachers reported spending fewer hours per day with the student than did elementary school teachers. Reports of warmth and conflict did not differ based on whether the language arts or another teacher completed the questionnaire. Teachers were paid \$25.00 for completing each student survey. Teachers reported on warmth and conflict in their relationships with students for the 3 years prior to the transition and the 3 years post-transition. Teachers reported on outcomes (i.e., classroom engagement and conduct problems) at baseline (the year prior to transition to middle school) and 3 years post-transition.

Students reported on their perceived sense of school belonging in individual interviews at school between November and April of the outcome year (i.e., the 3rd year post-transition) and at baseline (i.e., the year prior to transition to middle school). Bilingual students were interviewed and tested in the language in which they were more proficient, based on scores on the Woodcock- Muñoz Language Test (Woodcock & Muñoz-Sandoval, 1993). Students received small gifts for completing the assessments.

Measures

Teacher student relationship—The Teacher Network of Relationships Inventory (TNRI; Hughes & Kwok, 2006) was developed from the child version of the Network of Relationships Inventory (Furman & Buhrmester, 1985). The 22-item TNRI yields three factors: Warmth (13 items), Conflict (6 items) and Intimacy (3 items) (Hughes, Gleason, & Zhang, 2005; Wu & Hughes, 2014). Scores on the TNRI have demonstrated good construct, factorial, and predictive validity across the elementary and middle school grades (Hughes, 2011; Hughes, Luo, Kwok, & Loyd, 2008; Wu & Hughes, 2014). Because the Intimacy Scale is less consistently predictive of students' school adjustment than are the Warmth and Conflict Scales (Wu & Hughes, 2014), the current study used only the Warmth and Conflict Scales. Teachers reported their provision of warmth and the level of conflict in their relationship with a given student on a 1–5 Likert scale (1 = “*not true at all*” and 5 = “*very true*”). Example Warmth scale items include “I enjoy being with this child,” and “This child gives me many opportunities to praise him or her.” Scale α averaged .95 pre-transition and .96 post-transition. Example Conflict scale items include “This child and I often argue or get upset with each other,” and “I often need to discipline this child.” Scale α averaged .92 pre-transition and .94 post-transition.

Importantly, with the same longitudinal sample as used in the current study, the TNRI demonstrated both metric and scalar longitudinal measurement invariance across ages 6 to 15 years as well as measurement invariance across gender and race/ethnicity (Wu & Hughes, 2014). Evidence of measurement invariance means that scores on a measure have the same meaning across time or across groups, which is a requirement for reaching valid conclusions regarding changes in a construct over time or differences in the construct between groups (Millsap, 2011). Across the age span of the current study, Cronbach's alphas for the 13 Warmth items ranged from .94 to .96, and Cronbach's alphas for the 6 Conflict items ranged from .92 to .94.

Academic achievement in reading and math—The Woodcock–Johnson III (WJ-III) Tests of Achievement (Woodcock, McGrew, & Mather, 2001) is an individually administered measure of academic achievement for individuals 2 years of age to adulthood. The WJ-III Broad Reading W scores (Letter–Word Identification, Reading Fluency, and Passage Comprehension subtests) and the WJ-III Broad Math W scores (Calculations, Math Fluency, and Math Calculation Skills subtests) were used. Extensive research documents the reliability and construct validity of scores on the WJ-III and its predecessor (Woodcock & Johnson, 1989; Woodcock et al., 2001). Spanish language-dominant children were administered the Bateria III, the equivalent Spanish version of the WJ III (Woodcock, Munoz-Sandoval, McGrew, Mather, & Schrank, 2004) by bilingual examiners.

School belonging—The Psychological Sense of School Membership Scale (Goodenow, 1993) was administered in individual interviews. Students were asked to indicate their agreement on a 5-point Likert-type scale (1 = “*not at all true*” and 5 = “*very true*”) with 18 items that assess students' perceived acceptance, feelings of inclusion, respect, and encouragement for participation. Example items include “I feel like a real part of this school,” “People at this school are friendly to me,” and “It is hard for people like me to be accepted here” (reverse scored). Higher scores are associated with greater school attendance, higher grades, more positive teacher-perceived relationship support, higher self-concept, greater time spent on homework, and better social–emotional adjustment (Goodenow, 1993; Hagborg, 1998; Hughes & Chen, 2011). The internal consistency reliability (Cronbach's α) of school belonging was .87 at baseline and .89 at the outcome year.

Student-rated school engagement—Students rated their school engagement on an 18-item scale drawn from Skinner, Zimmer-Gembeck, and Connell (1998). Results of exploratory and confirmatory factor analyses with the current sample supported three factors labeled Behavioral Engagement (7 items), Behavioral Disaffection (6 items), and Emotional Engagement (4 items) (Chen, Hughes, Liew, & Kwok, 2010). Only the behavioral engagement scale was used in the current study. This measure was only administered after students transitioned to middle school. This scale has demonstrated good criterion-related validity (Chen et al., 2010). Example items include: “When I am in class, I work as hard as I can,” and “When I am in class, I concentrate on doing my work.” Students were asked to indicate their agreement on each item on a 1 (*not at all true*) to 4 (*very true*) scale. A composite score was created as the mean item score for these 7 items (Cronbach's $\alpha = .82$ at the outcome year).

