

A LONGITUDINAL ANALYSIS OF TEACHER VS. STUDENT REPORTS OF TEACHER-
STUDENT RELATEDNESS AND THEIR RELATION TO ENGAGEMENT ACROSS THE
TRANSITION TO MIDDLE SCHOOL

BY

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DISSERTATION

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ABSTRACT

Teacher-student relatedness and student engagement were examined using data collected in the fall and spring of one school year; 48% of participants were in 5th grade and 52% of participants were in 6th grade (N = 672, 51% female, 57% White and 43% African-American). Teacher-reports and student-reports of relatedness were moderately positively correlated. The relationship between student- and teacher-reported relatedness was dependent on grade level, such that when 6th grade classes reported higher relatedness than other classes, their teachers did as well; but teachers' reports of 5th grade classes did not vary by student-reports. On average, engagement tended to decline across the school year. But, when students reported relatedness that was higher than their average, or that was higher than other students in their class, they also tended to report higher engagement. The relationship between student-reported relatedness and engagement was dependent on time of the year and grade level. Student-reports of relatedness were more strongly associated with engagement in the spring and for 6th graders, compared to the fall and for 5th graders. The relationship between teacher-reported relatedness and engagement was dependent on time of the year. The last analyses regarding congruency between student- and teacher-reports of relatedness suggested congruency was not predictive of variations in engagement. The final, best-fitting model of the data showed that both student-reported relatedness and teacher-reported relatedness were uniquely associated with student engagement. Thus, researchers should utilize reports from both parties when studying early adolescence in the future.

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CHAPTER 1

INTRODUCTION

The interaction between teachers and students in the classroom is vital to students' development. One facet of teacher-student relationships that is significant to student engagement and achievement is teacher relatedness, which is the bond between teacher and student (see Rolland, 2012). Teacher-student relatedness is especially important in early adolescence, when students make the transition from elementary to middle school. This is a time when students' needs, as well as their environments, are shifting (Eccles et al., 1993) and some students struggle with engagement and achievement. Some existing evidence suggests the bonds between teachers and students are associated with students' academic outcomes, but there is still much we do not know. Measurement of teacher-student relatedness in adolescence has almost entirely focused on student reports and perceptions of the relationship and has not taken into account both teacher and student perspectives. Further, analyses of teacher-student relatedness have rarely considered how the relationships in the larger classroom environment may impact individual student's relatedness and engagement. Teacher-student relationships do not occur in a vacuum, but are a part of a larger social dynamic. By their very nature, teacher-student relationships involve two participants and develop within classrooms; thus, it is important to examine them from both teacher and student points of view and within a classroom context.

This study's goal was to make three important contributions. First, this study examined teacher-student relationships using both teacher and student reports of relatedness. Specifically, I used multi-level modeling to examine the association between student- and teacher-reports of relatedness. Second, I employed both teacher and student reports of relatedness to understand changes in engagement around the transition to middle school. Third, I used student- and

teacher-reports of relatedness in the analysis in a way that allowed for interpretation of findings at multiple levels of variation. For example, student-reports of relatedness were used to examine the association of within-student variation, between-student within-classroom variation, and between classroom variations in student-reported engagement. This approach is described in more detail in the preliminary analysis section of this paper.

Middle School Transition

The transition to middle school is an especially important time to study teacher-student relatedness. Middle school is a challenging time for young adolescents, with studies showing there is decline in motivation, academic engagement, and achievement (Eccles, 2004; Eccles et al, 1993; Juvonen et al., 2004). Students face many changes when they enter middle school. Some have suggested that the changing school environment in adolescence does not adequately address the needs of students. This Stage-Environment Fit perspective purports that the changing developmental needs in adolescence should coincide with developmentally appropriate environmental change in order to foster motivation and interest (Eccles, et al., 1993). One significant environmental change is transitioning from staying in one classroom with one teacher to changing classes and having multiple teachers. Because of this structure, middle schools tend to be larger and impersonal, providing fewer opportunities for students to bond with teachers and peers (Eccles & Midgely, 1990). This change may have implications for academic development, considering that after the transition to middle school, students rate their teachers as less caring and less supportive than their elementary school teachers (Feldlaufer, Midgley, & Eccles, 1988).

Knowing that many adolescents struggle after the transition to middle school is troubling considering disengagement and maladjustment during early adolescence has far-reaching consequences toward their future. For many individuals these years mark the beginning of a

downward spiral, a spiral that leads some adolescents to academic failure and school dropout (Eccles et al, 1993; Rudolph et al., 2001). Research has shown a marked decline in some early adolescents' school grades, and the magnitude of this decline was predictive of subsequent school failure and dropout (Simmons, Black, & Zhou, 1991). The first step towards ameliorating outcomes like school failure and dropout is to understand the processes that are driving disengagement in early adolescence. Thus, I investigated how teacher versus student reports of relatedness are different in 5th and 6th grade and how changes in these reports might be related to students' engagement around the time students make the transition to middle school.

Teacher-Student Relatedness

One broad framework that is employed to explain human motivation is Self-Determination Theory (SDT; see Ryan & Powelson, 1991; Neimiec & Ryan, 2009). The overarching premise of SDT is that humans are innately curious and motivated to understand their surroundings. Social context can either propel motivation or hinder it, based on whether it meets basic psychological needs. In SDT, these basic psychological needs are autonomy, competence, and relatedness. In theory, if these needs are satisfied within a social context, then motivation will flourish. This study focuses on the third basic psychological need, relatedness, which is defined in SDT as the “emotional and personal bonds between individuals (p. 53, Ryan & Powelson, 1991).” Teacher-student relatedness has to do with the bond students feel with their teacher, or vice versa. High relatedness would mean a student feels like the teacher appreciates, accepts, and respects him or her (Niemiec & Ryan, 2009; Ryan & Deci, 2000).

Relatedness is associated with engagement and motivation via the process of internalization of extrinsic motivation. Relationships with others allow individuals to interact within a social context where certain values and beliefs about learning exist. When intrinsic

motivation is lacking, students internalize an extrinsic motivation that arises from being immersed in the classroom culture. Without relatedness, students may feel rejected by their teachers. Students who feel rejected or unimportant to teachers are less likely to internalize the classroom values and goals that lead to intrinsic motivation (Niemic & Ryan, 2009).

Many studies report teacher-student relatedness is associated with student engagement. In elementary school, teacher reports of teacher-student relatedness are moderately correlated with concurrent teacher-rated engagement ($r=.40-.58$) and significantly predict teacher-rated engagement in subsequent years (Archambault, Pagani, & Fitzpatrick, 2013; Hughes, 2011; Hughes, Luo, Kwok, & Loyd, 2008). In fifth grade, student-reports of teacher-student relatedness are correlated with student-reported engagement ($r=.49-.53$; Patrick, Ryan, & Kaplan, 2007). Furrer and Skinner (2003) found student-reported relatedness of teachers significantly predicted student-reported behavioral and emotional engagement in 3rd through 6th grade elementary schoolers, and the relation between relatedness and behavioral engagement was stronger as grade level increased. In middle school, student-reported teacher-student relationship was moderately correlated ($r=.44$) with student-rated engagement (Murray, 2009) and was directly related to student-rated emotional engagement (Sakiz, Pape, & Hoy, 2012). In addition, changes in students' perceptions of teacher support from sixth to seventh grade were significantly related to changes in attitudes towards math, such that those who went from low support to high support had positive changes in attitude (Midgley, Feldlaufer, & Eccles, 1989). Overall, findings indicate there are important associations between teacher-student relatedness and engagement, though these associations are often based on only teacher or only student reports of the two variables. Additionally, the transition to middle school is an important time to study these relations because teacher-student relationships, which may be shifting, are associated

with engagement and changes in student attitudes. Therefore, one goal of this study is to employ a methodology and analysis that allows for modeling relations over time---not just in the outcome variable (student-reported engagement), but also in the predictor variables (teacher- and student-reported teacher-student relatedness).

Evidence points to the idea that there are group differences in perceptions of the teacher-student relationship. Wu, Hughes, & Kwok (2010) found that African-American elementary students were more likely to report negative relationships with teachers, while girls were more likely to report positive relationships. In addition, the association between teacher-student relationship and school-liking was dependent on students' race; at low levels of closeness African-American students exhibited less school-liking than white students, but at high levels of closeness there was no difference between the groups. Similarly, the association between teacher-student relationship and school avoidance was dependent on the students' gender; when teacher-student relationship was more positive then girls exhibited less school avoidance (Murray, Waas, & Murray, 2008). In addition, boys are more likely than girls and African-American students are more likely than white students to exhibit negative academic outcomes like poor achievement and school dropout (Snyder & Dillow, 2013), thus it is important to examine the present research questions by gender and race of the students.

Multi-level modeling using centered variables

Much of the research on motivation concerns how *general patterns* of teacher-student relatedness are associated with engagement. Examining general patterns of association is problematic in longitudinal research because it does not inform the researcher whether results are due to variations within students or variations between students. Examining variations within students allows for an understanding of how differences *within a student* over time are related to

the outcome. In the present study, I examine how differences within students in teacher-student relatedness are associated with engagement. Examining variations between students allows for an understanding of how differences between students over time are related to the outcome. In the present study, I examine how differences *between students within classrooms* in teacher-student relatedness are associated with engagement. I also examine how differences *between classrooms* in teacher-student relatedness are associated with engagement. Examining both within-person and between-person effects are important to understand not only the general patterns in the data, but also the specific level of variation that is predictive of the outcome.

What is associated with student engagement: the student's individual teacher-student relatedness, how the student compares with others in his/her class, or how the student's class compares with other classes? The present study examines if one or more types of variation in teacher-student relationships are associated with student engagement.

Reports on Teacher-Student Relatedness

Many studies have found teacher-student relatedness to be significantly related to student motivation, engagement and achievement in elementary, middle, and high school. Some studies collect data on teacher-student relatedness from teachers, others survey students, and few solicit both teachers and students (See Table 1). Studies of elementary students have utilized a mixture of methods; some have used teacher reports of teacher-student relatedness, while others have used student reports or both teacher and student reports. However, studies across the transition to middle school or during the middle school years have used predominately student reports of teacher-student relatedness. Furthermore, middle school students are often reporting on their relationship with their teachers overall (Danielsen, Wiium, Wilhelmsen, & Wold, 2010; Furrer & Skinner, 2003; Murray, 2009; Rosenfeld, Richman, & Bowen, 2000; Voelkl, 1995; Wang &

Eccles, 2013; Wang & Homcombe, 2010; Wentzel, 1997,1998). It can be challenging for students, who many have up to 7 teachers, to report these general feelings and it presents interpretation challenges for researchers. This is especially problematic for researchers interested in examining the transition to middle school, since many elementary studies use student reports of relatedness with one teacher and middle school studies use student reports of relatedness with several teachers. The changing school structures present methodological and design challenges for researchers. In this study, students report on their relationship with their math *or* science teacher. This provided a common reference point for before and after the transition to middle school and allowed students to always report on their relationship with a single teacher.

A limited number of studies have compared teacher versus student reports of relatedness. In elementary school students, teacher reports of teacher-student relationships are often not statistically correlated with student reports of teacher-student relationships (Hughes, 2011; Hughes, Cavell, & Jackson, 1999; Li, Hughes, Kwok, & Hsu, 2012; Murray, Murray, & Waas, 2008). Actually, in 2nd and 3rd grade students there was a stronger agreement between teachers and peers than between teachers and students when reporting teacher-student relationship (Li, Hughes, Kwok, & Hsu, 2012). Over the course of a school year, reports may become more related; Skinner and Belmont (1993) found that correlations between teacher and student reports of teacher-student relationship in upper elementary school were not significantly correlated in the fall of the year but became modestly correlated ($r = .23$) by the spring of the school year. Group differences indicate that girls are more likely than boys to be congruent with their teachers and African American students are more likely than Hispanic or White Students to be incongruent with teachers (Wu, Hughes, & Kwok, 2010). Cumulatively, findings indicate that significant

differences exist between teacher reports and student reports of teacher-student relationship in elementary school.

