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Teacher–Student Relationships and Students' Engagement in High School: Does the Number of Negative and Positive Relationships With Teachers Matter?

Andrew J. Martin and Rebecca J. Collie
University of New South Wales

Teacher–student relationships are an important part of students' interpersonal context at school that impacts their academic development. This study extended prior research into teacher–student relationships by exploring the relative balance of negative and positive teacher–student relationships in high school students' academic lives (in each of English, mathematics, science, history, and geography subjects). Also examined was the role of this relational balance in predicting students' school engagement (operationalized by academic participation, enjoyment, and aspirations). The study involved a longitudinal sample of 2,079 students from 18 high schools. Findings identified a significant linear (main) effect, with an increase in the number of positive relationships (relative to negative relationships) with teachers predicting greater school engagement. This was accompanied by a significant curvilinear effect. Specifically, (a) when the relational balance became predominantly negative, students' engagement was lower, but did not decline with an increasing number of negative teacher–student relationships, and (b) when the relational balance became predominantly positive, students' engagement was higher and became increasingly more so as the number of positive teacher–student relationships outnumbered the negative. We conclude that the enhancing properties of positive teacher–student relationships seem to outweigh the limiting (or narrowing) properties of negative teacher–student relationships. Further, there is cumulative engagement yield through increasing the number of positive teacher–student relationships across students' school subjects.

Educational Impact and Implications Statement

Positive teacher–student relationships are important for students' academic development. Students in many secondary schools have multiple teachers throughout the day and may have a variety of different relationships with each of them. This study extended prior research into teacher–student relationships by collecting relational data across a range of students' school subjects to investigate how many positive and negative teacher–student relationships there are and whether the relative balance of negative to positive teacher–student relationships is implicated in students' academic engagement. Results showed that the enhancing properties of positive teacher–student relationships seem to outweigh the limiting properties of negative teacher–student relationships. Findings also showed that there is cumulative association between students' engagement and increasing the number of positive teacher–student relationships across the range of school subjects in students' academic lives.

Keywords: teacher–student relationships, engagement, high school

Students in many secondary schools have multiple teachers throughout the day and may have a variety of different relationships with each of them. However, research has not sought relational data across a breadth of students' school subjects to investigate how many negative and positive teacher–student relationships there are and whether the relative balance of negative to positive teacher–student relationships is implicated in students' academic outcomes. This is surprising given the numerous teachers in most secondary students' academic lives and the potential for the nature and effects of these relationships to vary from one teacher to the next. Therefore, the present study investigated whether students' engagement varied as a function of the range of relationships they have with different teachers for different school subjects. Our focus was on secondary school students because they typically have numerous teachers on any given school day (elementary school students typically have one teacher responsible for their

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Andrew J. Martin and Rebecca J. Collie, School of Education, University of New South Wales.

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Correspondence concerning this article should be addressed to Andrew J. Martin, School of Education, University of New South Wales, New South Wales 2052, Australia. E-mail: andrew.martin@unsw.edu.au

academic instruction) and also because the quality of relationships with adults (including with teachers) in students' lives during this developmental stage can decline (Gehlbach, Brinkworth, & Harris, 2012). We assessed students' interpersonal relationships with teachers in each of English, mathematics, science, history, and geography subjects because these subjects were compulsory for our sample of students. As such, we were able to ensure that students could feasibly rate their relationship with each teacher.

The approach adopted in our study followed a review by Martin and Dowson (2009; and also drew on related conceptualizing by Ang, 2005; Hughes, 2011; Munns, 1998) who suggested that teachers and students relationally connect interpersonally (via teacher warmth), substantively (via content and tasks assigned by the teacher), and pedagogically (via the teacher's communication of subject matter). In so doing, the present study built on the more typical approaches to interpersonal relationships (viz., warmth) by not only addressing interpersonal connections between teacher and student, but also how teachers connect to students via the transaction of subject matter and pedagogy.

We then explored the relative balance of negative and positive teacher–student relationships in high school students' academic lives—and the role of this balance in predicting students' school engagement (operationalized by academic participation, enjoyment, and aspirations). In the real world of high school, students are taught by many teachers—some of whom students may be positively connected to and some of whom students may be negatively connected to. To the extent that there is a cumulative engagement effect of negative or positive teacher–student relationships, findings have distinct implications for optimizing students' relational contexts and students' academic development.

Investigating the Number of Negative and Positive Teacher–Student Relationships

How and Why Interpersonal Relationships Impact Outcomes

Across the breadth of education and psychology, there are numerous theories that directly or indirectly conceptualize the role of interpersonal relationships (including teacher–student relationships) in students' academic engagement. For example, attribution theory describes how attributions may be learned from interactions with others, including teachers (Hareli & Weiner, 2002; Weiner, 2010). Goal theory articulates how goals can be fostered among students through the influence of significant others such as teachers (Elliot, 2005; Maehr & Zusho, 2009; also see expectancy-value theory for similar relational dynamics; Wigfield & Eccles, 2000; Wigfield & Tonks, 2002). Self-determination theory posits how basic psychological needs are satisfied through support from significant others, including teachers (Deci & Ryan, 2012; Jang, Kim, & Reeve, 2012).

There is a large body of research that has identified the psychological mechanisms implicated in how interpersonal relationships impact academic outcomes. For example, it has been found that interactions with the teacher provide students with greater knowledge about themselves and what is needed to effectively function in the classroom (Wentzel, 2009). Students develop beliefs and values that align with those held by their teachers and these values and beliefs help students operate more successfully in the academic domain (Deci & Ryan, 2012); for instance, positive teacher–student relationships lead students to internalize some of their teacher's beliefs and values (Martin & Dowson, 2009)—in turn, the beliefs and values held by students function to direct behavior and cognition via enhanced persistence, self-regulation, and goal striving (Wentzel, 2009). It is also the case that positive teacher–student relationships have an energizing function that activates positive academic-related emotions (Furrer & Skinner, 2003; Furrer, Skinner, & Pitzer, 2014). These positive emotional responses can "drive" achievement behavior in the form of engagement (Meyer & Turner, 2002). There is also evidence that more positive teacher–student relationships impact the structural features of classrooms that students experience. For example, Ruzek and colleagues (2016) found that in classrooms characterized by more emotionally supportive teacher–student interactions, students experienced higher levels of autonomy and more supportive peer relationships, and these structural features were, in turn, predictive of student engagement gains.

Cumulative and Trajectory Perspectives on Teacher–Student Relationships

Notably, however, the bulk of relational research has operationalized teacher–student relationships through students rating one teacher in a specific class (domain-specific; e.g., "In this class, my teacher . . .") or rating their teachers at school more generally (domain-general; e.g., "My teachers . . ."). Very little research has investigated the number of negative and positive teacher–student relationships in a student's academic life and its role in his or her academic engagement. As a result, it remains unclear whether students' engagement depends on the number of positive teacher–student relationships outnumbering the number of negative teacher–student relationships (or vice versa). Determining this was the purpose of the present study.

Research has investigated relational trajectories across time and shown that rising conflict can impair students' academic development (Spilt, Hughes, Wu, & Kwok, 2012). In a similar vein, Hughes (2011) suggested that chronic teacher–student conflict may have a cumulative negative effect over time, and Roorda, Koomen, Spilt, and Oort (2011) raised the possibility that negative teacher–student relationships over time may have a cumulative negative effect on students' academic outcomes. On a more positive note, Wentzel (2012) discussed the potentially positive cumulative effects of having positive relationships with many teachers over time. Wentzel (2009) also identified the importance of differentiating effects of relationship with a single teacher compared to the effects of relationships with multiple teachers.

Some work has considered the cumulative effect of multiple teachers, but such work focused on how teachers value-added for achievement rather than for relationships. For example, Sanders and Rivers (1996; see also Jordan, Mendro, & Weerasinghe, 1997) found that when students were placed with three high-performing teachers in a row, they scored significantly higher three years later; however, when students were placed with three low-performing teachers in a row, their average score on the same assessment was significantly lower three years later. In more recent work conducted over an even longer follow-up period, Chetty, Friedman, and Rockoff (2014) found positive cumulative and additive effects

of having multiple high value-added teachers across kindergarten through 12th grade on longer term outcomes such as postschool education and salaries.