Teacher-rated classroom engagement—Teachers rated students' classroom engagement using an 11-item questionnaire. Items were adapted from both the teacher and the student ratings of students' engagement (Connell & Wellborn, 1991; Skinner, Zimmer-Gembeck, & Connell, 1998). Items assess effort, persistence, concentration, and interest. Example items include the following: "Tries hard to do well in school," "concentrates on doing work," "tries to look busy" (reverse scored), and "participates in class discussion." Teachers were asked to indicate the extent to which each statement was true of the student on a scale ranging from 1 (*Not true at all*) to 4 (*Very true*). These 11 items demonstrate good construct validity (Chen, Hughes, Liew, & Kwok, 2010) and internal consistency (scale α at baseline and 3 years post transition were .91 and .92, respectively).

Teacher-rated conduct problems—Teachers completed the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), a brief screening measure for psychopathology. Each item is rated on a 0 to 2 scale (i.e., 0 = *not true*, 1 = *somewhat true*, 2 = *certainly true*). The SDQ yields five scales comprised of five items each. Only the Conduct Problems scale was used in the current study (scale α was .74 at baseline and .79 at the outcome year). Example items include "Generally well behaved, usually does what adults request" and "Often fights with other children or bullies them." Scores on the scale have demonstrated good internal consistency, inter-coder agreement, and convergent and discriminant validity (Hill & Hughes, 2007).

Auxiliary variables—To estimate missing data on outcomes, we incorporated auxiliary variables into the structural equation model. The 19 auxiliary variables were selected based on correlations with outcomes that have missing data (Enders, 2008; Savalei & Bentler, 2009; Schlomer, Bauman, & Card, 2010). The auxiliary variables include two demographic variables (i.e., ethnicity and economic status); both teacher and student ratings on the Emotional Symptoms, Conduct Problems, Hyperactivity-inattention, Peer Problems, and Prosocial Behaviors Scales of the Strengths and Difficulties Questionnaire (Goodman, 2001); teacher- and parent- rated highest level of education expected of the student; and scores on the five outcomes measured at baseline.

Covariates—To control for potential confounds in the outcome analyses, in addition to including the baseline score on the outcome (i.e., the score the year prior to transition to middle school), gender and the mean level school achievement for the middle school grades were included. Gender was included based on its association with academic and behavioral adjustment in middle school (Zembar & Blume, 2009). School-level achievement was included based on the finding that youth achieve at higher levels when attending higher achieving schools (Benner, Graham, & Mistry, 2008). School-level reading and math scores were obtained from the Texas Education Agency's on-line accountability system. The mean school-level achievement was calculated as the mean of the school-level reading and math scores.

Data analysis

All models were analyzed using *Mplus* version 7.2 (Muthén & Muthén, 1998–2014). Robust maximum likelihood estimation method was applied to estimate appropriate standard errors

when the normality assumptions are violated. The missing data were dealt with full-information likelihood estimation (FIML), which uses all the available information for parameter estimation (Enders, 2010). Auxiliary variables were included in the ML estimation to handle missingness. We used TYPE=COMPLEX in combination with the CLUSTER function (i.e., school at time 1) to take into account the data dependency (i.e., students nested within school). Piecewise linear latent growth model was selected, because there were only three time periods post-transition.

To assess pre-transition and post-transition trajectories, we determined the year and grade at which students transitioned to middle school. Schools differ in the grade at which students make the transition from elementary school to middle school: 143 students (26%) transitioned to middle school after completing grade 4, 403 students (73.3%) transitioned after completing grade 5, and 4 students (0.7%) transitioned after completing grade 6.

First, we tested the unconditional piecewise latent growth models. We centered the time predictor at the transition point (i.e., first year in middle school), and then applied piecewise latent growth curve modeling to investigate the pre-transition and post-transition trajectories for teacher-student relationship warmth and conflict. The four years prior to middle school (time points -3 to 0 in Figure 2) constituted the pre-transition trajectory and the three years post-transition (i.e., the first year of middle school and the following two years) constituted the post-transition trajectories (time points 0 to +2 in Figure 2). The unconditional piecewise latent growth curve models have four transition trajectory factors: intercept at the transition, shift in intercept from pre-transition to post-transition, pre-transition slope, and post-transition slope. We then used model comparison tests to determine whether pre-transition and post-transition slopes differ. We also tested the correlation between the shift in intercept and post-transition slope for warmth and conflict to determine if a drop at transition was associated with the post-transition rate-of-change.

Second, we examined the effect of gender on these two trajectory factors (i.e., shift in intercept and post-transition slope) in the conditional piecewise latent growth models. In these analyses, we also controlled for the effect of grade at which students transitioned to middle school (i.e., grade 5, 6, or 7) on the shift in intercept and the post-transition slope because we wanted to rule out the possibility that a shift in intercept was due to increasing age rather to a change in school level.

Third, in the outcome model, we investigated the effect of a shift in intercept and the post-transition slope in the conditional growth model on outcomes three years post-transition. In these models, we controlled for baseline scores on the outcome (i.e., scores the year prior to transition to middle school) and three additional covariates (i.e., gender and school level achievement in math and achievement). See figure 1 for the hypothesized model. Fourth, we investigated whether gender moderated the effect of a shift in intercept and the post-transition slope on outcomes.