No known studies exist that have examined the congruency between teachers and students as reporters of relationship in middle school, where researchers have often used student reports. It is important to study the association between teacher and student reports of relatedness in adolescence, which is a time when students are striving for autonomy and seeking bonds other than their parents (Eccles et al., 1993). A growing discrepancy between teacher and student reports of relatedness indicates that teachers and students perception of the relationship is becoming less similar. Adolescence is a pivotal time for teachers and students to be congruent so that students can get the type of relational support they need. Also, if teacher-reports and student-reports are quite different, perhaps they will provide unique information about academic outcomes. If so, it would be important for researchers to include both measures of relatedness in future studies. In this study, analyses were conducted in a way that allows insight into whether discrepancies between teacher and student reports of relatedness are predictive of student engagement across time.

Research questions and hypotheses

1. Does the relation between teacher and student reports of relatedness differ by time of the year, grade level, sex or race of the student?

Time of the year: The relation between teacher and student reports of relatedness will be more similar in the spring than in the fall. I hypothesize this will occur because teachers and students will have spent more time together, will have gotten to know each other more, and so will be more similar in their ratings of the relationship. Skinner and

Belmont (1993) showed that teacher and student reports of the relationship became more similar across time in upper elementary school.

Grade level: The relation between teacher and student reports of relatedness will be more similar in 5th grade than in 6th grade. I hypothesize this will be the case because students and teachers spend more time together each day in 5th grade. The classes are smaller and teachers have fewer students to form relational bonds with in 5th grade classrooms. Conversely, 6th grade teachers see many more students throughout the day for much shorter time periods and so have less opportunity to come to a common view on the relationship.

Sex and Race: The relation between teacher and student reports of relatedness will be more similar in girls than in boys and more similar in white students than in black students. Although limited studies have examined these relations, evidence exists that students' reports of relatedness are more congruent in white students than in black students and more congruent in girls than in boys (Wu, Hughes, Kwok, 2010).

2. Is there a relation between time-varying relatedness and emotional engagement?

Does the relation vary by grade level, sex of the student, race of the student, or agreement between teacher and student reports of relatedness?

Overall relation: There will be a significant, positive relationship between both teacher-reported relatedness and engagement, as well as between student-reported relatedness and engagement. Several studies have found this positive association (Furrer & Skinner, 2003; Hughes, 2011; Hughes et al., 2012 Patrick, Ryan, & Kaplan, 2007; Murray, 2009).

Grade: There will be a significant effect of grade level, such that the association between relatedness and engagement is stronger in 6th grade than in 5th grade. After making the transition to middle school, students have a tougher time forming bonds with teachers. Having a good relationship with a teacher will be protective against declining engagement in 6th grade.

Sex and Race: The relation between student- and teacher-reports of relatedness with engagement will be dependent on gender and race of the student. I hypothesize that relatedness for black students and boys, who often exhibit lower levels of engagement than white students and girls, will be more strongly related to students' engagement. Specifically, students who struggle with engagement will be more positively impacted by positive teacher-student relationships than those who do not struggle with engagement.

Agreement between teacher and student: There will be a significant interaction of teacher and student reports of relatedness and its association with engagement. I hypothesize that the effect of teacher-reported relatedness will depend on the level of student-reported relatedness. For example, the association between high teacher-reported relatedness and engagement will vary depending on the level of student-reported relatedness. Having high teacher-reported relatedness and high student-reported relatedness will be a stronger predictor of engagement than having high teacher-reported relatedness while having low student-reported relatedness.

CHAPTER 2

METHOD

Procedure

We recruited 6 middle schools in 3 Midwestern districts. Every 6th grade math and science teacher in these schools participated in the study (n=28 teachers) along with one of their classes. We recruited 2 feeder elementary schools for each of the participating middle schools. Every 5th grade teacher in these schools participated in the study (n=25 teachers) along with their class. Surveys were administered two times: one time in the fall of the school year and one time in the spring of the school year, about 6 months apart.

Permission slips were sent home to parents 2 weeks before data collection; 84% of students returned permission slips with 6% of parents declining participation. Middle school students completed either a math or science survey, depending on the subject matter of their participating class. Elementary school students were evenly split between math and science surveys, in order to have a comparable sampling. Surveys were administered to students in their classroom by research assistants. Instructions and survey items were read aloud while students read along and responded. Students were told that the purpose of the survey was to find out about students' beliefs and behaviors and that completing it was voluntary. Students were assured that the survey was confidential. Students received small gifts of school supplies and candy for participating. While student surveys were being conducted, teachers completed a one-page survey on each participating student in their class. Teachers received small monetary compensation for their participation.

Participants

Recruitment yielded 806 participants who participated in both time points of data collection. Some participants were excluded because of unknown or poorly represented race data (7% Hispanic, 5% Asian, 3% mixed race), while others were excluded because they were missing data on the predictor variables. Participants included in the cross-sectional sample ($N = 672$) were from 53 classes (321 5th graders and 351 6th graders). Participating students were 51% female, 57% White and 43% African-American. The 53 teachers (28 6th grade and 25 5th grade) were 82% female, 90% White and 8% African-American.

Measures

Teacher-Reported Relatedness. Teachers responded to a subset of 3 items from the Teacher as a Social Context Questionnaire (Wellborn, Connell, Skinner & Pierson, 1988): *(1) I find this student easy to get along with, (2) I know this student well and understand his/her needs in the classroom, and (3) In general, this student and I get along well in class.* Teachers rated items on a scale from 1 (*not at all true*) to 5 (*very true*). Responses to the 3 items were averaged to create the teacher-reported relatedness variable ($\alpha = .86-.90$).

Student-Reported Relatedness. Students responded to a subset of 8 items from the Teacher as a Social Context Questionnaire (Belmont, Skinner, Wellborn, & Connell, 1988): *(1) My teacher likes me, (2) My teacher knows me well, (3) My teacher really cares about me, (4) My teacher just does not understand me, (5) My teacher spends time with me, (6) My teacher talks with me, (7) I can't depend on my teacher for important things, and (8) I can't depend on my teacher when I need him/her.* Students rated items on a scale from 1 (*not at all true*) to 5 (*very true*). Negatively worded items were reversed scored. Responses to the 8 items were averaged to create the student-reported relatedness variable ($\alpha = .78-.83$).

Student-Reported Engagement. Students responded to 5 items from the emotional engagement subscale of the Engagement vs. Disaffection with Learning Measure (Skinner, & Belmont, 1993): (1) *My classes are fun*, (2) *I enjoy learning new things in my classes*, (3) *When we work on something in class, I feel interested*, (4) *When I am in class, I feel good*, and (5) *In my classes, I work as hard as I can*. Students rated items on a scale from 1 (*almost never*) to 5 (*often*). Students' responses to the 5 items were averaged to create the student-reported emotional engagement variable ($\alpha = .80-.84$).

Analytic Plan

To address research question 1, I used the PROC MIXED procedure in SAS (Version 9.3) with a maximum likelihood estimator to fit a taxonomy of 3-level models which accounted simultaneously for non-independence within-persons and within-classrooms, as well as model the between person variation between classrooms. Specifically, I partitioned student-reported relatedness into three levels of variation: 1. Within-student variation, 2. Between-student within-class variation, and 3. Between-class variation. I subsequently regressed teacher-reported relatedness on each of the partitioned measures of student-reported relatedness. The analysis was chosen to take into account that 672 students were nested within 53 classrooms, across 16 schools. As too few schools were sampled to allow random effects between schools, I adjusted for non-independence in schools by using a Huber-White sandwich estimator (Huber, 1967; White, 1982). Specifically, I fitted models which examined individually the associations of Time of the year, 3 levels of student-reported relatedness, Grade, Sex, and Race with the outcome variable, teacher-reported relatedness. I compared nested models using deviance test to determine goodness of fit. I then combined significant effects across models into a final model and systematically eliminated any effects which were not significant. The final model was:

Level 1: Within-student

$$(TRR)_{tij} = \beta_{0ij} + \beta_{1ij}(\text{Time})_{tij} + \beta_{2ij}(\text{pmcSRR})_{ij} + \varepsilon_{tij}$$

Level 2: Between students within classrooms

$$\beta_{0ij} = \gamma_{00j} + \gamma_{01j}(\text{bpwcSRR})_{ij} + \gamma_{02j}(\text{Girl})_{ij} + \gamma_{03j}(\text{Black})_{ij} + \gamma_{04j}(\text{Girl*Black})_{ij} + \zeta_{0ij}$$

$$\beta_{1ij} = \gamma_{10j}$$

$$\beta_{2ij} = \gamma_{20j} + \gamma_{21j}(\text{Girl})_{ij} + \gamma_{22j}(\text{Black})_{ij} + \gamma_{23j}(\text{Girl*Black})_{ij}$$

Level 3: Between classrooms

$$\gamma_{00j} = \delta_{000} + \delta_{001}(\text{gmcSRR})_j + \delta_{002}(\text{Grade})_j + \delta_{003}(\text{gmcSRR*Grade})_j$$

$$\gamma_{01j} = \delta_{010}$$

$$\gamma_{02j} = \delta_{020}$$

$$\gamma_{03j} = \delta_{030}$$

$$\gamma_{04j} = \delta_{040}$$

$$\gamma_{10j} = \delta_{100}$$

$$\gamma_{20j} = \delta_{200}$$

$$\gamma_{21j} = \delta_{210}$$

$$\gamma_{22j} = \delta_{220}$$

$$\gamma_{23j} = \delta_{230}$$

The predictor variable, student-reported relatedness, was centered to allow it to be modeled at the three levels of analysis. Level 1 accounts for differences within students. In the displayed specification, β_{1ij} represents the effects of time of the year. The Level 1 relatedness predictor, pmcSRR (β_{2ij}), is student-reported relatedness that is person-mean centered. This means that the variable is centered on each student's individual mean of relatedness from Time 1 and Time 2. This was calculated by dividing the students' time specific relatedness value by his or her mean relatedness across the two time points. As displayed, the model for the residual

variances includes both a within-person residual (ϵ_{ij}) and a random intercept (ζ_{0ij}), which allows each person to have his or her own intercept.

Level 2 accounts for differences between students within classrooms. The Level 2 relatedness predictor, bpwcSRR (Y_{01j}), is student-reported relatedness that centers the student's reports of relatedness on the overall average of relatedness within that student's classroom. This was calculated by subtracting the mean classroom relatedness score from each individual student's average (pmcSRR). The calculation of this score indicates whether the student reports similar, higher, or lower relatedness in comparison with their classmates. The Level 2 predictor of student-reported relatedness is orthogonal to the Level 1 predictor. In the displayed specification, let Y_{02j} , Y_{03j} , and Y_{04j} represent the respective between-person effects of sex, race and the sex by race interaction on teacher-reported relatedness. This allows me to address the question of how the associations between student- and teacher-reports of relatedness vary by sex and race on any given occasion.

Level 3 accounts for differences between classrooms. The Level 3 relatedness predictor, gmcSRR (δ_{001}), is student-reported relatedness that is grand-mean centered. This means the variable is centered on the grand mean of all student reports at both time points. This was calculated by subtracting the grand mean of relatedness from each classroom's mean relatedness score. The calculation of this score indicates whether individual classrooms report similar, higher or lower relatedness in comparison with other classrooms. The Level 3 predictor of student-reported relatedness is orthogonal to the Level 1 and Level 2 predictors. In the displayed specification, let δ_{002} and δ_{003} represent the respective between-classroom effects of grade level and the interaction of grade level and gmcSRR. This allows me to answer the question

regarding how the associations between student- and teacher-reports of relatedness vary by grade level.