Linear and Curvilinear Effects

Because we assessed students' relationships with their teachers in each of five school subjects, we were able to assess their engagement where there was a predominance of negative relationships (i.e., they have a negative relationship with relatively more of their teachers) and for students where there was a predominance of positive relationships (i.e., they have a positive relationship with relatively more of their teachers). This then allowed us to determine if there were different engagement effects for the former (predominantly negative) relative to the latter (predominantly positive) relational balances. Thus, for example, would there be an increase in engagement as the balance shifted from a preponderance of negative teacher–student relationships to a preponderance of positive teacher–student relationships? In its simplest form, this can be investigated as a linear effect. However, it may be that a preponderance of negative relationships impacts engagement differently to how a preponderance of positive relationships impacts engagement. For example, perhaps having a good relationship with most of one's teachers has a markedly positive association with academic engagement, but having a poor relationship with most of one's teachers does not impact one's engagement so markedly (or vice versa). This brings into consideration the potential for a curvilinear effect. To the extent there is a curvilinear effect, this will have implications for how much to target intervention at promoting positive and/or negative teacher–student relationships.

Conceptualizing About Cumulative Effects in Students' Academic Lives

There are theories that conceptualize the cumulative nature and effects of positive (and negative) psychological and educational phenomena. One such theory is the broaden-and-build theory of positive emotions which holds that positive emotions and related processes broaden an individual's awareness and adaptive thought and action repertoire (Fredrickson, 2001, 2004). In turn, this builds personal skills and resources. Interestingly, this theory also suggests slightly different effects for positive and negative emotions. Negative emotions tend to evoke quite immediate and marked effects (e.g., activating a "fight or flight" response) that are implicated in more immediate survival interests. However, although negative emotions are immediate, they are also somewhat narrow (primarily related to immediate survival). On the other hand, positive emotions tend to play out more slowly as they do not have immediate survival value (they do not evoke immediate threat). But over time or across different contexts (e.g., across classrooms as in the present study), the enhancing effects of positive emotions and processes become more salient and broader than the narrowing effects of negative emotions and related processes (Fredrickson, 2001). To what extent might a preponderance of positive teacher–student relationships be more important for students' engagement than the maladaptive effects from a preponderance of negative teacher–student relationships?

Engagement in the Present Study

This study adopted the tripartite engagement framework of Fredricks, Blumenfeld, and Paris (2004) that specifies behavioral, emotional, and cognitive engagement. We operationalized these forms of engagement by way of students' academic participation, their school enjoyment, and their educational aspirations respectively. Across various studies, when students actively participate in school, enjoy school, and have positive educational aspirations, these are shown to be desirable ends in themselves and also means to desirable ends. For example, in regard to participation, learning environments fostering students' participation enhance their commitment to learning and achievement (Martin, Martin, & Evans, 2017; Richter & Tjosvold, 1980); conversely, a lack of participation is associated with emotional withdrawal and poor identification with school (Finn, 1989). In terms of aspirations, several researchers have shown that when students have positive academic intent, they tend to attain greater achievement, are more motivated, and have more aspirational future course intentions (e.g., Burns, Martin, & Collie, 2017; Martin, 2007, 2009; Meece, Wigfield, & Eccles, 1990). As relevant to emotional engagement, enjoyment of school is a key factor in students' academic outcomes (Lee, Sheldon, & Turban, 2003; Remedios, Lieberman, & Benton, 2000).

Prior research has found that high quality teacher–student relationships are positively associated with students' participation, enjoyment, and aspirations (Martin, Marsh, McInerney, & Green, 2009; Martin, Marsh, McInerney, Green, & Dowson, 2007); but in these studies, teacher–student relationships were represented by an overarching domain-general scale requiring students to rate their relationship with teachers in general. In contrast, the present study is focused on assessing the number of negative and positive teacher–student relationships in five school subjects and links to school engagement operationalized by way of aspirations, participation, and enjoyment.

Other Relevant Factors to Include in Modeling Teacher–Student Relationships and Engagement

Although not central to the substantive issues under investigation, it is important to control for a number of factors to better understand the unique role of teacher–student relationships in academic engagement. Prior research has identified age as a factor relevant to engagement, with declines evidenced as students move further into adolescence (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Martin, 2009). There are also gender differences in engagement (girls tend to be more highly engaged than boys; for a summary, see Martin, 2007). Research has shown that socioeconomic status (SES) is positively associated with academic outcomes (Sirin, 2005). Language background may also be relevant, with Glick and Hohmann-Marriott (2007) finding that academic outcomes can vary as a function of language background. It is also known that students with greater academic ability and fewer learning-related disabilities tend to report greater engagement (Greene & Miller, 1996; Martin, 2014, 2015; Vaughn & Wanzek, 2014). It is also important to include students' prior engagement in modeling because it is highly correlated with their subsequent engagement (Martin, Ginns, & Papworth, 2017).

Taken together, our study included age, gender, language background, SES, disability status, ability, and prior engagement in

modeling. We employed these variables in our analyses in two ways. First, to understand unique variance attributable to teacher–student relationships (beyond the role of these sociodemographic and other background factors), in the main modeling we included them as predictors of students' engagement alongside the predictive role of teacher–student relationships. Second, to examine the extent to which teacher–student relationships predicted engagement for different groups of students, we used these variables as the bases to conduct multigroup analyses (e.g., girls vs. boys; low vs. high SES, etc.). These analyses are further described in the Method section.

Aims of the Present Study

The present study sought to extend research into teacher–student relationships by exploring the relative balance of negative and positive teacher–student relationships in high school students' academic lives (in each of English, mathematics, science, history, and geography subjects)—and the role of this balance in predicting students' school engagement (operationalized by academic participation, enjoyment, and aspirations). It investigated school engagement as a function of the range of relationships students have with their teachers (in each of five school subjects). This research design enabled us to determine if there was an increase in engagement as the balance shifted from a preponderance of negative teacher–student relationships to a preponderance of positive teacher–student relationships (i.e., a linear effect)—or, if a preponderance of negative relationships might have a relatively greater association with students' engagement than a preponderance of positive relationships (or vice versa; i.e., a curvilinear effect). We conducted structural equation modeling (SEM) to test the relative salience of the balance of negative to positive teacher–student relationships in predicting students' engagement, controlling for prior engagement, sociodemographic and background factors, and ability (see Figures 1 and 2). We hypothesized that (a) students' engagement would be greater with an increasing number of positive teacher–student relationships in their academic lives, (b) students' engagement would be lower with an increasing number of negative teacher–student relationships in their academic lives, but (c) whether there was a disproportionate role for negative over positive relationships on students' engagement (or, vice versa) was left as an open research question. Finally, to more closely examine the potential yields of our proposed cumulative approach to teacher–student relationships, we conducted subsidiary analyses that compared the present cumulative domain-specific approach with the more typical domain-general approach to assessing teacher–student relationships. This was a more exploratory aspect of the study and so no hypotheses were made here.

Method

Participants

The sample comprised 2,079 students from 18 Australian high schools.[1] Each student responded to a survey in the latter third of the school year in 2014 and again one year later in 2015, with >70% retention. By this point in each year, students were deemed to have a sound basis upon which to rate their relationship with teacher. The survey comprised all measures used in this study, and so data analyzed here were collected at the same time within each survey administration. Based on annual national literacy and numeracy assessment in which all schools participate, schools in this study were marginally above the national average in literacy and numeracy (Australian Curriculum Assessment Reporting Authority, 2011). Based on the Index of Community Socio-educational Advantage, participating schools were above the national average (1,000), with a mean of 1127 (SD = 74), suggesting higher aggregate socioeconomic advantage (Australian Curriculum Assessment Reporting Authority, 2011). Just over half were girls (53%; 47% boys) and the average age (in 2015) was 14.41 years (SD = 0.95). In 2014 and 2015, respectively, 819 students (39%) were in Grade 7 and then Grade 8, 698 students (34%) were in Grade 8 and then Grade 9, and 562 students (27%) were in Grade 9 and then Grade 10. A total of 369 (18%) were of non-English speaking background. When asked if they had been formally diagnosed with a learning disability (viz., writing, reading, and/or math difficulty, and/or attention-deficit/hyperactivity disorder [ADHD]), a total of 115 (6%) identified at least one such disability. Based on students' home postcodes (converted to the Australian Bureau of Statistics relative disadvantage and advantage index), students (M = 1070) were slightly above the national average (M = 1,000) in socioeconomic status. The study received all appropriate ethics approval from the authors' institution.