Results

Descriptive Statistics

Table 2 shows the correlations and descriptive statistics between the outcomes and covariates. Table 3 shows correlations and descriptive statistics between warmth and conflict and the covariates. All variables were checked for skewness and kurtosis, and none of the variables showed violation of the normality assumption based on commonly used cutoff values (i.e., skewness < 7 ; West, Finch, and Curran, 1995). The proportions of missing data ranged from 0% to 24.73%. The highest levels of missing data were teacher-reported student engagement at baseline (21.45%) and the outcome year (24.73%). The majority of missingness on teacher-rated variables was a result of teachers not returning the mailed questionnaire. Missingness on the remaining outcome variables ranged from 7.27% to 7.45% at baseline and from 9.64% to 10.0% 3 years post-transition. Missingness on these student-reported and performance variables was due to student absences on the dates of testing and student mobility or attrition.

As shown in Table 2, math and reading achievement were highly positively correlated ($r = .71$). Relative to girls, boys reported lower levels of school belonging and were rated by teachers as less engaged in the classroom. Students who transitioned to middle school at higher grades had lower math and reading scores. This result may be explained by the finding that growth in Woodcock Johnson Broad Reading and Broad Math W scores across ages 6 to 14 years is quadratic (i.e., the rate of increase, or growth, in W scores decelerates with increasing years) (Moser, West, & Hughes, 2012; Pianta, Belsky, Vanderfrift, Hourts, & Morrison, 2008).

As shown in Table 3, consistent with expectations, girls had higher teacher-reported warmth and lower teacher-reported conflict than boys at each year from elementary school through middle school. The gender effect sizes by Cohen's d ranged from 0.33 to 0.42 for warmth and the effect sizes for conflict ranged from 0.26 to 0.56, indicating small to medium effects (Cohen, 1988).

Before conducting the structural equation model, the intraclass correlation coefficients (ICC) were calculated for the teacher warmth and conflict as well as the outcome variables. ICCs for outcome variables (e.g., reading, math, school membership, teacher-rated engagement and student-rated engagement) range from 0.02 to 0.23 and ICC for teacher-rated warmth and conflict scores at pre-transition and post-transition range from 0.01 to 0.07.

Unconditional Latent Growth Model

The unconditional latent growth model for teacher-reported warmth and conflict with parameter estimates are shown in Figure 2. After fixing the variance of the post-transition slope as 0.01 in the conflict model, both models (each with four latent growth factors) had adequate model fit, based on suggested criteria (Hu & Bentler, 1999). For warmth, $\chi^2(14) = 17.75$, $p = 0.22$, RMSEA = 0.02, CFI=0.99, SRMR=0.03. For conflict, $\chi^2(15) = 11.57$, $p = 0.71$, RMSEA = 0.00, CFI = 1.0, SRMR = 0.02.

Warmth—Results of the unconditional growth model for warmth are shown in Panel A in Figure 2). The intercept at transition (I1) was statistically significant ($\gamma = 3.87$, $SE = 0.07$, $p < 0.01$). As expected, the slope in elementary school (S1) was statistically significant and declining ($\gamma = -0.05$, $SE = 0.02$, $p < 0.05$) as was the slope during middle school ($\gamma = -0.12$, $SE = 0.03$, $p < 0.01$). The negative coefficient for S1 means that, on average, children declined each year by 0.05 points on the 5-point Warmth scale during the last 4 years of elementary school. The negative coefficient for S2 means that, on average, students declined by 0.12 points each of the 3 post-transition years. Also, as expected, we found a statistically significant drop ($\gamma = -0.18$, $SE = 0.05$, $p < 0.01$) in average warmth scores over the transition from elementary to middle school (i.e., I). To examine whether S1 and S2 differ, we compared the two competing nested models (i.e., relax slopes vs. constrain them same) using the Satorra-Bentler test. The model comparison test showed no statistically significant difference between S1 and S2 for warmth, $\chi^2 = 2.88$, $p = 0.09$. Furthermore, the correlation between shift in intercept and slope was not statistically significant ($r = 0.04$, $SE = 0.05$, $p = 0.49$).

Conflict—As shown in Panel B in Figure 2, the intercept at transition (I1) was statistically significant ($\gamma = 1.66$, $SE = 0.06$, $p < 0.01$). As expected, the pre-transition slope was negative ($\gamma = -0.04$, $SE = 0.02$, $p < 0.05$) as was the post-transition slope (i.e., S2) ($\gamma = -0.06$, $SE = 0.02$, $p < 0.05$). For the change in average conflict score over the transition from elementary to middle school (i.e., I), we found a non-significant increase ($\gamma = 0.02$, $SE = 0.05$, $p = 0.64$). The model comparison test showed no statistical significant difference between S1 and S2 for conflict, $\chi^2 = 0.81$, $p = 0.37$. Furthermore, the correlation between shift in intercept and slope was not statistically significant ($r = -0.01$, $SE = 0.03$, $p = 0.82$).