For research question 2, I replicated the same procedure as in research question 1, instead using student-reported engagement as the outcome variable. I used the PROC MIXED procedure in SAS (Version 9.3) with a maximum likelihood estimator to fit a taxonomy of 3-level models which accounted simultaneously for non-independence within-persons and within-classrooms, as well as model the between person variation between classrooms. Specifically, I partitioned student-reported relatedness into three levels of variation: 1. Within-student variation, 2. Between-student within-class variation, and 3. Between-class variation. Also, I partitioned teacher-reported relatedness in three levels of variation: 1. Within-teacher variation for each student, 2. Between-student within-teacher variation, and 3. Between-class variation. I subsequently regressed student-reported engagement on each of the partitioned measures of student-reported relatedness and teacher-reported relatedness. The analysis was chosen to take into account that students were nested within classrooms and schools. As too few schools were sampled to allow random effects between schools, I adjusted for non-independence in schools by using a Huber-White sandwich estimator (Huber, 1967; White, 1982). Specifically, I fitted models which examined individually the associations of Time of the year, 3 levels of student-reported relatedness, 3 levels of teacher-reported relatedness, Grade, Sex, and Race with the outcome variable, student-reported engagement. I compared nested models using deviance test to determine goodness of fit. I then combined significant effects across models into a final model and systematically eliminated any effects which were no longer significant. The final model was:

Level 1: Within-student

$$(\text{Engagement})_{ij} = \beta_{0ij} + \beta_{1ij}(\text{Time})_{ij} + \beta_{2ij}(\text{pmcSRR})_{ij} + \beta_{3ij}(\text{pmcSRR} * \text{Time})_{ij} + \\ B_{4ij}(\text{pmcTRR})_{ij} + \varepsilon_{ij}$$

Level 2: Between students within classrooms

$$\beta_{0ij} = \Upsilon_{00j} + \Upsilon_{01j}(\text{bpwcSRR})_{ij} + \Upsilon_{02j}(\text{bpwcTRR})_{ij} + \zeta_{0ij}$$

$$\beta_{1ij} = \Upsilon_{10j}$$

$$\beta_{2ij} = \Upsilon_{20j}$$

$$\beta_{3ij} = \Upsilon_{30j}$$

$$B_{4ij} = \Upsilon_{40j}$$

Level 3: Between classrooms

$$\Upsilon_{00j} = \delta_{000} + \delta_{001}(\text{gmcSRR})_j + \delta_{002}(\text{Grade})_j + \delta_{003}(\text{gmcTRR})_j$$

$$\Upsilon_{01j} = \delta_{010} + \delta_{010}(\text{Grade})_j$$

$$\Upsilon_{02j} = \delta_{020} + \delta_{020}(\text{Grade})_j$$

$$\Upsilon_{10j} = \delta_{100} + \delta_{100}(\text{gmcTRR})_j$$

$$\Upsilon_{20j} = \delta_{200}$$

$$\Upsilon_{30j} = \delta_{300}$$

$$\Upsilon_{40j} = \delta_{400}$$

Level 1 accounts for differences within students. In the displayed specification, β_{1ij} represents the effects of time of the year. As described above for research question 1, the Level 1 relatedness predictors, β_{2ij} and β_{4ij} are student- and teacher-reported relatedness that are person-mean centered. In the displayed specification β_{3ij} represents the interaction of pmcSRR and Time, which allows me to address the question of how this within-person effect varies by time of the year. As displayed, the model for the residual variances includes both a within-person

residual (ε_{tij}) and a random intercept (ζ_{0ij}), which allows each individual to have his or her own intercept.

Level 2 accounts for differences between students within classrooms. The Level 2 relatedness predictor, bpwcSRR (Y_{01j}), is student-reported relatedness that centers the student's reports of relatedness on the overall average of relatedness within that student's classroom. The Level 2 relatedness predictor, bpwcTRR (Y_{02j}), is teacher-reported relatedness that centers the teacher's reports of relatedness for each student on the overall average of relatedness within that student's classroom.

Level 3 accounts for differences between classrooms. As described above for research question 1, the Level 3 relatedness predictors, δ_{001} and δ_{003} , are student- and teacher-reported relatedness that are grand-mean centered. In the displayed specification, let δ_{002} and δ_{010} represent the respective between-classroom effects of grade level on the intercept and as it varies between students within classrooms.

CHAPTER 3

RESULTS

Preliminary analysis

To ensure there was sufficient variability in the outcome variables, I fitted two unconditional means models. For the first outcome, teacher-reported relatedness, there were three levels of variation: within-student variation (Level 1, ICC= .39 or about 39%), between-student within-class variation (Level 2, ICC = .61 or about 61% of the total variation was between students), and between-class variation (Level 3, ICC= .46 or about 46% of the variation in Level 2, between students, was actually between *classes*). This indicated there was sufficient variation in each of the three levels to model the association between student- and teacher-reported relatedness using within-person, between-person within-class, and between-class variables. For the second outcome, student-reported engagement, there were three levels of variation: within-student variation (Level 1, ICC= .40 or about 40%), between-student within-class variation (Level 2, ICC = .60 or about 60% of the total variation was between students), and between-class variation (Level 3, ICC= .19 or about 19% of the variation between students was actually between *classes*). This indicated there was sufficient variation in each of the three levels to model the association between relatedness and engagement using within-person, between-person within-class, and between-class variables.

RQ1: Does the relation between teacher and student reports of relatedness differ by time of the year, grade level, sex or race of the student?

Descriptive statistics are displayed in Tables 2, 3, 4, and 5. On average, student-reported relatedness (T1 $m= 3.77$, T2 $m= 3.61$) was lower than teacher-reported relatedness (T1 $m= 4.41$, T2 $m= 4.38$). Descriptively, students and teachers tended to agree on their relatedness in the fall

($r = .23$, $p < .05$) and in the spring ($r = .20$, $p < .05$). Notably, although these relations were statistically significant, they were modest. Correlations between student- and teacher-reports of relatedness were stronger in 6th grade than in 5th grade (Table 2). To examine the relation between student- and teacher-reports of relatedness, as well as the extent which these relations differed systematically as a function of time, I fitted a taxonomy of models with teacher-reported relatedness as the outcome variable and student-reported relatedness as the predictor variable (see Table 6). Model 1 addresses the question of the main effect of student-reported relatedness and gives us a baseline model from which to test subsequent models. Models 2, 3, 4, and 5 tested for the effects of time of the year, grade, sex, and race, on the association between student- and teacher-reports of relatedness.

Student-reported relatedness

Within classrooms there was an indication of agreement between student and teacher regarding levels of relatedness ($\hat{\beta} = 0.168$, $p < .05$). In addition, classrooms with high average levels of student-reported relatedness also tended to have high average teacher-reported relatedness ($\hat{\beta} = 0.461$, $p < .05$). There was, however, no within-person relation, suggesting the within-person shifts in students' perception of their relatedness to their teacher were not associated with concurrent shift in teacher perceptions ($\hat{\beta} = 0.022$, $p > .05$).

Time of the year

The associations between student-reported relatedness and teacher-reported relatedness were not significantly different in the fall and the spring of the school year. The within-student ($\hat{\beta} = -0.206$, $p > .05$), between-students within classrooms ($\hat{\beta} = -0.015$, $p > .05$), and between classrooms ($\hat{\beta} = 0.62$, $p > .05$) effects were not dependent on time of year, suggesting that these effects are statistically identical over time.

Grade level

The associations between student-reported relatedness and teacher-reported relatedness indicated a cross-sectional interaction ($\hat{\beta} = 0.871, p < .05$), such that the relation varied as a function of grade level. When 6th grade classes reported relatedness that was higher than other classes on average, their teachers also reported higher relatedness (Figure 1). But, whether or not 5th grade classes reported relatedness that was 2 standard deviations below the average class relatedness or 2 standard deviations above the average class relatedness, 5th grade teachers' reports stayed the same. Follow-up analyses indicated that the slope for 6th grade was significant ($\hat{\beta} = 0.93, t = 3.31, p < .05$), but the slope for 5th grade was not significant ($\hat{\beta} = 0.06, t = 0.31, ns$).

Sex and Race of the student

To test whether the association between student- and teacher-reports of relatedness varied for boys and for girls, I included the interaction of student-reported relatedness by sex. Likelihood ratio tests between Models 1 and 4 (Table 6) show that including effects of student-reported relatedness by sex did not significantly improve model fit ($\Delta-2ll = 9, \chi^2_{crit} = 9.49, p > .05$), suggesting that the joint effects of relatedness do not depend solely on the sex of the student. Next, to test whether the association between student- and teacher-reports of relatedness varied by black or white students, I included the interaction of student-reported relatedness by race. Likelihood ratio tests between Models 1 and 5 (Table 6) show that including effects of student-reported relatedness by race significantly improved model fit ($\Delta-2ll = 33.9, \chi^2_{crit} = 9.49, p < .05$), suggesting that the association between students- and teachers-reports of relatedness vary depending on the race of the student. Lastly, to test whether the association between student- and teacher-reports of relatedness varied by gender/race groups, I included the 3-way interaction of student-reported relatedness, sex, and race. Figure 2 shows that within-person shifts in

student-reports of relatedness are not associated with shifts in teacher-reports for white boys ($\hat{\beta} = 0.02$, $t = 0.39$, *ns*), black boys ($\hat{\beta} = -0.11$, $t = -1.35$, *ns*), or white girls ($\hat{\beta} = 0.002$, $t = 0.04$, *ns*). They maintain levels of teacher-reported relatedness, irrespective of their own rating over the course of the year. In contrast, black girls show a positive relation ($\hat{\beta} = 0.14$, $t = 2.23$, $p < .05$) between student-reported and teacher-reported relatedness; on occasions when black girls report relatedness higher than their own average, their teachers also tend to report higher relatedness.

Research Question 1 Summary

Descriptive statistics suggested that student-reported relatedness and teacher-reported relatedness were positively, albeit modestly, correlated. The final model (Table 6; $R^2 = .136$) shows between-student within-classroom and between-classroom main effects of student-reported relatedness were positively related to teacher-reported relatedness. Although this relation did not vary by time of the year, it did vary by grade level and by the sex and race of the students. Specifically, 6th grade teachers-reports were more likely to vary in a similar direction to students-reports, while 5th grade teachers-reports did not vary along with students-reports. Additionally, teachers-reports were more positively related to black girls' reports.

RQ 2: Is there a relation between time-varying relatedness and emotional engagement?

Does the relation vary by grade level, sex of the student, race of the student, or agreement between teacher and student reports of relatedness?

To examine the relation between relatedness and student-reported engagement, I fit models first with student-reported relatedness as the predictor variable, then with teacher-reported relatedness as the predictor variable, and lastly with both student- and teacher-reported relatedness included as predictor variables. This strategy of analysis allows me to understand

how both student- and teacher-reports are related to student engagement both individually and jointly.

Student-Reported relatedness

On average, engagement declines across the school year. But, on occasions when students reported higher relatedness than they report on average, they also tended to report higher levels of engagement ($\hat{\beta} = 0.315, p < .05$). A similar relation was evident between children in a given classroom such that when students reported relatedness that was higher than other students in their class, they also tended to report higher levels of engagement ($\hat{\beta} = 0.663, p < .05$). Lastly, on occasions when classrooms reported relatedness that was higher than other classes, they tended to report higher engagement ($\hat{\beta} = 0.703, p < .05$).

Time of the year

The association between within-student variation in student-reported relatedness and student-reported engagement were significantly different in the fall and the spring of the school year ($\hat{\beta} = 0.315, p < .05$). Figure 3 shows that on occasions when students report relatedness that is lower than their own average, they tend to report lower concurrent engagement in the spring than in the fall. Follow-up analyses indicated that the slope for fall ($\hat{\beta} = 0.18, t = 2.48, p < .05$) and the slope for spring were both significant ($\hat{\beta} = 0.43, t = 4.90, p < .05$).