Materials

All measures (including an achievement test) were administered via survey. All substantive factors (teacher–student relationships—and academic participation, enjoyment, aspirations), excluding achievement and sociodemographic and other background factors, were measured from 1 (*strongly disagree*) to 7 (*strongly agree*)—with a rating of 4 reflecting a neutral position on any given item. Engagement was assessed in 2014 (prior engagement) and 2015; all other measures in this study were administered in 2015. Descriptive statistics and reliabilities (coefficient omega) are reported with each measure below.

Ratio of negative to positive teacher–student relationships. In 2015, we asked students to rate the relationship with their teacher for each of three teacher–student relationship indicators (Martin & Dowson, 2009) described in the Introduction: interpersonal ("My teacher is interested in me and provides help when I need it"), substantive ("My teacher sets work that is not too easy, but not too hard"), and pedagogical ("My teacher explains things and tries to make things easy to understand"). Students rated these indicators for each of the following five subjects in which they were all enrolled: English, mathematics, science, history, and geography. For each of these five subjects, the three-item measure demonstrated sound reliability (ω = .86; .86; .86; .85; .85, respectively). Given these indicators have not previously been employed across numerous school subjects, we conducted a preliminary 5-factor confirmatory factor analysis (CFA; a three-item teacher–student relationship factor for each of the five subjects) to ascertain fit. An excellent fit to the data

[1] The schools included in the sample were part of a broader research program on students' academic development in high school and the present longitudinal data were partially shared with studies on growth goals (e.g., Burns et al., 2017), growth mindset (Bostwick, Collie, Martin, & Durksen, 2017), and attention-deficit/hyperactivity disorder (Martin et al., 2017).

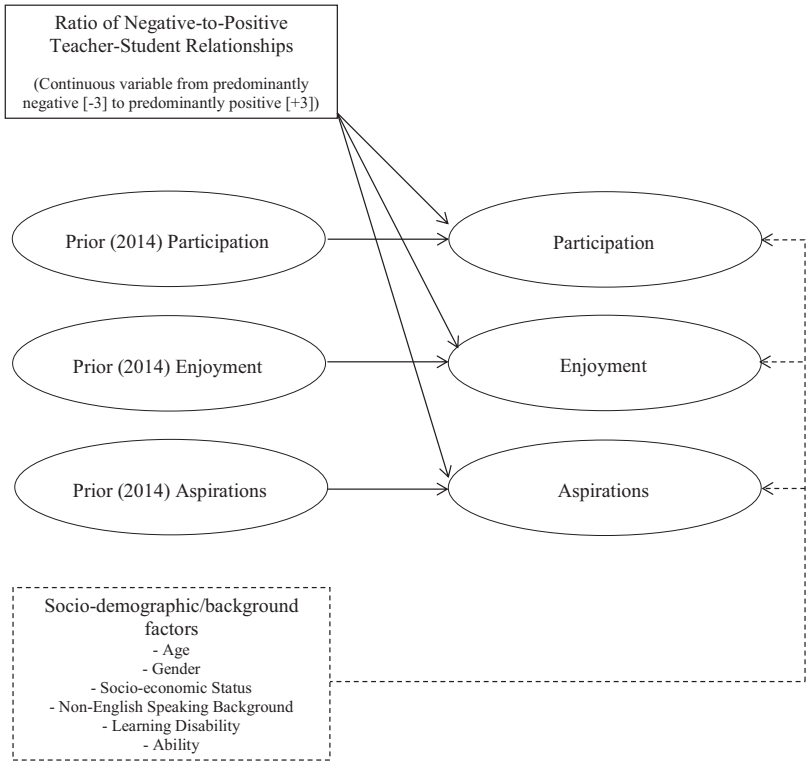

Figure 1. Hypothesized SEM, modeling the ratio of negative to positive teacher–student relationships as a continuous variable (scored from predominantly negative to predominantly positive).

was obtained, $\chi^2 = 116$, $df = 50$, $p < .001$, root mean square error of approximation (RMSEA) = .025, 95% confidence interval (CI) [.019, .013], comparative fit index (CFI) = .991. In the Data Analysis section, we describe the precise means by which we operationalized these items in analyses.

School engagement. We followed the tripartite engagement framework of Fredricks et al. (2004), comprising behavioral, emotional, and cognitive engagement. Because our study sought to assess teacher–student relationships across a breadth of school subjects (as a means of quantifying teacher–student relationships across school), we opted to assess school engagement as a domain-general measure (i.e., items asking about school and schoolwork in general). As we explain in the Data Analysis section, we modeled both prior engagement (in 2014; Time 1) and engagement (in 2015; Time 2). Behavioral engagement was represented by academic participation (four items; e.g., "I participate in activities and discussions"; Time 1 $M = 5.63$, $SD = 1.11$, $\omega = .92$; Time 2 $M = 5.49$, $SD = 1.15$, $\omega = .93$). Emotional engagement was represented by enjoyment of school (four items; e.g., "I enjoy school"; Time 1 $M = 5.75$, $SD = 1.22$, $\omega = .92$; Time 2 $M = 5.55$, $SD = 1.30$, $\omega = .93$). Cognitive engagement was represented by educational aspirations (four items; e.g., "I want to continue with and complete school"; Time 1 $M = 6.02$, $SD = 0.98$, $\omega = .85$; Time 2 $M = 5.97$, $SD = 1.01$, $\omega = .87$).

Sociodemographic and other background factors. Alongside prior engagement, we also controlled for variance attributable to sociodemographic and other background factors, as follows: gender (0 = girls; 1 = boys), non-English speaking background status (0 = English speaking; 1 = non-English speaking), age (operationalized as a continuous variable), socioeconomic status (a continuous measure of Australian Bureau of Statistics relative disadvantage and advantage based on students' home postcode; a higher score represented higher SES), and learning disability (0 = no formal diagnosis of reading, writing, mathematics, or ADHD difficulties; 1 = formal diagnosis of at least one of these difficulties). We also included ability as a covariate. Ability was assessed via a 10-item numeracy test and a 10-item literacy test in the survey. The literacy test is a brief adaptation of one validated by Green et al. (2012), and the mathematics test is a subset of a longer form validated by Martin, Anderson, Bobis, Way, and Vellar (2012). A single factor resulting from the combined tests was used to measure general ability. The reliability and validity of the tests, as well as their capacity to differentiate across grade levels has been demonstrated in recent work (Tarbetsky, Collie, & Martin, 2016), as has the use of the aggregate factor (Burns et al., 2017). For the current investigation, coefficient omega was .75. Taken together, controlling for these sociodemographic and other background factors, enabled us to partial out their variance, and thus better ascertain the unique role of teacher–student relationships in students' school engagement.

Data Analysis

Operationalizing the ratio of negative to positive teacher–student relationships in analyses. A key component of our study was how we operationalized the ratio of negative to positive teacher–student relationships. Earlier we described the teacher–student relationship items and here we describe the procedure for