Conditional Growth Models

In the conditional growth models, we tested the effect of gender on the two parameters of interest (i.e., I and S2) after controlling for the grade at which students transitioned to middle school. The conditional growth models had adequate fit: $\chi^2(26) = 44.25$, $p < .05$, CFI = 0.96, RMSEA = 0.04, SRMR = 0.04 for warmth; $\chi^2(29) = 70.30$, $p < 0.01$, CFI = 0.95, RMSEA = 0.05, SRMR = 0.08 for conflict. For warmth, gender had no effect on I ($\gamma = -0.16$, $SE = 0.18$, $p = 0.37$) or S2 ($\gamma = 0.04$, $SE = 0.12$, $p = 0.73$), and grade had no effect on I ($\gamma = 0.04$, $SE = 0.13$, $p = 0.77$) or S2 ($\gamma = -0.14$, $SE = 0.15$, $p = 0.38$).

For conflict, gender had no effect on I ($\gamma = 0.4$, $SE = 0.28$, $p = 0.16$), but it had a significant effect on post-transition slope ($\gamma = -0.33$, $SE = 0.17$, $p < 0.01$), that is, boys declined less in conflict than girls in middle school. Grade had no effect on I or S2 ($\gamma = 0.003$, $SE = 0.14$, $p = 0.99$) or S2 ($\gamma = 0.21$, $SE = 0.23$, $p = 0.37$).

Outcome Model

In separate analyses, we tested the effect of shift in intercept (I) and post-transition slope (S2) for the conditional growth models for teacher-reported Warmth and for Conflict on outcomes assessed 3 years post-transition, above the covariates (i.e., baseline measure of the outcome, gender, and school-level achievement in reading and math). With the exception of student-rated engagement, the same measure was used to assess scores at baseline and at the

outcome year. Lacking a measure of student-rated engagement at baseline, teacher-rated engagement was employed as the baseline covariate. All the outcome models had adequate fit: CFI range from 0.96 to 0.99, RMSEA range from 0.03 to 0.05, SRMR range from 0.05 to 0.08 (see Table 4).

Warmth—As shown in Table 4 (Panel A), we first considered the shift in intercept (i.e., I). As predicted, a smaller drop over the transition from elementary to middle school in teacher-reported warmth predicted higher math achievement ($\gamma = 0.18$, $SE = 0.07$, $p < 0.05$), higher teacher-rated engagement ($\gamma = 0.25$, $SE = 0.11$, $p < 0.05$), and higher student-rated engagement ($\gamma = 0.30$, $SE = 0.11$, $p < 0.01$) 3 years post-transition. Contrary to expectation, the shift in intercept for warmth did not predict post-transition reading achievement ($\gamma = 0.10$, $SE = 0.10$, $p = 0.31$) or student-reported school belonging ($\gamma = 0.15$, $SE = 0.09$, $p = 0.09$).

Next, we considered the post-transition slope for warmth (i.e., $S2$). As expected, less decline in warmth across the middle school grades predicted more teacher-rated engagement ($\gamma = 0.86$, $SE = 0.06$, $p < 0.01$). Contrary to expectations, post-transition warmth trajectories did not predict reading ($\gamma = -0.01$, $SE = 0.08$, $p = 0.91$), math ($\gamma = -0.03$, $SE = 0.06$, $p = 0.57$), student-reported school belonging ($\gamma = 0.14$, $SE = 0.10$, $p = 0.18$), or student-rated engagement ($\gamma = 0.03$, $SE = 0.15$, $p = 0.85$).

Conflict—As shown in Table 4 (Panel B), we first considered the shift in intercept. As expected, a greater increase (or less decrease) in teacher-reported conflict over the transition from elementary to middle school predicted lower teacher-rated engagement ($\gamma = -0.46$, $SE = 0.12$, $p < 0.01$). Contrary to expectation, the shift in intercept for conflict did not predict reading achievement ($\gamma = 0.03$, $SE = 0.26$, $p = 0.90$), math ($\gamma = -0.31$, $SE = 0.19$, $p = 0.10$), student reported school belonging ($\gamma = -0.16$, $SE = 0.17$, $p = 0.37$), or student-rated engagement ($\gamma = -0.13$, $SE = 0.16$, $p = 0.41$).

Next, we considered the effect of the post-transition slope for conflict on outcomes. As expected, a more positive (or less negative) growth rate in conflict predicted lower teacher-rated engagement ($\gamma = -0.77$, $SE = 0.11$, $p < .01$). Contrary to expectation, post-transition slope for conflict did not predict reading ($\gamma = -0.02$, $SE = 0.30$, $p = .95$), math ($\gamma = 0.17$, $SE = 0.10$, $p = 0.08$), school belonging ($\gamma = 0.03$, $SE = 0.19$, $p = 0.89$), or student-rated engagement ($\gamma = -0.14$, $SE = 0.23$, $p = 0.54$).

Gender moderation effect

We tested whether gender moderated the effect of shift in intercept and post-transitions slope on outcomes. Since the moderation model included latent variables (i.e., I and $S2$), we applied latent moderation structural equation models using TYPE = RANDOM, and ALGORITHM = INTEGRATION in *Mplus* (Maslowsky, Jager, & Hemken, 2014). The interaction effects between gender and the latent variables (i.e., I and $S2$) were tested in the moderation model. No significant moderation (interaction) effect was found for teacher warmth or for teacher conflict.