Grade level

The associations between student-reported relatedness and engagement indicated a cross-sectional interaction, such that the relation varied as a function of grade level. On occasions when students reported relatedness that was lower than others in their class, 6th graders report lower engagement than 5th graders ($\hat{\beta} = 0.247, p < .05$). But on occasions when students reported relatedness that was higher than others in their class, 6th graders report higher

engagement than 5th graders (Figure 4). Both of the slopes for 5th graders ($\hat{\beta} = 0.52$, $t = 6.15$, $p < .05$) and for 6th graders ($\hat{\beta} = 0.76$, $t = 12.62$, $p < .05$) were significant, indicating a positive relation between relatedness and engagement.

Sex and race of the student

The associations between student-reported relatedness and student-reported engagement did not differ by sex or race of the student. I tested 2-way interactions of student-reported relatedness with sex and race individually and 3-way interactions of student-reported relatedness with sex and race together (Model 4) and none improved model fit.

Teacher-Reported relatedness

On occasions when teachers reported relatedness that was higher than they report on average or that was higher than other classes, there was not significant association with student engagement ($\hat{\beta} = 0.048$, 0.125 , $p > .05$). But, on occasions when teachers reported students had higher relatedness than what the teacher reports on average, there was a positive relationship with engagement ($\hat{\beta} = 0.286$, $p < .05$).

Time of the year

At the classroom level, there was evidence of an interaction between teacher-reported relatedness and time of the year ($\hat{\beta} = 0.204$, $p < .05$). Follow-up analyses indicated that the slopes of the lines for fall ($\hat{\beta} = 0.03$, $t = 0.20$, *ns*) and spring ($\hat{\beta} = 0.23$, $t = 1.72$, *ns*) were not significantly different from zero. Therefore, average levels of engagement were lower in spring than in fall, but did not vary systematically across levels of relatedness.

Grade level

The associations between teacher-reported relatedness and engagement indicated a cross-sectional interaction, such that the relation varied as a function of grade level ($\hat{\beta} = 0.649$, p

< .05). Specifically, there is a positive relation of classroom-level relatedness and student engagement in 6th grade ($\hat{\beta} = 0.35$, $t = 2.43$, $p < .05$); however, the relation is null in 5th grade (Figure 6; ($\hat{\beta} = -0.29$, $t = -1.27$, *ns*).

Sex and race of the student

To test whether the association between teacher-reported relatedness and engagement varied by sex or race, I first examined 2-way interactions. Ultimately, a 3-way interaction between teacher-reported relatedness, sex, and race was significant ($\hat{\beta} = -0.693$, $p < .05$; Table 8, Model 4). Follow-up tests indicate that the slopes of the lines for all groups are not statistically different from zero (Figure 7), suggesting that sex and race are not statistically significant moderators of between classroom teacher-reported relatedness and student-engagement.

Both Student-Reported and Teacher-Reported relatedness

To test the extent to which student- and teacher-reports of relatedness were uniquely associated with student engagement, I fitted taxonomy of models which included within-student, between-student within-class and between-class variation in student-reported relatedness and within-teacher, between-person within-class, and between-class variation in teacher-reported relatedness predicting student-reported engagement. Model 1 (Table 9) shows that both student- and teacher-reported relatedness are positively related to student-reported engagement.

Specifically, when students report relatedness that was higher than they receive on average ($\hat{\beta} = 0.314$, $p < .05$), that was higher than other students in their class ($\hat{\beta} = 0.651$, $p < .05$), and that was higher than other classes it was associated with higher student-reported engagement ($\hat{\beta} = 0.768$, $p < .05$). Additionally, when teachers reported relatedness that was higher than their own average relatedness with students it was associated with higher student-reported engagement ($\hat{\beta} = 0.121$, $p < .05$).

Agreement of Student-Reported and Teacher-Reported relatedness

To test whether the effect of one is dependent on the other, Model 2 (Table 9) includes interactions between student- and teacher-reports of relatedness. The interaction of within-student and within-teacher reports ($\hat{\beta} = -0.075, p > .05$), between-person within-class reports ($\hat{\beta} = -0.076, p > .05$), and between class reports ($\hat{\beta} = -0.197, p > .05$) of relatedness were non-significant, indicating the effect of one type of relatedness was not dependent on the other. Also tested, but not included in the table, were mixed level interactions of student- and teacher-reported relatedness. None of the mixed level interactions were significantly associated with student-reported relatedness, indicating that the effect of one type of relatedness did not depend on the other.

Research Question 2 Summary

The final model (Table 9; $R^2 = 0.279$) indicates that both student-reports and teacher-reports of relatedness explain unique parts of the variance in student-reported engagement. In addition, the way student-reports of relatedness are related to student-reports of engagement differ depending on grade level, sex and race of the student (as previously discussed). This final model shows a significant improvement in fit over an unconditional growth model ($\Delta-2ll = 307.5, \chi^2_{crit} = 16.9, p < .05$) and a significant improvement in fit over Model 1, which includes only main effects ($\Delta-2ll = 16.1, \chi^2_{crit} = 9.48, p < .05$).

CHAPTER 4

DISCUSSION

The relationship between teacher and student is dynamic and involves two parties; however, much of the research in adolescence has measured this relationship through only student reports. Using multi-level modeling techniques, the present study examined the relationship between student-reported relatedness and teacher-reported relatedness, as well as the unique ways these reports were associated with student engagement. The study provided insight into how students and teachers view their relationship similarly, and variables that may impact when they view it differently. In addition, the study showed how different levels of variation in student and teacher reports were related to student engagement.

Comparison of student- and teacher-reported relatedness

Studies of teacher-student relationship in elementary school students have indicated that student and teacher reports of the relationship are either not correlated (i.e., Hughes, Cavell, & Jackson, 1999) or slightly correlated ($r = .10$; Li, Hughes, Kwok, & Hsu, 2012). The present study indicated that in early adolescence student- and teacher-reports of relatedness were modestly correlated in both the fall ($r = .23$) and the spring ($r = .20$) of the school year. Surprisingly, this relationship did not differ by the time of the year. I hypothesized that the relation between student- and teacher-reports of relatedness would become more similar as they spent more time together across the school year; this was not true in our sample. Despite not differing in the fall and the spring, the relation did differ by grade at the between-classroom level of variation. Sixth grade teachers reports of relatedness aligned closer to students reports than did 5th grade teachers reports such that 6th grade teachers were more likely than 5th grade teachers to report lower levels of relatedness in classes where students reported lower levels of

relatedness. Although contradictory to my hypothesis, this finding may be due to the fact that there was less variability in the 5th grade teachers' ratings; they tended to rate higher and with less variation than the 6th grade teachers. An alternative explanation for the finding is 6th grade teachers have several classes throughout the day and are able to see variations in classes, while 5th grade teachers have only one class throughout the day and so cannot make simple comparisons.

Additionally, the present study examined other variables that might contribute to differences in student- and teacher-reports of relatedness and found that the sex and the race of the students mattered. Teacher-reports of relatedness did not vary, irrespective of how white boys, white girls, and black boys rated their relatedness. But, there was a positive relation between student- and teacher-reported relatedness for black girls, indicating congruence between black girls and teachers. This finding is partially contrasting with Wu, Hughes, and Kwok (2012), who found that black students are more likely than white students to be incongruent with their teachers when it came to positive teacher-student relationship in elementary school. I attribute the finding that teachers and black girls are more in-tune to each other because black girls may be more likely than other groups to express how they feel about the teacher-student relationship, even when they feel negatively. Black girls are more likely to be outspoken, even at the risk of seeming rude, in order to be heard or avoid be overlooked (Way, 1995). White girls are more likely to remain quiet about negative feelings toward a teacher so as not to risk more conflict or disagreement (Taylor, Gilligan, & Sullivan, 1995).

Teacher-student relatedness and student engagement

The results of the present study were compatible with previous research indicating that student-reported relatedness was associated with student-reported engagement in early

adolescence (Furrer & Skinner, 2003; Murray, 2009; Patrick, Ryan, & Kaplan, 2007). No known studies have examined reports of the teacher-student relationship from both perspectives, thus this study makes a unique contribution to the literature by finding that teacher-reported relatedness was also associated with student-reported engagement in early adolescence. In fact, both student-reported and teacher-reported relatedness uniquely predicted variations in student-reported engagement. This was particularly compelling because the outcome variable, student engagement, was reported by the students. Therefore, above and beyond the association of student-reported relatedness and its shared measurement variance with student-reported engagement, teacher-reported relatedness was still a unique predictor. This suggests that there truly is something important about how the *teacher* perceives the teacher-student relationship that impacts student-engagement.

Surprisingly, there was not an association of agreement or disagreement between students and teachers regarding teacher-student relatedness and student engagement. I hypothesized that when students and teachers disagreed about the warmth and responsiveness of their relationship then there would be a corresponding association with student engagement. Knowing that the two reports of relatedness are only modestly correlated, there is certainly disagreement about the relationship between some students and their teachers. In fact, the data provide evidence for an association between both student- and teacher-reports of relatedness and engagement, but the level of one type of relatedness (i.e. student-reported) was not dependent on the level of the other (i.e., teacher-reported) when predicting engagement.

Strengths, limitations and future research

This study has two notable strengths. First, using two reporters of the teacher-student relationship allowed not only for a comparison of the perceptions of the two parties, but also a

modeling of associations between both reports of relatedness and student engagement. Comparing teacher versus student reports of the teacher-student relationship is especially informative in adolescence when students are striving for increased autonomy from adults. Previous research has not utilized both student- and teacher-reports of relatedness to understand variations in student engagement. The present study employed both reports and found that both student- and teacher-reports provided unique information about variations in student engagement. This is a distinctive finding that indicates that even after controlling for shared method variance and the student's own perception of the teacher-student relationship, the teachers' perception of the teacher-student relationship predicted variations in student engagement. A second strength of the present study was the use of centering strategies on predictor variables. Studies that do not use centering strategies are left unclear about whether the variation within-reporters or between-reporters is the cause of the significant relations. The present study centered predictor variables within-reporter and between-reporter, allowing an intricate understanding regarding which level of variation in the predictor variables was most related to the outcome variable.

Although the methodology and analytic approach provided new insights regarding teacher-student relationships, there are two limitations that should be considered. First, the data consisted of only two data points spanning one school year. Less than 3 data points does not allow for the modeling of change over time. Thus, the conclusions are in terms of associations between variables and not related to growth or change within or between students. In the future, research on this topic would benefit from a longitudinal study with 3 or more data points following students from elementary school to middle school. A second limitation surrounds how the student-reported relatedness measures and the teacher-reported relatedness measures were not identical (see Appendix for measures). Although the current survey questions elicited

information from both reporters regarding their perceptions of relatedness, future studies might benefit from using survey questions that are exactly the same across reporters.

Conclusion

By using two reporters of teacher-student relationship, the present study was able to garner a more complete understanding of agreement between reporters. The finding that student and teacher reports of relatedness in early adolescence are only modestly related and uniquely predictive of engagement should compel researchers to obtain both reports in future studies. By using centering techniques in combination with multi-level modeling, the study pinpointed which levels of variation of teacher-student relatedness contributed to differences in student engagement. In fact, both within-reporter and between-reporter associations were significantly related to outcome variables at different points, which should compel researchers to use a centering strategy to obtain a clearer picture regarding relations among variables.

As student's move into adolescence, they need relational support from teachers. High teacher-student relatedness, no matter who perceives it, is positively related to student engagement. The perception of the student and the perception of the teacher regarding the teacher-student relationship are both important, and should both be considered, when understanding student engagement in the classroom.