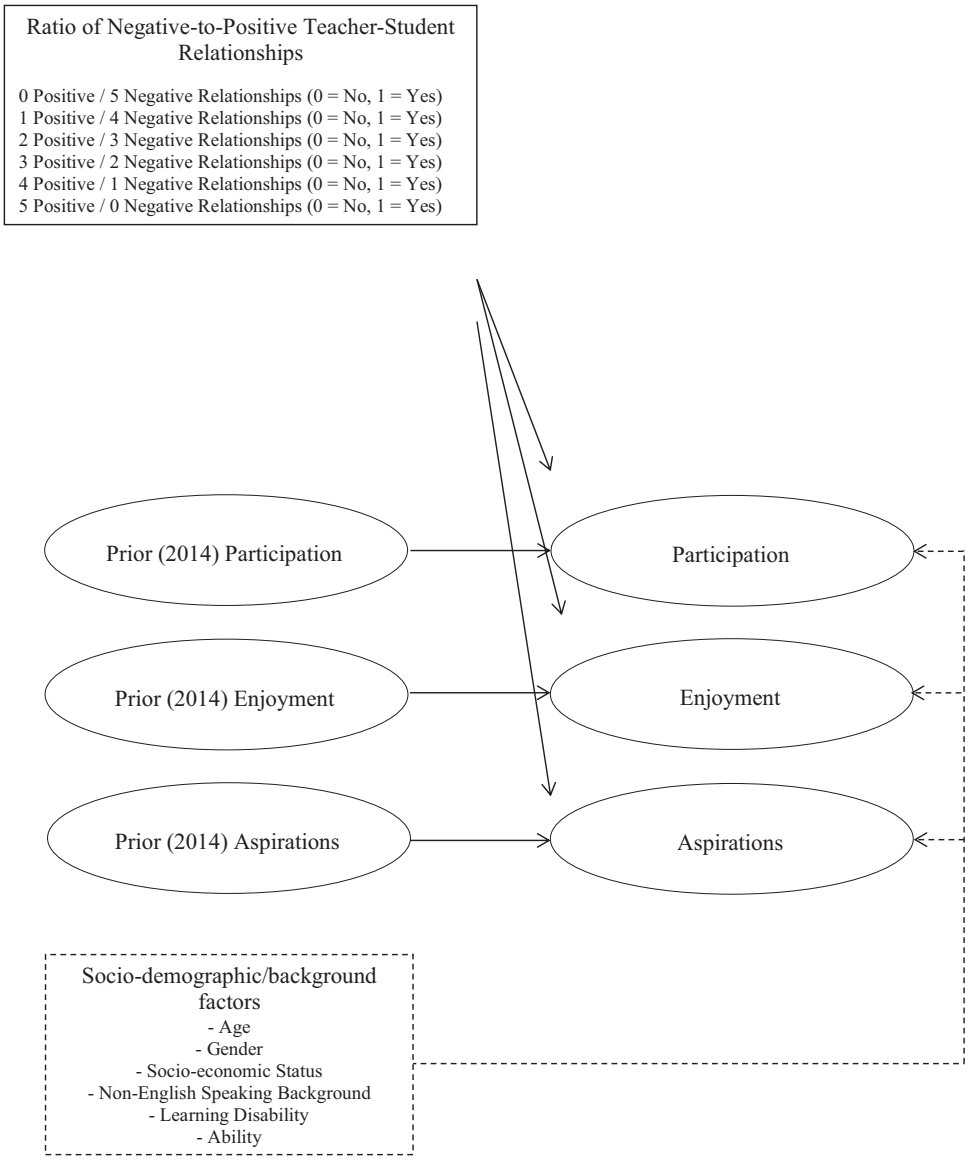

Figure 2. Hypothesized SEM, modeling the ratio of negative to positive teacher–student relationships as a set of dummy variables (Note: although included as a response option in the Figure, it should be noted that 5 Negative/0 Positive was the omitted Reference Category in data analysis).

operationalizing them in our analyses. For each of the five subjects in which students rated their relationship with teacher, scale scores (the mean of the three items for each subject) were calculated. Then, for each subject, students were categorized as scoring *below* the "neutral" score of 4 (reflecting a *negative* relationship) or *above* the "neutral" score of 4 (reflecting a *positive* relationship[2]). This allowed us to generate a series of teacher–student relationship ratios, as follows: 0:5 positive-to-negative teacher–student relationship ratings, 1:4 positive-to-negative, 2:3 positive-to-negative, 3:2 positive-to-negative, 4:1 positive-to-negative, and 5:0 positive-to-negative teacher–student relationship ratings. As a context for interpreting findings, Table 1 shows the relative distribution of students (and sociodemographic and ability groups) in each teacher–student ratio group.

There were two reasons why we adopted this approach to operationalizing teacher–student relationships, and not for example, quantifying students in a way to tap into more extreme disagreement (a rating of 1 *strongly disagree*) or agreement (a rating of 7 *strongly agree*). First, the bulk of existing research into teacher–student relationships is based on analyses that utilize these rating scales that have allowed researchers to tap into ratings that are

[2] For the purposes of this study, we were interested in the role of the ratio of negative to positive teacher–student relationships in school engagement. Thus, for clarity as relevant to this research study, we removed 237 students who rated any one of their teacher–student relationships in any of the five subjects as "neutral." This meant that the original sample of 2,316 students was reduced to the 2,079 students reported in this study.

Table 1
Sample Descriptive Statistics for Each Teacher–Student Ratio Group

Ratio	Sample descriptives
0:5 Positive-to-negative relationships (n = 10)	FM = 40%; NESB = 30%; disability = 20%; M_{age} = 14.70; M_{SES} = 1,095; $M_{achievement}$(z score) = −1.40
1:4 Positive-to-negative relationships (n = 9)	FM = 67%; NESB = 22%; disability = 22%; M_{age} = 14.56; M_{SES} = 1,065; $M_{achievement}$(z score) = −.08
2:3 Positive-to-negative relationships (n = 39)	FM = 59%; NESB = 21%; disability = 3%; M_{age} = 14.46; M_{SES} = 1,055; $M_{achievement}$(z score) = −.33
3:2 Positive-to-negative relationships (n = 107)	FM = 54%; NESB = 14%; disability = 10%; M_{age} = 14.58; M_{SES} = 1,057; $M_{achievement}$(z score) = −.27
4:1 Positive-to-negative relationships (n = 327)	FM = 50%; NESB = 13%; disability = 5%; M_{age} = 14.50; M_{SES} = 1,084; $M_{achievement}$(z score) = .02
5:0 Positive-to-negative relationships (n = 1,587)	FM = 53%; NESB = 19%; disability = 5%; M_{age} = 14.38; M_{SES} = 1,067; $M_{achievement}$(z score) = .10

Note. FM = females; NESB = non-English-speaking background; SES = socioeconomic status.

more extreme at either end of the disagreement-agreement continuum. There is thus a large body of work already reporting on this approach. We adopted the novel approach of tapping into extremes in another way; that is, extremes in terms of the sum of positive and negative relationships. Developing a sum of this nature led us to count ratings of agreement (i.e., ratings above the neutral point) and to count ratings of disagreement (i.e., ratings below the neutral point). Thus, while truncating information in one way, we were able to unpack information in another way. Second, research suggests that there can be differences between respondents in terms of how they perceive specific points on a rating scale above or below a midpoint, with some respondents more (or less) inclined to endorse extremes (or values closer to a midpoint) than others. Normally this is not an issue in parametric data analysis, because researchers tend to treat these rating scales in terms of an underlying latent construct of disagreement through to agreement (particularly when seven or more categories are available and there is a sufficiently large sample as was the case in our study; Dolan, 1994; see also Norman, 2010). However, in our study, taking specific levels of disagreement or agreement too literally may introduce idiosyncrasies that are not central to the substantive purpose. We therefore dealt with potential such differences between respondents in our operationalization of teacher–student relationships by focusing on any occurrence of agreement and disagreement and counting sums of these occurrences.

In fact, when students were each coded 0 = no and 1 = yes for each of these ratios, these ratios represented a set of dummy variables we would subsequently use in analyses to understand the role of different ratios in predicting school engagement. Using these dummy variables, we were also able to generate a single continuous variable that represented the number of negative and positive teacher–student relationships, as follows: 0:5 positive-to-negative (−3), 1:4 positive-to-negative (−2), 2:3 positive-to-negative (−1), 3:2 positive-to-negative (1), 4:1 positive-to-negative (2), and 5:0 positive-to-negative teacher–student relationships (3). Thus, the study employed two variables representing the ratio of negative to positive teacher student relationships: a single continuous score (see Figure 1) and a set of dummy variables (see Figure 2). Together, these two complementary approaches to operationalizing teacher–student relationships allowed us to answer unique research questions relevant to the substantive issues. Specifically, the continuous score allowed modeling of both linear and curvilinear effects and the dummy variables allowed us to inspect each specific relational balance. Together, they provided new insights into how teacher–student relationships are implicated in students' engagement.

Approaches to analyzing the hypothesized processes. CFA and SEM performed with M*plus* Version 7.31 (Muthén & Muthén, 2015) were the main analyses conducted in this study to assess the hypothesized processes. In the CFA, 13 first-order factors were hypothesized—three prior (2014) school engagement factors, three subsequent (2015) school engagement factors, the ratio of negative to positive teacher–student relationships, five sociodemographic and background factors, and ability. All multi-item scales were estimated as latent factors and single-item measures were estimated as "observed" variables with the loading fixed to unit value and the uniqueness fixed to zero.