Discussion

Changes in Trajectories of Teacher-Reported Warmth and Conflict

The first objective of this study was to investigate developmental changes in teacher-perceived warmth and conflict in their relationships with students at and following the transition to middle school. As expected, the slope for warmth was negative in the last 4 years of elementary school, and continued to decline at a similar rate during the 3 years post-transition to middle school. Of greater interest, the transition to middle school was associated with a significant drop in level of warmth, above the normative rate of decline prior to or following the transition. The drop in warmth at the transition was more than 3 times the annual rate of pre-transition decline. Because the drop in warmth is not associated with the grade at which students transition to middle school, it is most likely a result of changes in the context of schooling rather than developmental changes.

According to Stage-Environment Fit Theory (Eccles et al., 1993), students are most motivated, and experience the highest levels of well-being, when school contexts meet their socio-emotional needs. As students move from elementary to middle school they must adjust to multiple changes in the context of schooling, including a larger and more diverse peer culture to navigate, increased academic demands, a greater focus on grades and competition, and fewer opportunities for student decision-making (Roeser et al., 1998). At this critical juncture, they report a marked decrease in levels of teacher emotional support (Bru, Stornes, Munthe, & Thuen, 2010; Košir & Tement, 2013). The decline in teacher warmth is likely due to the fact that each student attends multiple classes, with multiple teachers. Thus students spend less time with any given teacher. Secondary teachers may also differ in their role expectations for teacher-student relationships (Lane, Pierson, & Givner, 2003; Munthe, 2003). The combination of a mis-fit between youths' needs and their school environment, combined with a reduction in teacher emotional support may account for why many students decline in behavioral, cognitive, and emotional engagement across and beyond the middle school grades (Wang & Eccles, 2012a).

The pre-transition and post-transition slopes for teacher-rated conflict were negative. That is, the decline in conflict observed in the last 3 years of elementary school continues across middle school grades, at a similar rate. Contrary to findings for warmth, the transition to middle school is not associated with an increase or decrease in the rate of change begun in elementary grade. Rather, the rate of decline in conflict appears to be linear from grade 3 or 4 to the end of middle school and does not change as students make the transition to middle school.

The finding of a shift in level of warmth but not in conflict may reflect differences in the nature of teacher-student relationship warmth and conflict. Based on the finding that teacher-reported relationship conflict is more stable than teacher-reported warmth across grades 1–5 (Hughes & Im, 2016; Spilt, Hughes, Wu, & Kwok 2012), researchers have suggested that teacher conflict is more driven by student characteristics than is teacher warmth (Silver, Measelle, Armstrong, & Essex, 2005; Hughes & Im, 2016). That is, teacher warmth or closeness is viewed as a relationship variable rather than a reaction to a child's behavior and

may be more negatively impacted by the more limited time teachers spend with students in middle school.

It is somewhat surprising that teacher-reported conflict declines across middle school, a developmental period characterized by increases in adolescent problem behaviors (Dishion & Andrews, 1995). Teacher-student conflict may be a response to forms of problem behaviors that are more characteristic of pre-adolescent youth (defiance, noncompliance with rules, oppositional behaviors, attention-getting behaviors) that decline in late childhood. As youth enter adolescence they shift from these more overt forms of antisocial behavior to more covert forms of antisocial behavior, such as substance use, truancy, shoplifting and theft (Patterson, Dishion, & Yoerger, 2000).

Effects of Post-transition Trajectories

The second objective of the current study was to test the effects of a shift in level of teacher-reported warmth and conflict at the transition to middle school and the post-transition slope for teacher-reported warmth and conflict on students' academic achievement and reading and math scores, students' sense of school belonging, and teacher-rated engagement 3 years after the transition to middle school. As expected, students experiencing less of a drop in warmth at the transition to middle school had higher math achievement scores, were rated by their teachers as more engaged in learning, and rated themselves as more engaged in school, controlling for several covariates. Furthermore, students who declined less in warmth across middle school were rated by teachers as more engaged 3 years post-transition. This is the first study to demonstrate effects of middle school trajectories of teacher-perceived support on changes in students' levels of academic engagement and tested achievement. Teacher reported support at the transition and continuing throughout the middle school years buffers students from normative declines in academic engagement.

Contrary to expectations, no significant effects were found for a drop in level of warmth or declining warmth across the middle school grades on reading scores or students' sense of school belonging. The findings of an effect for math but not for reading is unexpected, especially given the fact that the student's language arts teacher reported on the teacher-student relationship. On the other hand, because math instruction is more hierarchical in nature than reading instruction (i.e., mastery of certain mathematical concepts depends on having mastered previous concepts), math skills may be more influenced by changing levels of student academic engagement than is the case for reading skills. The lack of an effect of post-transition trajectories on school belonging may indicate that students' sense of school belonging may be more influenced by approval and support from peers than from teachers.

Finally, students who declined more in level of teacher-reported conflict at the transition to middle school and students who had a more negative post-transition slope for conflict were rated by teachers as less engaged in learning at the end of middle school, controlling for baseline level of engagement. Neither shift in intercept for conflict nor post-transition rate-of-change in conflict predicted reading or math achievement or students' sense of school belonging. It is likely that teacher-student conflict and students' behavioral disengagement influence each other in a reciprocal fashion across the middle school years.