CHAPTER 5

TABLES AND FIGURES

Table 1: *Studies that use Reports of Teacher-Student Relationship as it is Associated with Engagement and/or Achievement*

	Reporter of teacher-student relationship		
	Teacher	Student	Both
Elementary Totals	13	10	7
<i>Archambault, Pagani, & Fitzpatrick, 2013</i>	*		
<i>Baker, 2006</i>	*		
<i>Birch & Ladd, 1997</i>	*		
<i>Decker, Dona, & Christenson, 2007</i>			*
<i>Doumen et al., 2012</i>	*		
<i>Elias & Haynes, 2008</i>		*	
<i>Gest, Welsh, & Domitrovich, 2005</i>		*	
<i>Gruman et al., 2008</i>		*	
<i>Hamre & Pianta, 2001</i>	*		
<i>Hamre & Pianta, 2005</i>	*		
<i>Henricsson & Rydell, 2006</i>	*		
<i>Hughes, 2011</i>			*
<i>Hughes & Chen, 2011</i>			*
<i>Hughes & Kwok, 2007</i>	*		
<i>Hughes, Luo, Kwok, & Loyd, 2008</i>	*		
<i>Hughes et al., 2012</i>		*	
<i>Hughes, Zhang, & Hill, 2006</i>		*	
<i>Liew, Chen, & Hughes, 2010</i>	*		
<i>Maldonado-Carreno & Votruba-Drzal, 2011</i>	*		
<i>Mercer, Nellis, Martinez, & Kirk, 2011</i>		*	
<i>Murray, Murray, & Waas, 2008</i>			*
<i>O'Connor & McCartney, 2006</i>	*	*	
<i>Patrick et al., 2008</i>		*	
<i>Patrick, Ryan, & Kaplan, 2007</i>		*	
<i>Skinner & Belmont, 1993</i>			*
<i>Skinner & Kindermann, 2008</i>		*	
<i>Spilt, Hughes, Wu, & Kwok, 2012</i>	*		
<i>Valiente, Lemery-Chalfant, Swanson, & Reiser, 2008</i>			*
<i>Wu, Hughes, & Kwok, 2010</i>			*
Transition to and/or Middle School Totals	0	19	1
<i>Connell & Klem, 2004</i>		*	
<i>Daly et al, 2009</i>		*	
<i>Danielson, Wiium, Wilhelmsen & Wold, 2010</i>		*	
<i>De Bruyn, 2005</i>		*	
<i>Furrer & Skinner, 2003</i>		*	
<i>Gehlbach, Brinkworth, & Harris, 2012</i>			*
<i>Levpuscek & Zupancic, 2009</i>		*	

Table 1 (continued): *Studies that use Reports of Teacher-Student Relationship as it is Associated with Engagement and/or Achievement*

	Reporter of teacher-student relationship		
	Teacher	Student	Both
<i>Murray, 2009</i>		*	
<i>Rosenfeld, Richman, & Bowen, 2000</i>		*	
<i>Ryan & Patrick, 2001</i>		*	
<i>Ryan, Stiller, & Lynch, 1994</i>		*	
<i>Sakiz, Pape, & Hoy, 2012</i>		*	
<i>Voelkl, 1995</i>		*	
<i>Wang & Eccles, 2013</i>		*	
<i>Wang & Holcombe, 2010</i>		*	
<i>Wentzel, 1997</i>		*	
<i>Wentzel, 1998</i>		*	
<i>Wentzel, Battle, Russell, & Looney, 2010</i>		*	
<i>Woolley, Kol, & Bowen, 2008</i>		*	
Transition to and/or High School Totals	2	13	0
<i>Brewster & Bowen, 2004</i>		*	
<i>Close & Solberg, 2008</i>		*	
<i>Crosnoe, Johnson, & Elder, 2004</i>		*	
<i>Danielsen, Breivik, & Wold, 2011</i>		*	
<i>Diseth, Danielsen, & Samdal, 2012</i>		*	
<i>Gregory & Weinstein, 2004</i>		*	
<i>Hafen et al., 2012</i>		*	
<i>Konishi, Hymel, Zumbo, & Li, 2010</i>		*	
<i>Pallock & Lamborn, 2006</i>		*	
<i>Perry, Liu, & Pabian, 2010</i>		*	
<i>Shin, Lee, & Kim, 2009</i>		*	
<i>Van Ryzin, 2010</i>		*	
<i>Van Ryzin, Gravely, & Roseth, 2009</i>	*		
<i>Wang & Eccles, 2012</i>	*		
<i>Zimmer-Gembeck et al., 2006</i>		*	

Note: This literature search was performed in a PsychInfo search engine. The search terms used in the subject and keyword fields were “teacher-student relation(ship),” “teacher-student relatedness,” “teacher support,” and “teacher-student interactions.” These were all combined with keywords “engagement and/or achievement.” Studies were included in the table above if they were quantitative studies of K-12 students that included a teacher-student emotional support/relatedness variable as it was associated with engagement or achievement. Studies concerning only specific, non-normal participants (for example, special education, developmental disabilities) were not included.

Table 2: *Correlations, Means, and Standard Deviations of Study Variables*

	T1 SRR	T2 SRR	T1 TRR	T2 TRR	T1 SRE	T2 SRE
T1 SRR						
T2 SRR	.55**					
T1 TRR	.23**	.19**				
T2 TRR	.20**	.20**	.62**			
T1 SRE	.43**	.38**	.13**	.09*		
T2 SRE	.38**	.57**	.12**	.13**	.61**	
Overall Mean	3.77	3.61	4.41	4.38	3.76	3.56
Overall SD	0.80	0.90	0.71	0.78	0.99	1.07

Note: T1= Fall; T2= Spring SRR= student-reported relatedness; TRR= teacher-reported relatedness; SRE= Student-reported engagement.

Table 3: *Correlations of Study Variables by Grade Level*

	T1 SRR	T2 SRR	T1 TRR	T2 TRR	T1 SRE	T2 SRE
T1 SRR		.52**	.09	.06	.34**	.30**
T2 SRR	.57**		.09	.14*	.28**	.42**
T1 TRR	.33**	.26**		.59**	.00	.02
T2 TRR	.29**	.21**	.61**		-.05	-.02
T1 SRE	.52**	.44**	.23**	.19**		.63**
T2 SRE	.44**	.63**	.23**	.22**	.60**	

Note: 5th grade above diagonal, 6th grade below diagonal. T1= Fall; T2= Spring SRR= student-reported relatedness; TRR= teacher-reported relatedness; SRE= Student-reported engagement.

Table 4: *Means and Standard Deviations by Grade and Time of the Year*

		SRR	TRR	SRE
5 th Grade	Fall	3.81	4.46	3.74
		(0.79)	(0.67)	(1.01)
	Spring	3.68	4.52	3.62
		(0.87)	(0.68)	(1.06)
	Overall	3.75	4.49	3.68
		(0.72)	(0.60)	(0.93)
6 th Grade	Fall	3.72	4.36	3.77
		(0.81)	(0.75)	(0.98)
	Spring	3.54	4.26	3.50
		(0.93)	(0.84)	(1.07)
	Overall	3.63	4.31	3.63
		(0.77)	(0.71)	(0.92)

Note: SRR= student-reported relatedness; TRR= teacher-reported relatedness; SRE= Student-reported engagement.

Table 5: *Means and Standard Deviations by Sex and Race of the student*

		SRR	TRR	SRE
Boy	AA	3.62 (0.78)	4.16 (0.76)	3.72 (0.95)
	White	3.61 (0.77)	4.44 (0.67)	3.56 (0.96)
	Overall	3.61 (0.77)	4.33 (0.72)	3.62 (0.96)
Girl	AA	3.69 (0.74)	4.35 (0.68)	3.73 (0.92)
	White	3.82 (0.71)	4.56 (0.52)	3.65 (0.87)
	Overall	3.76 (0.73)	4.46 (0.61)	3.69 (0.89)

Note: SRR= student-reported relatedness; TRR= teacher-reported relatedness; SRE= Student-reported engagement.

Table 6: *Estimates of Effects from a Taxonomy of Models with Teacher-Reported Relatedness as Outcome*

		Unconditional Model	M1	M2	M3	M4	M5	M6	Final
Fixed Effects	Intercept	4.372** (0.059)	4.387** (0.057)	4.379** (0.058)	4.474** (0.083)	4.347** (0.068)	4.489** (0.051)	4.452** (0.067)	4.521** (0.086)
	Initial status								
Level 1:	Time		-0.027 (0.038)	-0.026 (0.038)	-0.028 (0.038)	-0.024 (0.038)	-0.027 (0.038)	-0.025 (0.038)	-0.025 (0.038)
	PMC_SRR		0.022 (0.037)	0.124 (0.069)	0.053 (0.047)	-0.039 (0.054)	0.012 (0.045)	0.023 (0.058)	0.023 (0.058)
	PMC_SRR*Time			-0.206 (0.125)					
Level 2:	Girl					0.080 (0.043)		0.084 (0.059)	0.079 (0.057)
	Black						-0.226** (0.042)	-0.252** (0.050)	-0.257** (0.055)
	Girl*Black							0.029 (0.068)	0.039 (0.067)
	BPWC_SRR		0.168** (0.038)	0.183** (0.037)	0.133* (0.058)	0.202** (0.044)	0.183** (0.042)	0.196** (0.051)	0.159** (0.036)
	PMC_SRR*Girl					0.120 (0.066)		-0.020 (0.077)	-0.020 (0.077)
	PMC_SRR*Black						0.018 (0.069)	-0.129 (0.089)	-0.129 (0.089)
	PMC_SRR*Girl*Black							0.274* (0.118)	0.274* (0.118)
	BPWC_SRR*Time			-0.015 (0.043)					
	BPWC_SRR*Girl					-0.081 (0.055)		-0.048 (0.072)	

Table 6 (continued): *Estimates of Effects from a Taxonomy of Models with Teacher-Reported Relatedness as Outcome*

		Unconditional Model	M1	M2	M3	M4	M5	M6	Final
	BPWC_SRR*Black						-0.053 (0.068)	0.021 (0.099)	
	BPWC_SRR*Girl*Black							-0.118 (0.157)	
Level 3:	Grade				-0.095 (0.094)				-0.071 (0.095)
	GMC_SRR		0.461** (0.212)	0.444 (0.224)	0.060 (0.192)	0.479 (0.251)	0.309 (0.182)	0.384 (0.255)	0.0476 (0.197)
	PMC_SRR*Grade				-0.059 (0.070)				
	BPWC_SRR*Grade				0.059 (0.077)				
	GMC_SRR*Grade				0.871* (0.341)				0.855* (0.353)
	GMC_SRR*Time			0.062 (0.108)					
	GMC_SRR*Girl					-0.055 (0.136)		-0.184 (0.219)	
	GMC_SRR*Black						0.291* (0.189)	0.174 (0.212)	
	GMC_SRR*Girl*Black							0.231 (0.217)	
Variance Components									
Level 1:	Within-student	0.221	0.221	0.220	0.220	0.219	0.221	0.218	0.218
Level 2:	Between students within class	0.186	0.174	0.172	0.174	0.172	0.158	0.156	0.161
Level 3:	Between classes	0.158	0.131	0.133	0.103	0.129	0.135	0.133	0.106
Goodness of Fit	Deviance	2555.5	2517.2	2512.7	2506.9	2508.2	2483.3	2464.9	2467.0
	AIC	2563.5	2533.2	2534.7	2530.9	2532.2	2507.3	2504.9	2499.0
	BIC	2571.4	2549.0	2556.3	2554.5	2555.8	2530.9	2544.3	2530.5

Note: * $p < .05$; ** $p < .01$. PMC=Person-mean centered; BPWC = Between-person within-class; GMC = Grand Mean Centered; SRR= Student-reported relatedness..

