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The role of affective teacher-student relationships in adolescents' school engagement and achievement trajectories

Maaike C. Engels [a,b,*], Jantine Spilt [c], Katrijn Denies [d], Karine Verschueren [c]

[a] Department of Sociology, University of Groningen, the Netherlands
[b] Interuniversity Center for Social Science Theory and Methodology (ICS), University of Groningen, the Netherlands
[c] School Psychology and Development in Context. Tiensestraat 102, Box 3717, 3000, Leuven, Belgium
[d] Educational Effectiveness and Evaluation, Dekenstraat 2, Box 3773, 3000, Leuven, Belgium

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ABSTRACT

This longitudinal study investigated the role of teacher-student closeness and conflict in adolescents' school engagement trajectories, and how school engagement dimensions predict achievement trajectories. A sample of 5,382 adolescents ($M_{age.wave1} = 13.06$, $SD = 0.51$; 49.6% boys) were followed from Grade 7 to 9. Yearly measures included student reports on school engagement dimensions, teacher reports on closeness and conflict, and standardized tests for math achievement. Latent growth models revealed that closeness positively and conflict negatively predicted students' school engagement. Furthermore, adolescents' behavioral and emotional engagement, and disaffection in particular, played an important role in predicting achievement within the same schoolyear. Moreover, increases in behavioral disaffection and emotional engagement aligned with reduced and steeper increases in achievement between Grade 7 and 9, respectively. In general, this study underscores the importance of adolescents' affective teacher-student relationships for their engagement in school, and the role of school engagement in predicting achievement.

1. Introduction

Affective teacher-student relationships have been found to promote students' engagement and achievement in school (Hamre & Pianta, 2001; Hughes, 2011; Roorda, Jak, Zee, Oort, & Koomen, 2017; Roorda, Koomen, Spilt, & Oort, 2011). However, relatively few empirical studies have examined trajectories of school engagement and achievement, while taking the role of affective teacher-student relationships into account (Hughes & Cao, 2018). This study addresses this gap by investigating (a) the role of teacher-student closeness and conflict as simultaneous precursors of adolescents' school engagement trajectories, and (b) whether school engagement trajectories predict the development of students' math achievement. It builds on prior research by taking a multidimensional perspective to school engagement by distinguishing between behavioral and emotional dimensions, as well as engagement and disaffection, and to teacher-student relationships by including both positive (i.e., closeness) and negative (i.e., conflict) dimensions. Furthermore, prior research in secondary school has predominantly used student perceptions on their relationship with teachers and teacher-assigned grades. Extending prior research by taking a different perspective, we used teacher reports on teacher-student relationships in secondary education to investigate their relation with student reported engagement and students' performance on a standardized achievement test. We examined these longitudinal associations during adolescence, which is an important developmental period characterized by many contextual changes and is a relatively understudied period in the field of affective teacher-student relationships.

1.1. Affective teacher-student relationships

Based on bio-ecological models, the development of students' engagement and academic achievement can be conceptualized as a function of the social environment (Bronfenbrenner & Morris, 2006). In the school environment, teachers are key in shaping students' engagement and achievement (Hughes & Cao, 2018; Roorda et al., 2017; Wang & Eccles, 2012b). According to an attachment-based approach to teacher-student relationships, teachers who create warm, safe, and supportive relationships with their students can serve as important non-parental attachment figures and role models (Bergin & Bergin, 2009). Students can use teachers as a safe haven from which they can

* Corresponding author. Grote Rozenstraat 19, 9712, TG, Groningen, the Netherlands.
E-mail address: M.C.Engels@rug.nl (M.C. Engels).