Taken together, study findings suggest that higher levels of teacher-reported emotional support and lower levels of teacher-reported conflict across the transition to middle school protects students from declining academic achievement and engagement. Even though adolescents report less reliance on teachers for emotional support than do younger students (Bokhorst et al., 2009; Furman & Buhrmester, 1985; Košir & Tement, 2013), middle school students whose teachers report more supportive relationships with them are more motivated and achieve at higher levels. It is likely that the specific ways that middle school teachers express their support to students differ from the ways elementary teachers express support. Specifically, teachers who meet students' needs for relatedness may also meet their needs for competence and autonomy. Evidence that these provisions often go together come from a study reporting that when teachers are observed to offer more emotional support in the beginning of the school year, adolescents report more opportunities to make decisions about their learning. Furthermore, students' perceptions of opportunities to exercise autonomy mid-year mediated the effect of observed teacher emotional support at the beginning of the year on students' academic engagement and motivation at the end of the year (Ruzek et al., 2016).

Gender

As expected, teachers report higher levels of support and lower levels of conflict for girls than for boys at each assessment period, and there were no gender differences in the slope for warmth or in the shift in intercept for warmth or for conflict. Not unexpectedly, boys declined less than girls in conflict across the middle school years and continued to have higher conflict than girls throughout the post-transition period. No gender differences were found in the strength of the association between trajectory parameters (i.e., shift in intercept or post-transition slope) and outcomes 3 years post-transition. That is, boys and girls are equally affected by the quality of their relationships with teachers.

Strengths, Limitations, and Future Directions

Among the methodological strengths of the study is use of a measure of TSRQ that has demonstrated longitudinal measurement invariance as well as gender invariance, thereby ensuring that scores on the measure have the same meaning across time and for boys and girls. Additional strengths include use of baseline scores on outcomes measures (before the transition to middle school) as covariates in the outcome analyses, thereby reducing the threat that the observed effects of warmth and conflict on outcomes are due to levels of the outcome prior to the transition. Additionally, multiple sources of data are used to assess outcomes, including tested achievement, student report, and teacher report, reducing inflated associations due to source effects. Finally, the study controlled for the effect of the grade at which students transitioned to middle school, reducing the probability that a change in level of teacher warmth or conflict at the point of transition is due to grade or age effects rather than the change in school context.

Study results should be interpreted in light of several limitations. The most significant limitation is reliance on a single teacher, the student's language arts teacher, for the measure of teacher warmth and conflict. It would have been preferable to have reports of TSRQ from multiple teachers; however, the financial cost of doing so was prohibitive. We selected the

language arts teacher because all students take a language arts class in the grades covered in this study, thereby providing a common context for the teacher support measure. It is likely that the effects of students' relationships with teachers on their adjustment may be underestimated due to reliance on a single teacher's reports rather than on all of a student's teachers.

A second limitation is reliance only on teacher reports of the relationship. To obtain a fuller understanding of the role of TSRQ on middle school students' academic adjustment, future studies are needed that include both teacher and student perceptions of teacher support. Prior studies on TSRQ in middle and high school have reported positive associations between students' reports of an emotionally supportive relationship with their teachers and increased academic engagement, sense of belonging to school, and academic self-efficacy (Barber & Olsen, 2004; Roeser, Midgley, & Urdan, 1996; Ryan & Patrick, 2001; Wang & Dishion, 2012; Wang & Eccles, 2012b, 2013; Wentzel, 1997). Furthermore, teacher-reported and student-reported TSRQ predict different outcomes, with correlations between measures of TSRQ and measures of child adjustment stronger when both are completed by the same rater (i.e., teacher or student) than when completed by different raters (Hughes, 2011; Murray, Murray, & Waas, 2008). Because student and teacher supports of support show only modest agreement in the elementary and middle school grades and predict different outcomes, (Hughes, 2011, 2012; Košir & Tement, 2013; Mantzicopoulos & Neuharth-Pritchett, 2003), it is important to understand how they work together (e.g., additively or synergistically) to influence students' school engagement and achievement.

Future research is also needed to identify contextual factors that may contribute to changes in the teacher-student relationship as student transition to middle school. For example, middle school students spend much less time with any given teacher than they did in the elementary grades. Other contextual differences that might affect teacher-student relationships include clustering students into teams that share the same teachers for different subjects and the amount of class time spent in whole-class versus independent work.

A third limitation is the selective nature of the sample. Students in the current sample were recruited into a longitudinal study in first grade on the basis of scoring below the median for their school district on a test of early literacy. Thus, findings may not generalize to students entering school with above average academic readiness. Future studies with samples representative of the full spectrum of academic risk are needed to determine if level of risk moderates effects of TSRQ on academic adjustment. Prior research has found that supportive relationships with teachers may be especially important to students at risk for low educational attainment due to ethnic minority status, poverty, or low academic performance (Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002; Meehan, Hughes, & Cavell, 2003).

Conclusions and Practice Implications

The transition to middle school and the associated changes in the school environment marks a major transition in a young adolescent's life- a transition often marked by declining academic motivation and achievement. Findings from the current study suggest that a supportive relationships with teachers at the beginning of middle school buffers academically at-risk youth from declining school engagement and math achievement.