Having ascertained measurement properties and bivariate correlations (both derived from the CFA), SEM was conducted to test the relative salience of the ratio of negative to positive teacher–student relationships in predicting school engagement, with appropriate controls for prior school engagement, sociodemographic and background factors, and ability. To gain a sense of the relative contribution of different factors, SEM was conducted in three (hierarchical) steps: Step 1 entered prior school engagement (2014; Time 1) as a predictor of subsequent 2015 (Time 2) school engagement (to better ascertain the unique role of teacher–student relationships on subsequent engagement at Time 2 beyond the role of prior engagement at Time 1); Step 2 added sociodemographic, other background, and ability factors as predictors of 2015 school engagement; and Step 3 added the ratio of negative to positive teacher–student relationships as a predictor of 2015 school engagement. The three engagement factors were included alongside each

other (and correlated) as dependent variables in each step. Two sets of hierarchical SEMs were conducted. The first SEM (see Figure 1) examined the role of the negative to positive teacher–student relationship ratio as a single continuous measure (i.e., a continuous scale from predominantly negative relationships through to predominantly positive relationships; see the Materials section for further description). To gain a more fine-grained sense of different ratios, the second SEM (see Figure 2) examined the set of dummy variables that each represented a different mix of negative to positive relationships: from five negative and zero positive teacher–student relationships through to zero negative and five positive teacher–student relationships (see the Materials section for further description).

To test for significant differences between predictive parameters for each dummy variable, we converted β values to *r* values using Peterson and Brown's (2005) guidelines and then used Steiger's (1980) method to compare these *r* values. Given numerous comparisons were conducted here, we implemented a Bonferroni correction such that the revised *p* value was .004. In further analyses, we also investigated whether the predictive role of negative to positive teacher–student relationship ratios were moderated by any of the sociodemographic and other background factors. To test this, we conducted multigroup SEMs where we examined if the beta parameters significantly varied as a function of gender, age, language background, disability status, ability, and SES. Here, we first estimated a model where betas were freely estimated. We then estimated a model where we constrained the betas to be fixed across moderator subgroups (e.g., across girls and boys). Invariance (generalizability) was concluded if there was no greater change of .01 in CFI (Cheung & Rensvold, 2002) and .015 in RMSEA (Chen, 2007) between freely estimated and constrained models.

For CFAs and SEMs, missing data (3.82% of the dataset) were dealt with using the M*plus* full information maximum likelihood defaults (Enders, 2013; Muthén & Muthén, 2015). We did not have a sufficient number of schools to conduct multilevel modeling (Raudenbush & Liu, 2000), however, to account for the fact that students were clustered within schools, we adjusted standard errors using the "cluster" and "complex" commands in M*plus*. Maximum likelihood with robustness to nonnormality was the method of estimation used for CFA and SEM. In evaluating goodness of fit, RMSEA and CFI are emphasized. For RMSEAs, values at or less than .08 and .05 were taken to reflect an acceptably close fit and an excellent fit respectively (see Schumacker & Lomax, 2004). The CFI varies along a 0-to-1 continuum in which values at or greater than .90 and .95 were typically taken to reflect acceptable and excellent fits to the data, respectively (McDonald & Marsh, 1990).

Results

Confirmatory Factor Analysis and Correlations

CFA for the full set of variables in the model reflected acceptable fit to the data, $\chi^2 = 1944$, $df = 392$, $p < .001$, RMSEA = .044 (95% CI [.042, .046]), CFI = .940. CFA correlations are reported in Table 2. For brevity, only relationships statistically significant at $p < .001$ are reported here—all others are in Table 2. Not surprisingly, prior engagement (2014; Time 1, T1) was the strongest correlate with subsequent engagement (2015; Time 2, T2): T1–T2 participation, $r = .57$, $p < .001$; T1–T2 enjoyment, $r = .56$, $p < .001$; T1–T2 aspirations, $r = .57$, $p < .001$. Age was negatively correlated with participation, $r = -.12$, $p < .001$, enjoyment, $r = -.13$, $p < .001$, and aspirations, $r = -.13$, $p < .001$, with younger students scoring higher on all three engagement factors. Ability was positively correlated with participation, $r = .29$, $p < .001$, enjoyment, $r = .26$, $p < .001$, and aspirations, $r = .47$, $p < .001$, with students higher in ability scoring higher on all three engagement factors. Learning disability was negatively correlated with aspirations, $r = -.11$, $p < .001$, such that students with learning disabilities scored lower on aspirations. Finally—and of central relevance to this study's substantive concerns—the ratio of negative to positive teacher–student relationships (as a continuous variable) was positively correlated with participation, $r = .24$, $p < .001$, enjoyment, $r = .30$, $p < .001$, and aspirations, $r = .30$, $p < .001$, with a preponderance of positive (over negative) relationships associated with higher scores on all three engagement factors.

SEM Predicting School Engagement

Using SEM, we then explored the ratio of negative to positive teacher–student relationships (as a continuous variable—see Figure 1) in predicting school engagement, controlling for prior engagement and relevant sociodemographic and other background factors. SEMs were conducted in three steps, with Step 1 entering

Table 2
Latent Correlations From Confirmatory Factor Analysis

Predictor variables	Participation	Enjoyment	Aspirations
Prior engagement	.57***	.56***	.57***
Sociodemographic/background factors			
Gender (male)	−.01	.03	−.09
Age	−.12***	−.13***	−.13***
Socioeconomic status	.10**	.15**	.11*
Non-English-speaking background (yes)	−.01	.01	.04
Ability	.29***	.26***	.47***
Learning disability (yes)	−.07**	−.05	−.11***
Teacher–student relationship ratio			
Negative-to-positive	.24***	.30***	.30***

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

prior (2014) engagement as a predictor of subsequent (2015) engagement, Step 2 adding sociodemographic and other background factors (age, gender, SES, language background, disability status, ability) to this, and Step 3 adding the ratio of negative to positive teacher–student relationships as a predictor of engagement beyond prior engagement and sociodemographic and other background factors.

At each step, this model provided an acceptable fit to the data: Step 1 $\chi^2 = 1{,}430\ (243)$, $p < .001$, RMSEA = .049 (95% CI [.046, .051]), CFI = .947; Step 2 $\chi^2 = 1{,}909\ (379)$, $p < .001$, RMSEA = .044 (95% CI [.042, .046]), CFI = .940; Step 3 $\chi^2 = 1{,}950\ (398)$, $p < .001$, RMSEA = .043 (95% CI [.041, .045]), CFI = .940. Table 3 shows detailed results for each step. Our focus was on Step 3 and the role of the ratio of negative to positive teacher–student relationships in predicting engagement. After controlling for prior engagement and all sociodemographic and other background factors, the ratio of negative to positive teacher–student relationships was statistically significant for participation ($\beta = .13$, $p < .001$), enjoyment ($\beta = .16$, $p < .001$), and aspirations ($\beta = .14$, $p < .001$). For each engagement factor, as the balance of relational quality shifted from negative to positive (i.e., more positive relationships than negative relationships), there was a positive shift in participation, enjoyment, and aspirations.

Multigroup Invariance: Moderator Findings

We then sought to determine whether the predictive role of negative to positive teacher–student relationship ratio (as a continuous variable) was moderated by any of the sociodemographic and other background factors. We conducted multigroup SEMs where we examined if the beta parameters significantly varied as a function of gender, age, language background, disability status, ability, and SES. We first estimated a model where betas were freely estimated. We then estimated a model where we constrained the betas to be fixed across moderator subgroups (e.g., across girls and boys). Table 4 shows findings. As is evident, there was no significant change in CFI (Cheung & Rensvold, 2002) or RMSEA (Chen, 2007) between freely estimated and constrained models. The role of teacher–student relationship ratio thus appeared to generalize across gender, age, language background, disability status, ability, and SES.

Table 4
Multigroup Invariance Tests for the Role of Teacher–Student Relationships

Invariance groupings	$\chi^2(df)$	RMSEA	CFI
Gender (females; males)			
β freed	2,615 (777)	.048	.938
β fixed	2,640 (798)	.047	.938
Age (≤13 years; ≥14 years)			
β freed	2,560 (777)	.047	.935
β fixed	2,609 (798)	.047	.934
Non-English-speaking background (no; yes)			
β freed	2,611 (777)	.048	.935
β fixed	2,639 (798)	.047	.934
Learning disability (no; yes)			
β freed	2,798 (777)	.050	.933
β fixed	2,831 (798)	.050	.932
Ability (≤*M*; >*M*)			
β freed	2,269 (720)	.046	.938
β fixed	2,301 (741)	.046	.937
Socioeconomic status (≤*M*; >*M*)			
β freed	2,613 (777)	.048	.936
β fixed	2,645 (798)	.047	.936

Note. RMSEA = root mean square error of approximation; CFI = comparative fit index.