Table 7: *Estimates of Effects from a Taxonomy of Models with Student-Reported Engagement as Outcome*

		Unconditional Model	Unconditional Growth	M1	M2	M3	M4	Final
Fixed Effects		3.647**	3.748**	3.714**	3.725**	3.717**	3.697**	3.721**
Initial status	Intercept	(0.059)	(0.063)	(0.054)	(0.053)	(0.084)	(0.066)	(0.083)
Level 1:	Time		-0.202**	-0.153**	-0.157**	-0.150**	-0.154**	-0.153**
			(0.046)	(0.041)	(0.041)	(0.040)	(0.041)	(0.041)
	PMC_SRR			0.315**	0.178*	0.218**	0.404**	0.192**
				(0.049)	(0.072)	(0.065)	(0.086)	(0.069)
	PMC_SRR*Time				0.249*			0.246*
					(0.124)			(0.122)
Level 2:	Girl						-0.046	
							(0.081)	
	Black						0.108	
							(0.079)	
	Girl*Black						-0.006	
							(0.100)	
	BPWC_SRR			0.663**	0.608**	0.517**	0.649**	0.509**
				(0.053)	(0.059)	(0.084)	(0.110)	(0.084)
	PMC_SRR*Girl						-0.171	
							(0.138)	
	PMC_SRR*Black						-0.118	
							(0.137)	
	PMC_SRR*Girl*Black						0.209	
							(0.190)	
	BPWC_SRR*Time				0.092			
					(0.056)			
	BPWC_SRR*Girl						-0.071	
							(0.135)	
	BPWC_SRR*Black						0.011	
							(0.150)	
	BPWC_SRR*Girl*Black						0.211	
							(0.184)	

Table 7 (continued): *Estimates of Effects from a Taxonomy of Models with Student-Reported Engagement as Outcome*

		Unconditional Model	Unconditional Growth	M1	M2	M3	M4	Final
Level 3:	Grade					0.007 (0.096)		0.005 (0.101)
	GMC_SRR			0.703** (0.135)	0.619** (0.147)	0.616** (0.182)	0.687** (0.230)	0.685** (0.142)
	PMC_SRR*Grade					0.185 (0.096)		
	BPWC_SRR*Grade					0.247* (0.104)		0.246* (0.102)
	GMC_SRR*Grade					0.208 (0.274)		
	GMC_SRR*Time				0.141 (0.118)			
	GMC_SRR*Girl						-0.108 (0.231)	
	GMC_SRR*Black						0.168 (0.225)	
	GMC_SRR*Girl*Black						0.011 (0.244)	
Variance Components								
Level 1:	Within-student	0.431	0.411	0.378	0.375	0.375	0.376	0.378
Level 2:	Between students within class	0.517	0.528	0.336	0.335	0.331	0.331	0.326
Level 3:	Between classes	0.118	0.117	0.074	0.077	0.073	0.072	0.076
Goodness of Fit	Deviance	3555.4	3523.1	3238.3	3229.9	3224.2	3227.6	3226.9
	AIC	3563.4	3533.1	3254.3	3251.9	3248.2	3267.6	3248.9
	BIC	3571.3	3542.9	3270.0	3273.6	3271.8	3307.0	3270.6

Note: * $p < .05$; ** $p < .01$. PMC=Person-mean centered; BPWC = Between-person within-class; GMC = Grand Mean Centered; SRR= Student-reported relatedness.

Table 8: *Estimates of Effects from a Taxonomy of Models with Student-Reported Engagement as Outcome*

		Unconditional Model	Unconditional Growth	M1	M2	M3	M4	Final
Fixed Effects		3.647**	3.748**	3.749**	3.748**	3.817**	3.663**	3.738**
Initial status	Intercept	(0.059)	(0.063)	(0.063)	(0.062)	(0.092)	(0.086)	(0.109)
Level 1:	Time		-0.202**	-0.200**	-0.200**	-0.198**	-0.202**	-0.200**
			(0.046)	(0.046)	(0.043)	(0.047)	(0.045)	(0.044)
	PMC_TRR			0.048	0.191	0.018	0.104	0.046
				(0.059)	(0.124)	(0.092)	(0.121)	(0.059)
	PMC_TRR*Time				-0.284			
					(0.227)			
Level 2:	Girl						0.047	0.028
							(0.108)	(0.100)
	Black						0.223*	0.214*
							(0.098)	(0.096)
	Girl*Black						-0.111	-0.090
							(0.146)	(0.132)
	BPWC_TRR			0.286**	0.314**	0.186	0.408**	0.347**
				(0.074)	(0.079)	(0.101)	(0.142)	(0.077)
	PMC_TRR*Girl						-0.111	
							(0.146)	
	PMC_TRR*Black						-0.139	
							(0.171)	
	PMC_TRR*Girl*Black						0.281	
							(0.264)	
	BPWC_TRR*Time				-0.036			
					(0.079)			
	BPWC_TRR*Girl						-0.173	
							(0.191)	
	BPWC_TRR*Black						0.001	
							(0.000)	
	BPWC_TRR*Girl*Black						0.085	
							(0.304)	

Table 8 (continued): *Estimates of Effects from a Taxonomy of Models with Student-Reported Engagement as Outcome*

		Unconditional Model	Unconditional Growth	M1	M2	M3	M4	Final
Level 3:	Grade					-0.077 (0.114)		-0.091 (0.113)
	GMC_TRR			0.125 (0.128)	0.027 (0.138)	-0.299 (0.236)	0.092 (0.145)	-0.442 (0.244)
	GMC_TRR*Time				0.204* (0.089)			0.205* (0.089)
	GMC_TRR*Grade					0.649* (0.276)		0.644* (0.271)
	PMC_TRR*Grade					0.051 (0.123)		
	BPWC_TRR*Grade					0.164 (0.146)		
	GMC_TRR*Girl						0.279 (0.179)	0.348 (0.179)
	GMC_TRR*Black						0.080 (0.148)	0.085 (0.139)
	GMC_TRR*Girl*Black						-0.693* (0.292)	-0.749** (0.284)
Variance Components								
Level 1:	Within-student	0.431	0.411	0.410	0.407	0.410	0.409	
Level 2:	Between students within class	0.517	0.528	0.503	0.503	0.502	0.489	
Level 3:	Between classes	0.118	0.117	0.117	0.118	0.099	0.118	
Goodness of Fit	Deviance	3555.4	3523.1	3500.6	3492.6	3492.9	3485.3	
	AIC	3563.4	3533.1	3516.6	3514.6	3516.9	3525.3	
	BIC	3571.3	3542.9	3532.3	3536.2	3540.6	3564.7	

Note: * $p < .05$; ** $p < .01$. PMC=Person-mean centered; BPWC = Between-person within-class; GMC = Grand Mean Centered; TRR= Teacher-reported relatedness.

Table 9: *Estimates of Effects from a Taxonomy of Models with Student-Reported Emotional Engagement as Outcome*

		Unconditional Model	Unconditional Growth	M1	M2	Final combined
Fixed Effects		3.647**	3.748**	3.711**	3.727**	3.728**
Initial status	Intercept	(0.059)	(0.061)	(0.053)	(0.054)	(0.079)
Level 1:	Time		0.202**	-0.152**	-0.152**	-0.153**
			(0.035)	(0.041)	(0.041)	(0.039)
	PMC_SRR			0.315**	0.315**	0.173*
				(0.049)	(0.049)	(0.069)
	PMC_SRR*Time					0.273*
						(0.122)
	PMC_TRR			0.037	0.037	0.036
				(0.489)	(0.054)	(0.054)
	PMC_TRR*PMC_SRR				-0.075	
					(0.207)	
Level 2:	BPWC_SRR			0.644**	0.644**	0.492**
				(0.051)	(0.051)	(0.083)
	BPWC_TRR			0.117*	0.117*	0.121*
				(0.059)	(0.059)	(0.060)
	BPWC_TRR*BPWC_SRR				-0.076	
					(0.069)	
Level 3:	Grade					-0.011
						(0.099)
	BPWC_SRR*Grade					0.241*
						(0.102)
	GMC_SRR			0.768**	0.768**	0.747**
				(0.162)	(0.162)	(0.166)
	GMC_TRR			-0.141	-0.141	-0.234
				(0.119)	(0.119)	(0.122)
	GMC_TRR*Time					0.169*
						(0.084)
	GMC_TRR*GMC_SRR				-0.197	
					(0.206)	

Table 9 (continued): *Estimates of Effects from a Taxonomy of Models with Student-Reported Emotional Engagement as Outcome*

		Unconditional Model	Unconditional Growth	M1	M2	Final combined
Variance Components						
Level 1:	Within-student	0.431	0.411	0.377	0.377	0.375
Level 2:	Between students within class	0.517	0.528	0.333	0.332	0.324
Level 3:	Between classes	0.118	0.117	0.070	0.069	0.072
Goodness of Fit	Deviance	3555.4	3523.1	3231.7	3230.1	3215.6
	AIC	3563.4	3533.1	3253.7	3258.1	3245.6
	BIC	3571.3	3542.9	3275.4	3285.6	3275.1

Note: * $p < .05$; ** $p < .01$. PMC=Person-mean centered; BPWC = Between-person within-class; GMC = Grand Mean Centered; SRR= Student-reported relatedness; TRR= Teacher-reported relatedness.

Figure 1: *Outcome of Teacher-Reported Relatedness across Levels of Student-Reported Relatedness by Grade Level*

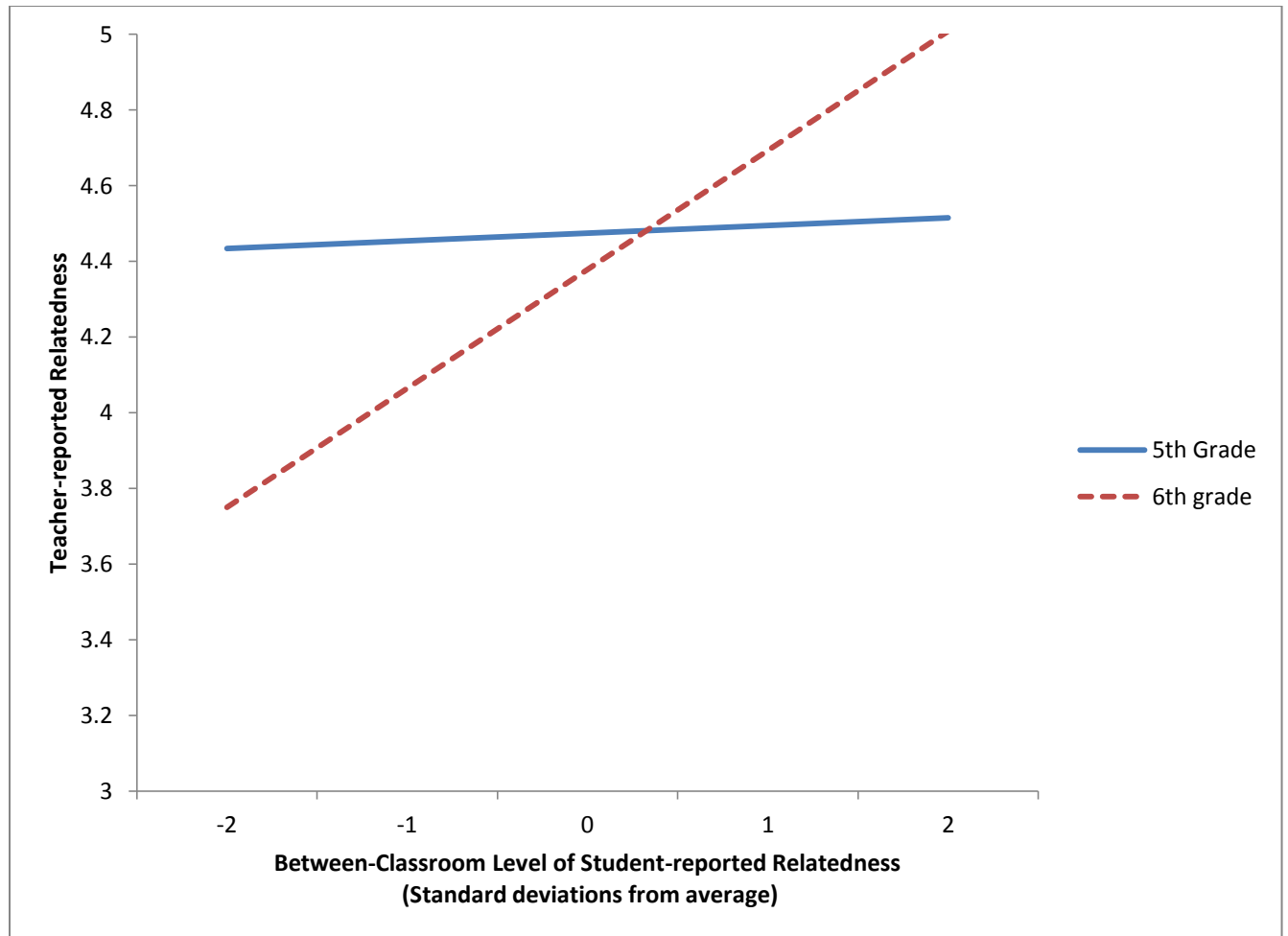


Figure 2: *Outcome of Teacher-Reported Relatedness across Levels of Student-Reported Relatedness by Students' Sex/Race Group*