Until recently, interventions focused on improving teacher-student relationships have focused on elementary classrooms (Gershenson, Lyon, & Budd, 2010; Pianta, Mashburn, Downer, Hamre, & Justice, 2008; Spilt, Koomen, Thijs, & van, 2012), perhaps based on conventional ideas about the role and training of elementary and secondary teachers. For example, elementary teachers may place a higher priority of relationship building with students than do secondary teachers (Munthe, 2003). Recent research has demonstrated that an intervention focusing on improving secondary teachers' ability to provide classroom emotional support and opportunities for student autonomy (the My Teaching Partner-Secondary Program; MTP-S) improves students' academic achievement (Allen et al., 2011). Importantly, improvements in targeted teacher-student interactions accounted for the positive effects on academic achievement. Given the importance of teacher-student relationships to middle school students' engagement and achievement, school psychologists should promote high quality professional development opportunities such as MTP-S for middle school teachers to develop their abilities to provide an emotional supportive classroom.

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Figure 1.

Hypothesized model. Baseline outcomes were collected at the year before transition to middle school. T1 to T7 refers to teacher-student relationship warmth or conflict scores at pre-transition and post-transition.

Figure 2.

Unconditional latent growth model for teacher-student warmth and teacher-student conflict. All coefficients are unstandardized. Standard errors are presented within parentheses. Time period 0 includes data for the last year of elementary school and for the first year of middle school. Thus, piece 1 includes 4 data points and piece 2 includes 3 data points. S = slope and I = intercept.

$^{**}p < .01$; $^*p < .05$.

Table 1

Descriptive statistics for teachers in elementary and middle school

	Elementary school	Middle School
<i>Gender and Ethnicity (%)</i>		
Female	94.2	92.6
Black	4.8	9.6
Hispanic	11.9	2.8
White	81.5	83.2
Other	1.8	4.4
<i>Highest Degree (%)</i>		
Bachelor's degree	54.5	66.8
Some post-bachelor graduate coursework	24.2	15.1
Master's degree	17.8	16.2
Master's degree plus additional graduate coursework	3.5	1.9
<i>Years of experience (%)</i>		
3 or fewer years	23.0	28.1
4–6 years	19.7	15.4
7–12 years	19.3	20.3
More than 12 years	38.0	36.2
<i># Hours spent with student</i>		
Mean(SD)	5.19 (1.88)	1.5 (0.66)
Range	1 to 8	1 to 5

Note. # hours spent with student is the number of hours the teacher spent with the child each school day.

Table 2

Descriptive statistics and correlations between outcomes and covariates

	1	2	3	4	5	6	7	8	9	10	11	12
<i>Correlations</i>												
1 Reading-post ^a	-											
2 Math-post ^a	.71**	-										
3 Schmemb-post	.06	.11*	-									
4 T-rated Engage-post	.20**	.22**	.15**	-								
5 S-rated Engage-post	-.02	.03	.53**	.24**	-							
6 Reading-base	.84**	.63**	.03	.19**	-.001	-						
7 Math-base	.69**	.85**	.03	.20**	-.01	.68**	-					
8 Schmemb-base	.09	.03	.34**	.01	.26**	.12**	.04	-				
9 T-rated Engage base	.36**	.37**	.09	.38**	.05	.35**	.37**	.11*	-			
10 Sch_achieve	.19**	.32**	.06	.004	.00	.09	.20**	-.02	-.02	-		
11 Gender	-.06	.03	-.11*	-.23**	-.09*	-.09*	.002	-.05	-.19**	.001	-	
12 Grade	-.20**	-.32**	-.07	.06	-.04	-.14**	-.23**	-.02	.04	-.64**	.01	-
<i>Descriptive Statistics</i>												
Mean	96.98	97.44	3.90	2.75	3.16	95.55	101.14	3.90	2.78	85.25	-	-
SD	14.26	12.83	0.64	0.69	0.51	13.64	11.98	0.67	0.66	7.90	-	-
Skewness	0.38	-0.36	-0.45	-0.08	-0.58	-0.11	-0.38	-0.72	-0.16	0.09	-	-
Kurtosis	1.79	1.75	-0.30	-0.99	0.23	2.59	1.11	0.33	-0.92	-1.30	-	-
%Missing	9.64	9.82	10.00	24.73	9.82	7.45	7.45	7.27	21.45	6.18	0	0

^a Age standard scores are reported in table because descriptive statistics for more easily interpreted than are W scores.

Note.

* $p < .05$;

**

 $p < .01$. Sch_achieve is school level achievement. Schmemb is student rated school membership. T-rated is teacher rated, S-rated is student rated, base is baseline (i.e., the last year of elementary school), and post is three years post-transition to middle school. Gender is coded 0 = female and 1 = male.

Table 3
Descriptive statistics and correlations between warmth, conflict and the covariates