SEM Predicting Engagement: Dummy Coding Ratios

We then explored for a more specific sense of teacher–student relationships by modeling a set of dummy variables that each represented shifts in the ratio of negative to positive teacher–student relationships, as follows: 0:5 positive-to-negative teacher–student relationships, 1:4 positive-to-negative, 2:3 positive-to-negative, 3:2 positive-to-negative, 4:1 positive-to-negative, and 5:0 positive-to-negative teacher–student relationships. We designated the first category (zero positive and five negative) as the (omitted) reference category. Because Step 1 and 2 of the SEM are

Table 3
Ratio of Positive-to-Negative Teacher–Student Relationships Predicting Engagement (as a Continuous Variable, Scored From Predominantly Negative to Predominantly Positive)

Predictor variables	Participation			Enjoyment			Aspirations		
	Step 1 β	Step 2 β	Step 3 β	Step 1 β	Step 2 β	Step 3 β	Step 1 β	Step 2 β	Step 3 β
Step 1: Prior engagement	.59***	.55***	.54***	.56***	.53***	.50***	.57***	.49***	.47***
Step 2: Current sociodemographic/background factors									
Gender (male)		.01	.01		.03	.02		−.02	−.03
Age		−.04	−.03		−.04	−.03		−.05	−.05
Socioeconomic status		.01	.03		.05	.06*		.01	.02
Non-English-speaking background (yes)	.01	.01		.03	.03		.01	.01	
Ability		.18***	.15***		.10**	.07*		.26***	.23***
Learning disability (yes)		.02	.02		.01	.01		.03	.03
Step 3: Teacher–student relationship									
Negative-to-Positive R'ship Ratio			.13***			.16***			.14**

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

the same as those conducted in the previous SEM (see Table 3), we moved immediately to Step 3 in which prior engagement, sociodemographic and other background factors (age, gender, SES, language background, disability status, ability), and the dummy variables were modeled as predictors of subsequent engagement. Figure 2 shows key parameters that were estimated in this SEM.

This model provided an acceptable fit to the data, $\chi^2 = 2{,}047$ (474), $p < .001$, RMSEA = .040 (95% CI [.038, .042]), CFI = .946. Table 5 shows details. As is demonstrated, for each engagement factor, there were increasingly positive findings as the number of positive relationships increasingly exceeded the number of negative relationships. For participation, there were positive predictive findings for a 3:2 positive-to-negative relationship ratio ($\beta = .11$, $p < .05$), a 4:1 positive-to-negative relationship ratio ($\beta = .16$, $p < .01$), and a 5:0 positive-to-negative relationship ratio ($\beta = .26$, $p < .001$). For enjoyment, there were positive predictive findings for a 3:2 positive-to-negative relationship ratio ($\beta = .08$, $p < .05$), a 4:1 positive-to-negative relationship ratio ($\beta = .21$, $p < .01$), and a 5:0 positive-to-negative relationship ratio ($\beta = .35$, $p < .001$). For aspirations, there were positive predictive findings for a 4:1 positive-to-negative relationship ratio ($\beta = .22$, $p < .05$) and a 5:0 positive-to-negative relationship ratio ($\beta = .32$, $p < .01$).

Notably, Table 5 also suggests a consistent level of equivocal (and relatively lower) engagement as the number of negative relationships exceeded the number of positive relationships—with these equivocal engagement findings remaining generally steady regardless of how many negative relationships outnumbered the positive relationships (i.e., engagement was lower, but did not appear to further decline with an increasing number of negative teacher–student relationships).

Exploring Curvilinear Relationships

With the aforementioned consistent level of equivocal (and relatively lower) engagement that then gave way to positive engagement once there was a preponderance of positive teacher–student relationships, we explored the potential for curvilinear relationships. The equivocal and then rising nature of school engagement suggested one predominant inflection point and thus a quadratic relationship (indeed, Kline, 2015, observes that for psychobehavioral data it is rarely necessary to estimate more complex patterns). In a first step we plotted linear and quadratic associations of the ratio of negative to positive teacher–student relationships (as a continuous variable) on each of the three engagement factors using the curve estimation function in SPSS for Windows. These relationships are shown in Figures 3a, 3b, and 3c. Linear and quadratic models were statistically significant: participation, $F(1, 2038) = 100.51$, $p < .001$ (linear), $F(2, 2037) = 50.31$, $p < .001$ (quadratic); enjoyment, $F(1, 2038) = 190.72$, $p < .001$ (linear), $F(2, 2037) = 101.87$, $p < .001$ (quadratic); and, aspirations, $F(1, 2038) = 173.01$, $p < .001$ (linear), $F(2, 2037) = 88.27$, $p < .001$ (quadratic).

In a second step, to more precisely determine where nonlinear findings resided, we returned to the findings in Table 5 for each of the dummy variables. Here, we tested for significant differences between each ratio parameter. We did so by converting β values to *r* values using Peterson and Brown's (2005) guidelines and then tested for statistically significant differences with these converted parameters using Steiger's (1980) method. Given numerous comparisons were conducted, we implemented a Bonferroni correction such that the revised *p* value was .004. When comparing the results of the different ratios, we found the strongest associations (at $p < .001$) once there was a preponderance of positive-to-negative relationships: there was a significant increase in engagement as the ratio moved from 3:2 positive-to-negative to 4:1 positive-to-negative relationship ratio (enjoyment, $z = 4.07$, $p < .001$; aspirations, $z = 4.70$, $p < .001$) and a further increase in engagement as the ratio moved from 4:1 positive-to-negative to 5:0 positive-to-negative relationship ratio (participation, $z = 3.29$, $p < .001$; enjoyment, $z = 4.75$, $p < .001$; aspirations, $z = 3.37$, $p < .001$). In line with the curvilinear findings, there was a more equivocal pattern of results for predominantly negative teacher–student relationships such that there were no shifts in findings at $p < .001$, and only one at the adjusted *p* value of .004 (2:3 positive-to-negative to 3:2 positive-to-negative relationship ratio for participation, $z = 3.19$, $p < .01$).

Table 5
Ratio of Positive-to-Negative Teacher–Student Relationships Predicting Engagement (Using a Set of Dummy Variables to Represent Specific Teacher–Student Relationship Ratios)

Predictor variables	Participation β	Enjoyment β	Aspirations β
Prior engagement	.54***	.50***	.47***
Gender (male)	.01	.02	−.03
Age	−.03	−.03	−.04
Socioeconomic status	.03	.06*	.02
Non-English-speaking background (yes)	.01	.03	.01
Ability	.15***	.08*	.23***
Learning disability (yes)	.02	.01	.03
1:4 Positive-to-negative relationships	−.05	−.03	−.01
2:3 Positive-to-negative relationships	.01	.05	.04
3:2 Positive-to-negative relationships	.11*	.08*	.07
4:1 Positive-to-negative relationships	.16**	.21**	.22*
5:0 Positive-to-negative relationships	.26***	.35***	.32**

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

Domain-General Versus Domain-Specific Approaches to Analyzing Relational Data

These analyses operationalized teacher–student relationships in a domain-specific way (viz., modeling such that teacher–student relationships in each subject were distinctly accounted for—e.g., through dummy coding). For completeness, we reran the Table 5 analysis using a domain-general teacher–student relationship factor where all teacher–student relationship items were used as indicators to estimate a global (overarching) domain-general relational factor (rather than the domain-specific dummy coded variables that sought to disentangle the cumulative effects). Following a long line of prior research (see Introduction for a summary), this overarching teacher–student relationship factor did indeed significantly predict participation (β = .22), enjoyment (β = .26), and aspirations (β = .25). Importantly, however, the way our study operationalized teacher–student relationships allowed us to show