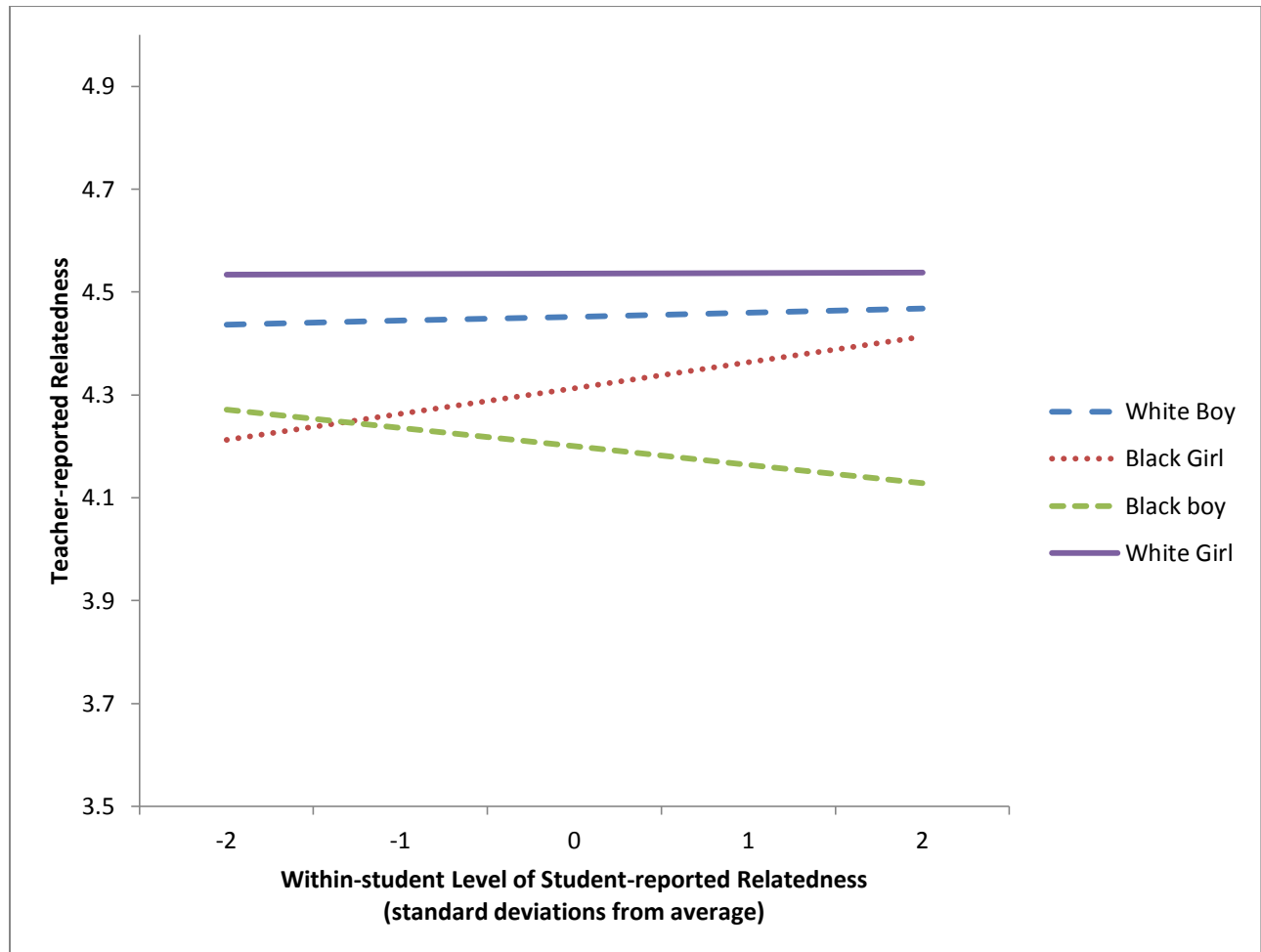


Figure 3: *Outcome of Student-Reported Engagement across Levels of Student-Reported Relatedness by Time of the Year*

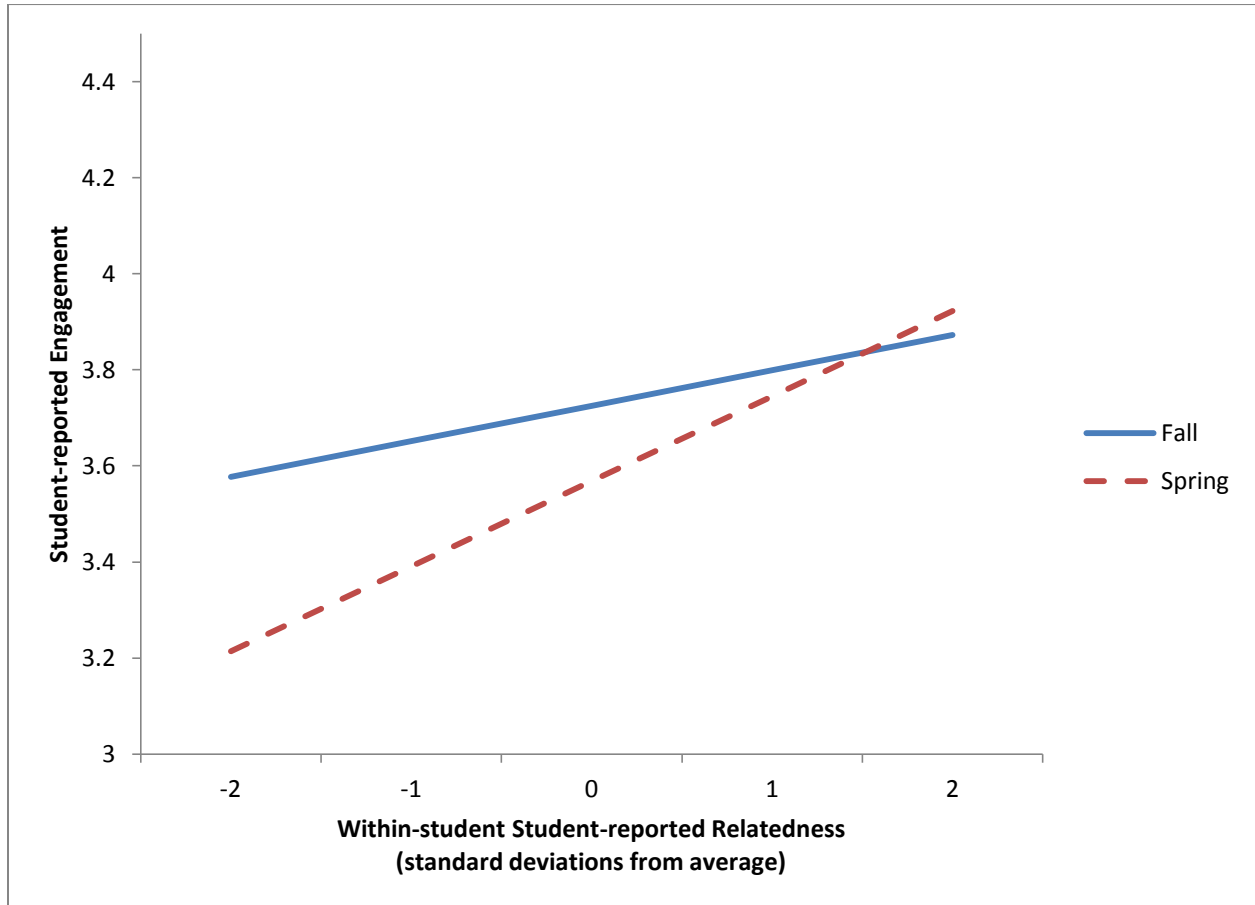


Figure 4: *Outcome of Student-Reported Engagement across Levels of Student-Reported Relatedness by Grade Level*

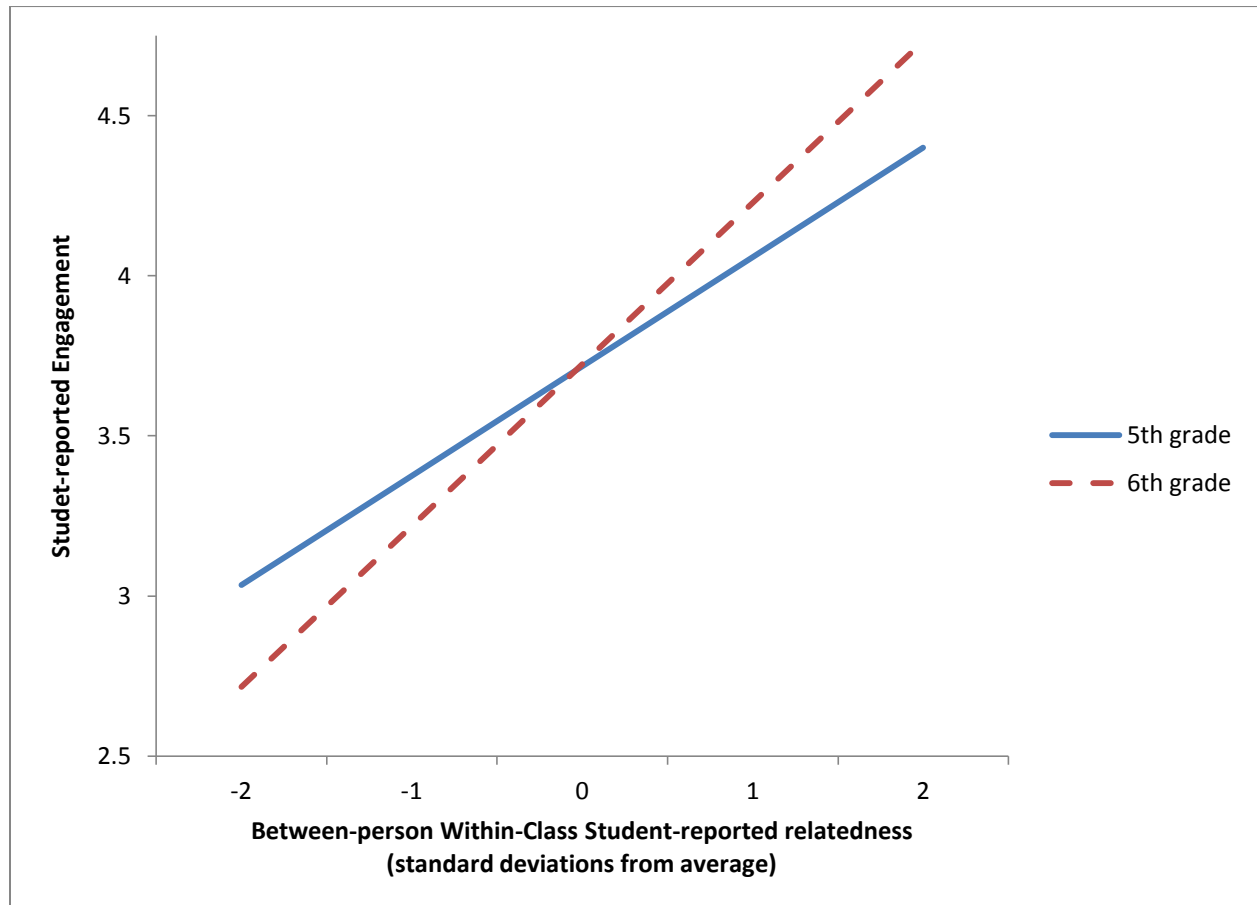


Figure 5: *Outcome of Student-Reported Engagement across Levels of Teacher-Reported Relatedness by Time of the Year*