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<i>Correlations</i>																
1 Warmth -4	-															
2 Warmth -3	.37**	-														
3 Warmth -2	.36**	.38**	-													
4 Warmth -1	.23**	.40**	.38**	-												
5 Warmth 0	.30**	.27**	.32**	.30**	-											
6 Warmth +1	.31**	.21**	.27**	.25**	.36**	-										
7 Warmth +2	.18**	.13*	.18**	.19**	.34**	.43**	-									
8 Conflict -4	-.64**	-.39**	-.31**	-.30**	-.39**	-.37**	-.15**	-								
9 Conflict -3	-.39**	-.62**	-.41**	-.36**	-.31**	-.27**	-.26**	.56**	-							
10 Conflict -2	-.44**	-.50**	-.57**	-.32**	-.35**	-.33**	-.27**	.56**	.64**	-						
11 Conflict -1	-.35**	-.43**	-.36**	-.57**	-.33**	-.29**	-.29**	.50**	.54**	.55**	-					
12 Conflict 0	-.32**	-.32**	-.27**	-.32**	-.62**	-.30**	-.32**	.49**	.53**	.47**	.50**	-				
13 Conflict +1	-.26**	-.22**	-.23**	-.27**	-.36**	-.59**	-.29**	.37**	.34**	.36**	.43**	.42**	-			
14 Conflict +2	-.20**	-.16**	-.19**	-.18**	-.29**	-.31**	-.46**	.35**	.43**	.44**	.45**	.48**	.40**	-		
15 Gender	-.21**	-.16**	-.19**	-.17**	-.21**	-.17**	-.19**	.21**	.23**	.27**	.19**	.26**	.13**	.17**	-	
16 Grade	-.05	.02	-.01	.04	.07	-.13**	.01	.06	.05	.07	.003	.05	.03	.06	.01	-
<i>Descriptive Statistics</i>																
Mean	4.07	3.97	3.97	3.91	3.63	3.67	3.42	1.78	1.76	1.72	1.72	1.67	1.66	1.52	-	-
SD	0.82	0.86	0.85	0.84	0.97	0.98	0.96	0.95	0.93	0.92	0.90	0.91	0.99	0.79	-	-
Skewness	-0.99	-0.95	-0.68	-0.57	-0.38	-0.57	-0.28	1.26	1.37	1.39	1.46	1.62	1.63	1.91	-	-
Kurtosis	0.60	0.48	-0.41	-0.49	-0.76	-0.33	-0.53	0.70	1.18	1.10	1.46	2.09	1.66	3.39	-	-
% Missing	18.00	23.27	23.09	21.64	22.91	21.27	24.73	17.64	23.27	23.09	21.64	22.91	21.27	24.73	0	0

Note.

* $p < .05$;

SD is standard deviation.

[†]*p* < .01.

^{##}

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Table 4

Standardized effects of hypothesized model

Predictors	Reading		Math		School belonging		Teacher rated Engagement		Student rated Engagement	
	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE
<i>Panel A: Warmth</i>										
I	0.10	0.10	0.18*	0.07	0.15	0.09	0.25*	0.11	0.30*	0.11
S2	-0.01	0.08	-0.03	0.06	0.14	0.10	0.86**	0.06	0.03	0.15
Baseline	0.84**	0.03	0.83**	0.02	0.36**	0.15	0.60**	0.05	0.12**	0.05
Gender	0.02	0.03	0.03	0.05	-0.06	0.05	-0.08	0.06	-0.02	0.05
Sch_ach	0.10**	0.03	0.12**	0.03	0.05	0.06	-0.05	0.06	-0.01	0.06
Gender on I	-0.17	0.17	-0.17	0.18	-0.17	0.16	-0.13	0.13	-0.13	0.11
Grade on I	-0.15	0.20	-0.22	0.14	-0.06	0.15	-0.07	0.14	-0.06	0.11
Gender on S2	0.01	0.10	0.001	0.10	0.01	0.10	0.01	0.09	0.003	0.09
Grade on S2	-0.13	0.15	-0.10	0.13	-0.17	0.13	-0.02	0.09	-0.13	0.13
χ^2/df	95.45/41**		79.21/41**		72.41/41**		106.66/41**		109.21/41**	
CFI	0.97		0.98		0.97		0.96		0.95	
RMSEA	0.05		0.04		0.04		0.05		0.06	
SIRM	0.06		0.06		0.06		0.08		0.08	
<i>Panel B: Conflict</i>										
I	0.03	0.26	-0.31	0.19	-0.16	0.17	-0.46**	0.12	-0.13	0.16
S2	-0.02	0.30	0.17	0.10	0.03	0.19	-0.77**	0.11	-0.14	0.23
Baseline	0.84**	0.03	0.83**	0.02	0.35**	0.04	0.46**	0.05	0.08	0.05
Gender	-0.01	0.13	0.10	0.12	-0.05	0.10	-0.37**	0.12	-0.11	0.10
Sch_ach	0.10	0.08	0.10**	0.03	0.07	0.07	0.001	0.06	-0.03	0.07
Gender on I	0.12	0.16	0.11	0.18	0.13	0.16	0.09	0.12	0.10	0.13
Grade on I	-0.01	0.73	0.23	0.10	0.09	0.24	0.04	0.24	0.06	0.22
Gender on S2	-0.35*	0.15	-0.35*	0.16	-0.36*	0.16	-0.36*	0.17	-0.35*	0.16
Grade on S2	0.23	0.54	0.08	0.21	0.17	0.27	-0.04	0.13	0.24	0.23

Predictors	Reading		Math		School belonging		Teacher rated Engagement		Student rated Engagement	
	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE
χ^2/df	59.27/42 *		62.79/42 *		58.07/42		104.48/43 **		86.18/42 *	
CFI	0.99		0.99		0.99		0.96		0.97	
RMSEA	0.03		0.03		0.03		0.05		0.04	
SRMR	0.05		0.05		0.05		0.06		0.05	

Note. 1 is shift in intercept, S2 is post-transition slope, Sch_ach is school level achievement.

* $p < .05$;

** $p < .01$.

^aResidual variance was fixed as 0 due to negative value.