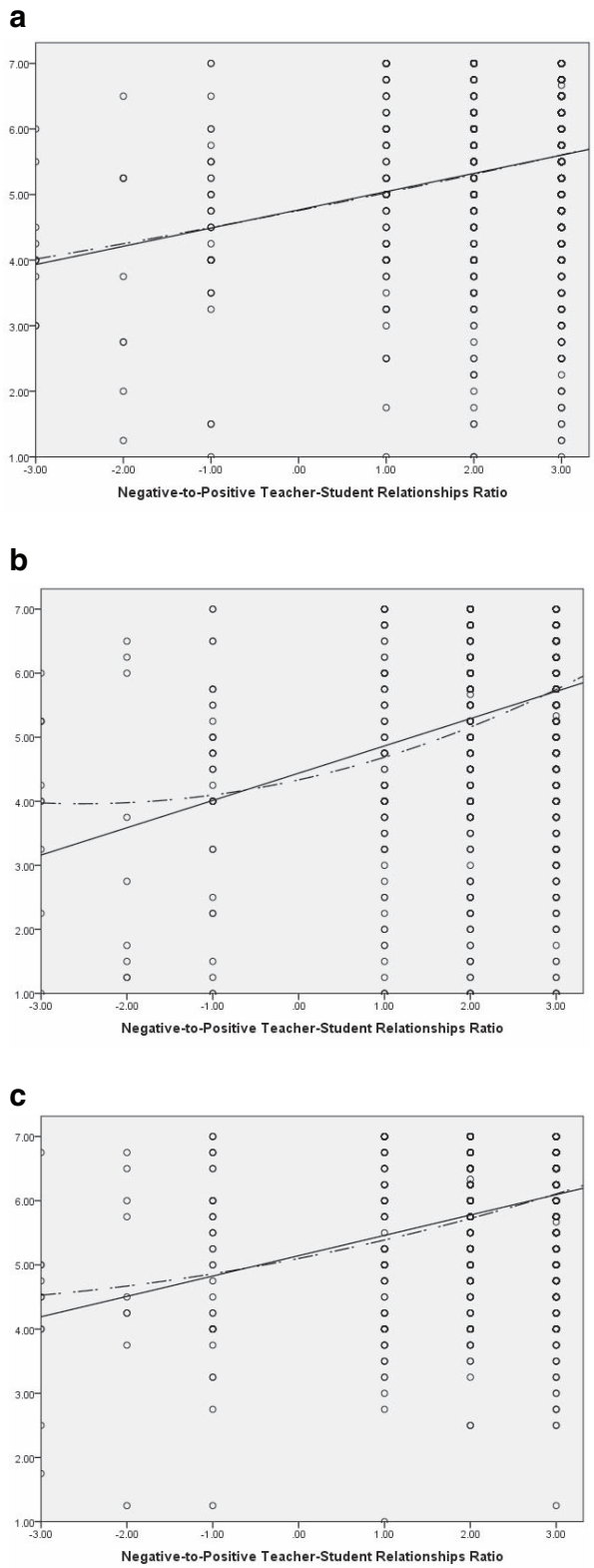

Figure 3. a. Teacher–student relationship ratio (X axis) predicting participation (Y axis). b. Teacher–student relationship ratio (X axis) predicting enjoyment (Y axis). c. Teacher–student relationship ratio (X axis) predicting aspirations (Y axis).

that adopting a domain-general approach may mask important nuances within the teacher–student relationship phenomenon. For example, Table 5 shows that having 5 positive and zero negative relationships with teachers predicted engagement more strongly than the domain-general relationship factor did: participation ($\beta = .26$), enjoyment ($\beta = .35$), and aspirations ($\beta = .32$). Conversely, having 1:4 positive-to-negative relationships with teachers barely predicted engagement: participation ($\beta = -.05$), enjoyment ($\beta = -.03$), and aspirations ($\beta = -.01$). Interestingly also, better model fit was derived from the domain-specific cumulative approach in Table 5 (CFI = .946, RMSEA = .040, 95% CI [.038, .042]) than the overarching domain-general approach (CFI = .933, RMSEA = .040, 95% CI [.039, .042]). Thus, the cumulative approach to analyzing relational data has identified nuances and provided insights into the role of teacher–student relationships not possible through overarching domain-general relational approaches.

Discussion

Findings of Note

This study extended prior research into teacher–student relationships by exploring the balance of negative and positive teacher–student relationships in high school students' academic lives (in each of English, mathematics, science, history, and geography subjects)—and the role of this balance in predicting students' school engagement (operationalized by academic participation, enjoyment, and aspirations). Results showed a significant linear (main) association, with an increase in the number of positive relationships with teachers predicting greater school engagement. This was accompanied by a significant curvilinear effect such that (a) when the relational balance became predominantly negative (i.e., 3:2 negative-to-positive teacher–student relationships), students' engagement was lower, but did not decline with an increasing number of negative teacher–student relationships, and (b) when the relational balance became predominantly positive (i.e., 2:3 negative-to-positive teacher–student relationships), students' engagement was higher and became increasingly more so as the number of positive teacher–student relationships outnumbered the negative. Finally, subsequent domain-general and domain-specific analyses revealed that our cumulative domain-specific approach identified a way of operationalizing and analyzing relational data that unearthed relational insights that might be masked by more domain-general approaches.

We conclude that the enhancing properties of positive teacher–student relationships seem to outweigh the limiting properties of negative teacher–student relationships. We also conclude that there is significant and cumulative yield in striving to increase the number of positive teacher–student relationships across the range of school subjects in students' academic lives. We also observe that although students' negative engagement did not increase with an increasing preponderance of negative teacher–student relationships, it was evident as soon as the negative relationships outnumbered the positive relationships. Thus, students' engagement seemed immediately sensitive to a shift in the relational balance from positive to negative.

Implications for Relational Research

As noted earlier, much previous research has operationalized teacher–student relationships through students rating a teacher in a specific class (domain-specific; e.g., "In this class, my teacher . . .") or rating their teachers at school more generally (domain-general; e.g., "My teachers . . ."). Far less research has assessed the number of negative and positive teacher–student relationships in a student's academic life. Thus, our findings are unique in that they offer a different perspective on cumulative relational associations across multiple teachers at a given point in time (not one relational dynamic over time). In so doing, the findings have lent further weight to the viability of cumulative approaches to relational research. They have also identified potentially fruitful new directions for cumulative relational research. Specifically, we demonstrated the yield of (a) asking students to rate their relationship with teachers across a diversity of school subjects, (b) establishing relational variables that indicate the relative balance of negative to positive teacher–student relationships, and (c) analytically assessing for linear and curvilinear associations of this balance. This approach might be used to assess for linear and curvilinear associations of teacher–student relationships with other academic outcomes in future research.

Alongside methodology we have implemented here, it is worth noting related approaches that can provide other nuanced insights into relational processes in the classroom. For example, whereas we assessed students' reports of teacher–student relationships, Hughes (2011) assessed both student and teacher reports, finding that each predicted different outcomes. Of relevance to engagement factors in our study, Hughes (2011) found student reports predicted school belonging (perhaps an indicator of emotional engagement) and teacher reports predicted students' behavioral engagement. Our study found student reports predicted both these engagement factors, but it would be useful to include teacher reports in future modeling to see the unique role of each respondent's reports. Also in other research (Wu, Hughes, & Kwok, 2010), it was evident that whether there was consistency in child versus other reports had implications for the role of engagement. In a study also accounting for parents, Hughes and Kwok (2007) found that teacher–parent relationships impacted students' engagement; specifically, by mediating the relationship between students' background attributes and their engagement. Collecting teacher and parent data might add to what has been found in our study.

Implications for Relational and Engagement Conceptualizing

When considering the main effect of the ratio of negative to positive teacher–student relationships (as a continuous variable), findings aligned with a vast body of prior research and theory; namely, that students are more academically engaged when they are positively connected with their teachers (Furrer & Skinner, 2003; Furrer et al., 2014; Martin & Dowson, 2009; Wentzel, 2009). Importantly, however, the curvilinear associations suggest greater consideration of research and theory that explicitly recognize the enhancing and promotive role of positive dynamics, processes, and constructs. Specifically, because our findings showed qualitatively superior results when the balance of relationships became predominantly and increasingly positive, we suggest positive psychological perspectives may be helpful in psychoeducational theorizing in this space.