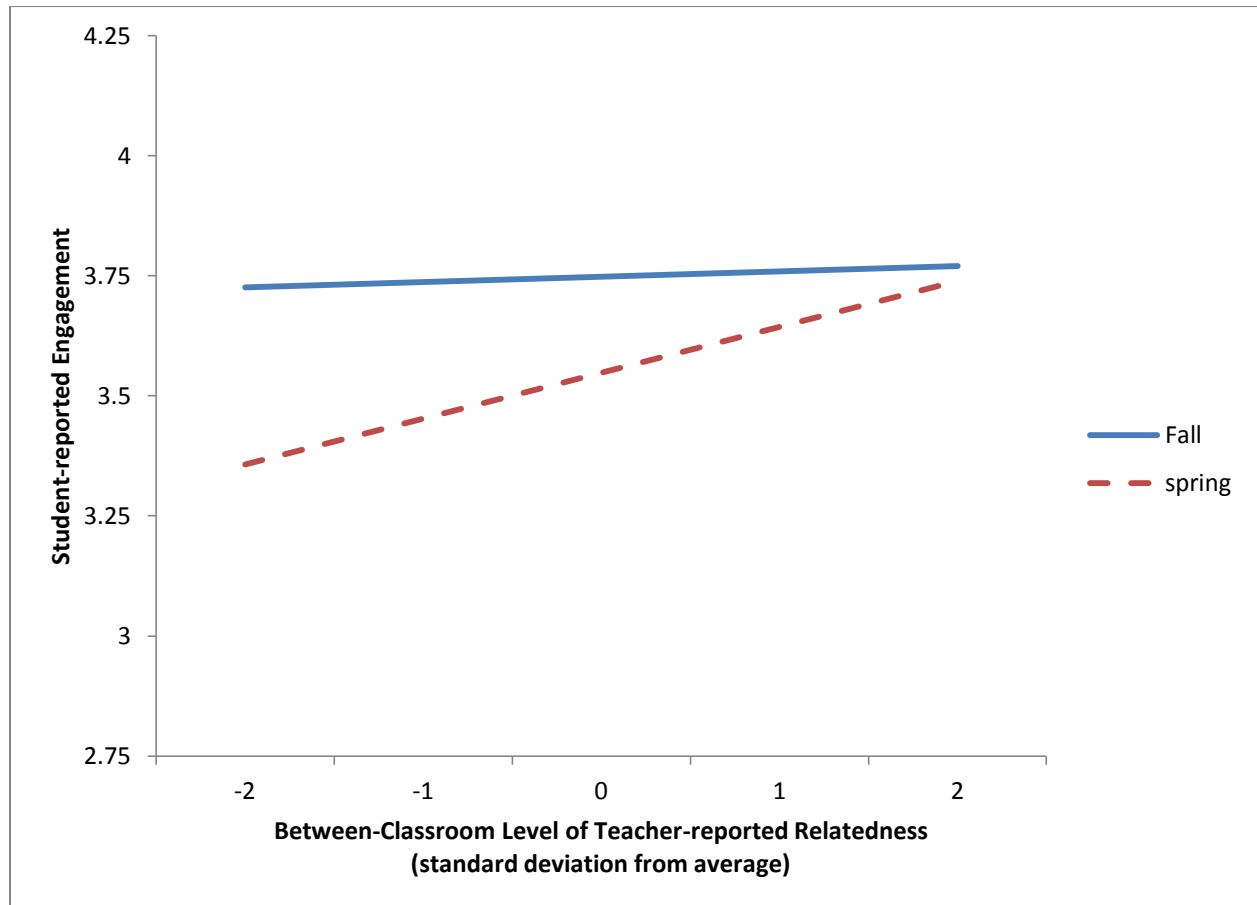


Figure 6: *Outcome of Student-Reported Engagement across Levels of Teacher-Reported Relatedness by Grade*

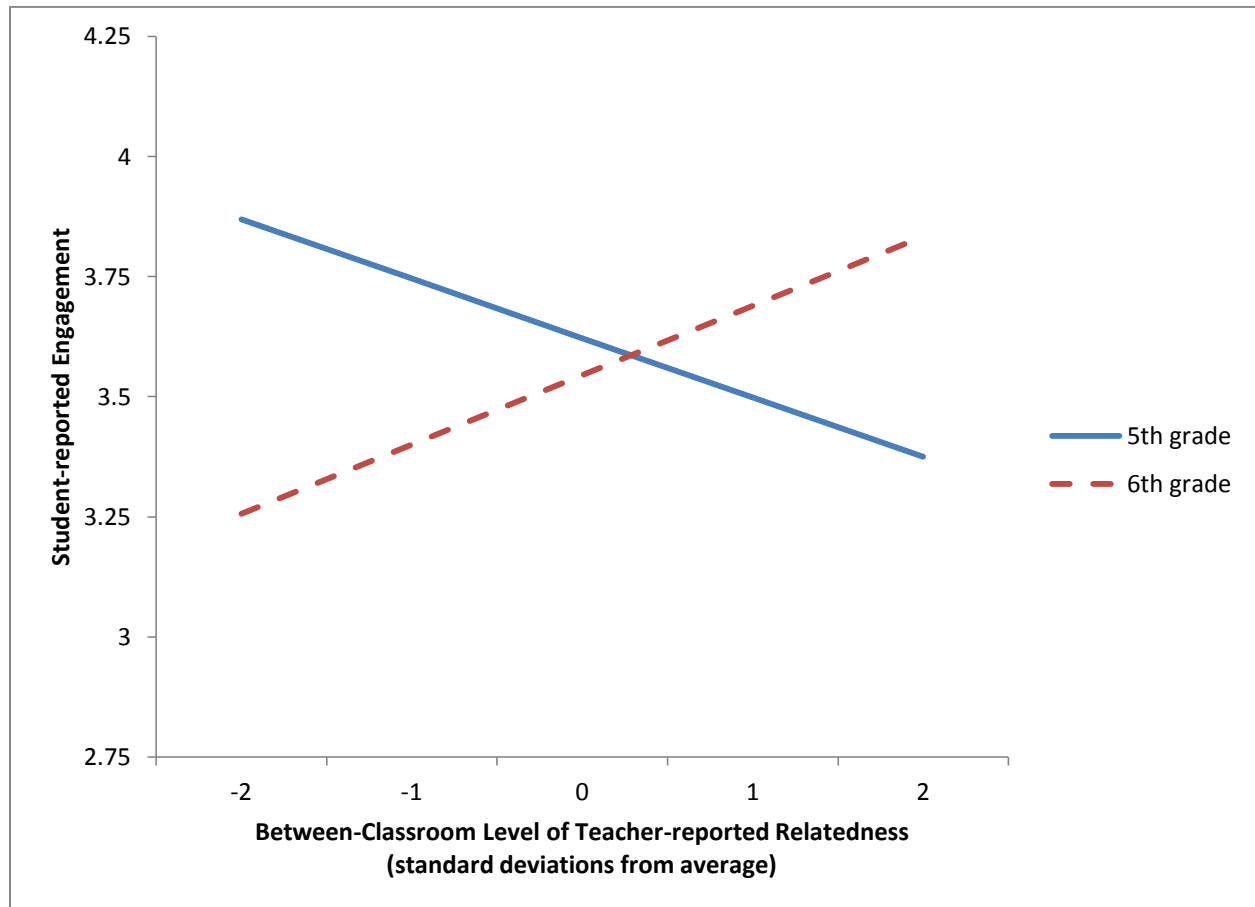
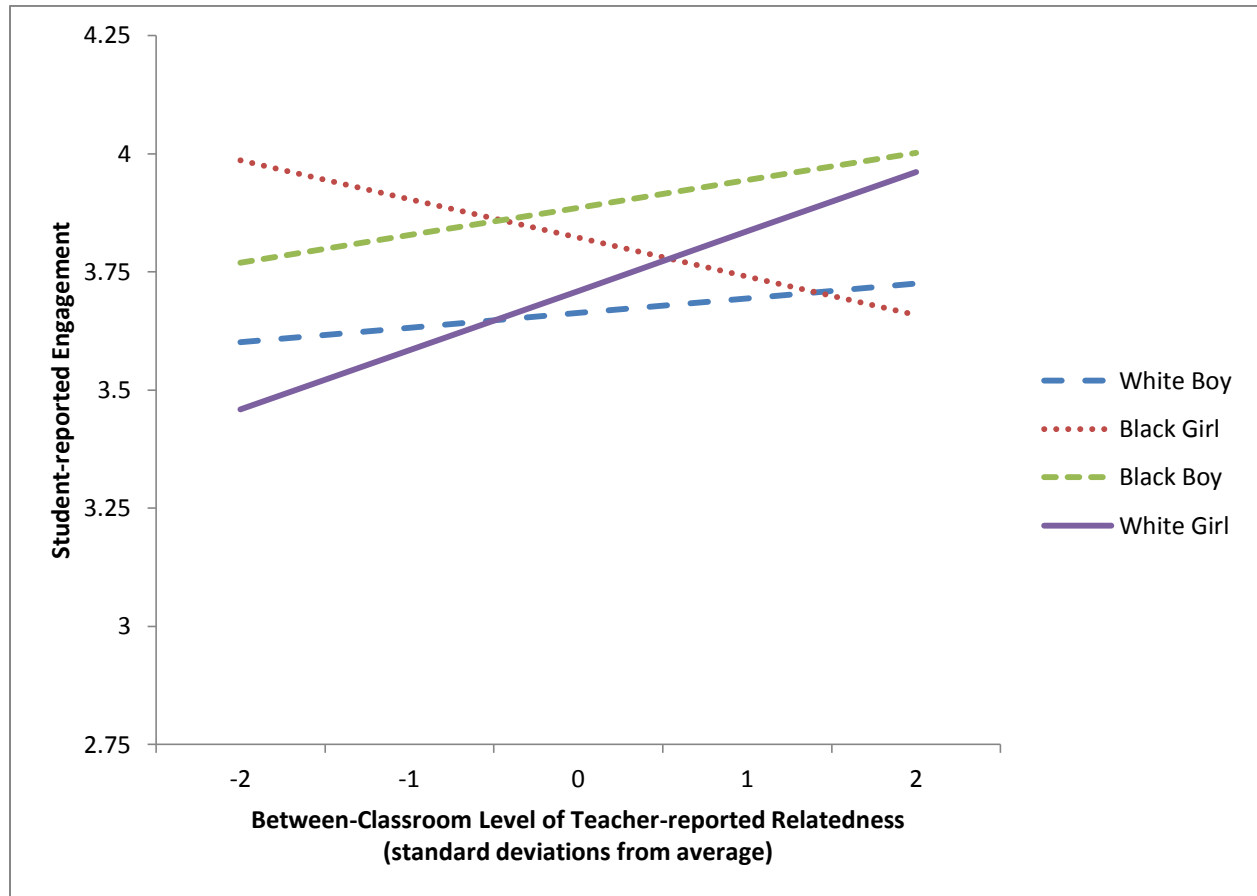


Figure 7: *Outcome of Student-Reported Engagement across Levels of Teacher-Reported Relatedness by Sex and Race of Student*



APPENDIX

Student-reported relatedness:

My teacher likes me.
My teacher knows me well.
My teacher really cares about me.
My teacher just does not understand me.
My teacher spends time with me.
My teacher talks with me.
I can't depend on my teacher for important things.
I can't depend on my teacher when I need him/her.

Teacher-reported relatedness:

I find this student easy to get along with.
I know this student well and understand his/her needs in the classroom.
In general, this student and I get along well in class.

Student-reported engagement:

My classes are fun.
I enjoy learning new things in my classes.
When we work on something in class, I feel interested.
When I am in class, I feel good.
In my classes, I work as hard as I can.

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