As noted in the Introduction, the broaden-and-build theory of positive emotions is one such perspective (Fredrickson, 2004). It posits that positive emotions and cognate processes broaden one's awareness and adaptive thought and action repertoire. Subsequently, this builds personal skills and resources. Moreover, the theory holds that the longer term effects (or the effects accumulated across different contexts—e.g., classrooms, as in the present study) of positive emotions and processes will tend to be salient over the narrowing effects of negative emotions and related processes (Fredrickson, 2001). This helps explain our findings to the extent that the increasingly positive role of a predominance of positive teacher–student relationships across classrooms expanded students' academic repertoire in the form of participation, enjoyment, and aspirations. On the other hand, however, we did not find the markedly negative role for negative teacher–student relationships that might be predicted by the theory. As described in the introduction, the theory argues for an immediate and salient negative effect based on the initial survival threat that negative emotions evoke. Although we found that a preponderance of negative teacher–student relationships was associated with lower engagement, this was not as salient or marked as the positive role for a preponderance of positive teacher–student relationships. Perhaps in a generally supportive environment such as school, negative relationships with teachers do not evoke survival threat. Or, because our sample had predominantly positive relationships with teachers (see Table 1), a marked and cumulative negative role for negative teacher–student relationships was less likely. Further research is warranted to disentangle what we found here.

The association between teacher–student relationships and students' engagement was similar for the three types of engagement (behavioral, emotional, and cognitive). This finding matches the conceptualization of Fredricks and McColskey (2012). Notwithstanding congruence across engagement factors, it was interesting to note some idiosyncrasies in the pattern of findings, particularly with regard to enjoyment. In this case, students' ability played a lesser role, while teacher–student relationships and SES played a relatively greater role. Ability and SES findings are discussed more fully below, however, it is illuminating to observe here that the more emotional engagement factor (enjoyment) is less related to students' cognitive attributes (viz., ability), whereas the more cognitive and behavioral engagement factors are more strongly explained by ability. Future framing of engagement that seeks to differentiate specific engagement dimensions might take these sorts of distinctions into account.

Implications for Relational Practice

Our findings showed that there is significant and cumulative yield in striving to increase the number of positive teacher–student relationships across the range of school subjects in students' academic lives. Findings demonstrated that each additional positive relationship with a teacher was associated with greater academic engagement by way of participation, enjoyment, and aspirations. Results also suggested that provided there is the presence of positive teacher–student relationships in a student's academic life, it seems that students may be able to tolerate some negative

relational dynamics with a teacher before it greatly shifts their engagement.

There are two levels at which to direct practical efforts: school-level and class-level. At the school-level it is important to ensure that across the range of school subjects there is a predominance of relational positivity between teachers and students. As relevant to this, there may be specific attention directed to teacher–student relationships in professional development and staff training at school. According to Spilt and colleagues (2012), training is one important means of helping teachers foster positive relationships among their students. At the school-level it might also be prudent to monitor the number and balance of negative and positive relationships in students' lives. This may require assessment of relational support in all or most of students' school subjects, and probably at least once each year.

At the class-level, "connective instruction"—the conceptualizing on which our teacher–student relationship items were based—has been identified as a framework for operationalizing positive teacher–student relationships (Martin & Dowson, 2009). Connective instruction comprises interpersonal, substantive, and pedagogical elements that collectively serve to promote quality relational links between teacher and student. Subsequent research (e.g., Martin & Collie, 2016) has identified numerous instructional strategies to promote these three dimensions of teacher–student relationships, including, for example, getting to know and affirming all students (for the interpersonal relationship), assigning work that is important, significant, and interesting (for the substantive relationship), and providing clear feedback to students focusing on how they can improve (for the pedagogical relationship).

With regards to educational practice, there is also the issue of timing. Student engagement tends to decline as students progress through school, with relatively larger declines occurring after the transition from elementary to middle school (Mahatma, Lohman, Matjasko, & Farb, 2012; Wigfield, Byrnes, & Eccles, 2006) and from the beginning to the end of the school year (Gehlbach et al., 2012; Opdenakker, Maulana, & den Brok, 2012). Importantly, however, positive teacher–student relationships can help offset and potentially reverse declines in students' engagement over the course of a school year (Gehlbach et al., 2012) and beyond. Also, when students have positive teacher–student relationships, this predicts greater engagement in subsequent grades in the first few years of schooling (Hughes, Luo, Kwok, & Loyd, 2008; Hughes, Wu, Kwok, Villarreal, & Johnson, 2012; O'Connor & McCartney, 2007) and during the transition to middle school (Ryan & Patrick, 2001; Wang & Holcombe, 2010). Taken together, then, it may be especially fruitful for a relatively greater practical focus on teacher–student relationships at key points of academic transition (e.g., from elementary to middle school) and at the start of academic years.

Although not the focus of the study, the findings for sociodemographic and other background factors also identify areas for practice. Findings showed that not only were these factors critical in better identifying unique variance attributable to teacher–student relationships (i.e., teacher–student relationship findings were purged of variance due to sociodemographic and other background factors), they were illuminating in their own right. For example, in Step 3 of Table 3, ability (prior literacy and numeracy) was a significant predictor of participation, enjoyment, and aspirations, and SES was a significant predictor of enjoyment. Three observations are made here. First, alongside attending to teacher–student relationships as a factor in promoting engagement, educators might also identify students with a history of poor literacy and numeracy, and seek to provide support for these as necessary. Thus, relational support would be accompanied by appropriate academic support for literacy and numeracy. Recent work that emphasizes explicit instruction to develop literacy and numeracy for struggling learners might be informative here (Martin, 2015, 2016). Second, it is interesting to observe that beyond the role of relational support, SES is a factor implicated in students' enjoyment of school, with students lower in relative SES not enjoying school as much as their higher SES peers. The reason for this is unclear, but researchers have identified the role of low SES in poorer educational outcomes (Sirin, 2005) and further work is needed to investigate this in the context of relational matters. In any case, schools might look to provide or assist with some of the educational resources low SES students can lack, such as an area for study, textbooks, computing resources, and so forth (Organisation for Economic Co-Operation and Development, 2010). Third, it is interesting to note that sociodemographic and other background factors were associated with engagement in bivariate correlations (see Table 2), yet after accounting for prior engagement and teacher–student relationships, very few remained significant in multivariate analyses (e.g., Table 3). Thus, at least for the present sample, intake and background characteristics of students are not as salient in their academic engagement as school-relevant attributes. For practitioners, then, there is significant scope for enhancing academic engagement beyond the sometimes immutable attributes of the student.

Limitations and Future Directions

There are some limitations in this study that are important to consider when interpreting findings and that provide some direction for future research. Although objective achievement data were used where necessary (e.g., to assess ability) and the focal constructs were all intrapsychic factors that justify self-report methodology (Brener, Billy, & Grady, 2003), there are some known limitations to self-report surveys (e.g., misinterpreting questions, under- or overreporting, etc.; Karabenick et al., 2007). Future work may look at gathering information from other sources, such as classroom observation and teacher reports. Also on the matter of data, although we included longitudinal data (prior engagement to control for subsequent engagement), future research might look at temporal shifts in the relative ratio of negative to positive teacher–student relationships. Further, because our study sought to assess teacher–student relationships across a breadth of school subjects, we opted to assess students' school engagement as a domain-general measure. Future research might look to assess engagement in each of the school subjects in which teacher–student relationships are assessed. It is also worth noting that the present study was conducted in five mandatory subjects that all junior high school students study. However, the full range of students' subjects was not audited (they typically study up to eight subjects in this investigation's educational jurisdictions). Indeed, it may be in some of their elective subjects (not assessed in this study) where there are more positive teacher–student relationships and/or more positive engagement. Nevertheless, Table 1 showed that even for the mandatory five subjects in our study there were more positive than negative teacher–student relationships (indeed, future re-

search is needed to examine the same models in contexts where there are more negative teacher–student relationships than what we had in our study). Finally, it is a reality that students are nested within teachers and that this has educational implications important to consider (e.g., Raudenbush & Liu, 2000). We did not know how students were clustered within each of the subjects assessed. Because of this, we could not conduct modeling for all five subjects in a way that took the nested data structure into account. Future research might look to do this.

Conclusion

The present study sought to extend prior engagement research into teacher–student relationships by exploring the relative balance of negative and positive teacher–student relationships in high school students' academic lives. The results showed that when students reported more positive relationships (relative to negative relationships), they tended to have greater school engagement. Notably, this was accompanied by a significant curvilinear relationship such that the enhancing properties of positive teacher–student relationships seemed to outweigh the limiting (or narrowing) properties of negative teacher–student relationships. Thus, there is cumulative yield in striving to increase the number of positive teacher–student relationships across the range of school subjects in students' academic lives. Findings hold implications for research, theory, and practice aimed at enhancing students' relationships with teachers and students' academic engagement through school.

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