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explore the environment and engage in learning activities, and as a source of support in stressful situations. Closeness is conceptualized as the degree to which communication in the teacher-student relationship is open, warm, and harmonious (Verschueren & Koomen, 2012). These close and positive relationships contribute to students' academic outcomes (Engels, Phalet, Gremmen, Dijkstra, & Verschueren, 2020; Hughes & Cao, 2018; Roorda et al, 2011, 2017). For instance, sense of relatedness with teachers was associated with higher initial levels of students' engagement and lower initial levels of disaffection, which in turn predicted students' final GPA (King, 2015). More teacher support was also found to buffer against increases in disaffection amongst girls during the early years of secondary education (Burns, Bostwick, Collie, & Martin, 2019). However, when teacher-student relationships are characterized by conflicts and lack of security this could hamper students' engagement and achievement in school (Engels et al., 2016; Engels, Pakarinen, Lerkkanen, & Verschueren, 2019; Hughes & Cao, 2018; Roorda et al, 2011, 2017). Conflict is conceptualized as the degree to which the teacher-student relationship is characterized by negative and conflictual interactions (Verschueren & Koomen, 2012). Within an attachment perspective, dependency is the third affective relational aspect of the teacher-student relationship. Dependency refers to the overreliance of the students on the teacher and the degree to which the students shows clinginess and possessiveness in their relationship with the teacher (Pianta, 2001; Verschueren & Koomen, 2020). Yet, prior research has mainly focused on closeness and conflict, because of the weaker psychometric qualities of the dependency subscale (Koomen, Verschueren, van Schooten, Jak, & Pianta, 2012). For that reason, this study focused on closeness and conflict, and not dependency.

Despite the fact that teachers are important for students of all ages, most research on affective teacher-student relationships has been conducted in early or late childhood samples, or employed unidimensional approaches by focusing solely on the positive dimension or combining the positive and negative dimension in a single measure (Bergin & Bergin, 2009; Roorda et al., 2011; Verschueren & Koomen, 2012). Furthermore, research in secondary school has predominantly used student perceptions of teacher-student relationships. Building on previous research (Burns et al., 2019; King, 2015), this study uses teacher perceptions of the dyadic teacher-student relationship. According to the dyadic system perspective (Pianta, Hamre, & Stuhlman, 2003), not only student perceptions but also the perceptions of teachers on the teacher-student relation relationship matter for students' engagement and achievement in school. Both relationship partners contribute to the daily interactions between teachers and students, and thus, students' functioning in school. In addition, from a conceptual point of view, teacher' perceptions of the dyadic teacher-student relationship may impact the quality of instruction delivered, which in turn, could affect students' behavioral and emotional involvement in school and their academic achievement (e.g., Ang, 2005). By using teacher perceptions, this study provides a different perspective compared to other studies predominantly using student perceptions and allows us to investigate whether results from previous research are robust over teacher and student reports. Moreover, with three sources of information (i.e. student reports, teacher reports, and standardized tests), we are able to avoid any shared method variance that occurs when a single source of information is used.

In addition, prior research has been limited in comparing the relative impact of positive and negative relationship dimensions. By including both a positive (i.e., closeness) and a negative (i.e., conflict) aspect of teacher-student relationships simultaneously as precursors of students' school engagement and achievement, we are able to examine the relative impact of these aspects. To date, evidence about the relative impact remains inconclusive. On the one hand, previous research suggests that negative aspects of teacher-student relationships have more impact on students' academic outcomes than positive aspects (Baker, 2006; Hamre & Pianta, 2001; Ladd, Birch, & Buhs, 1999). Negative relationships with teachers in early grades may have cumulative adverse effects over time (Rubie-Davies et al., 2014; Spilt, Hughes, Wu, & Kwok, 2012). Thus, for secondary education, having negative relationships with teachers in the early years may set up patterns of interactions that continue (or worsen) as students progress through grade levels (Gregory & Korth, 2016; Roorda et al., 2017). On the other hand, in secondary school positive aspects of teacher-student relationships could be more important compared to negative aspects, as less contact moments and more distant relationships between teachers and students could make secondary school students more sensitive for the degree of warmth and support they receive from their teachers (Roorda et al, 2011, 2017).

1.2. School engagement

School engagement is the quality of students' involvement with the endeavor of schooling and is seen as a necessary condition for learning and achievement (Skinner, Furrer, Marchand, & Kindermann, 2008). The current study uses a motivational conceptualization on the development of (dis)engagement (Skinner & Pitzer, 2012), which postulates that engagement reflects the outward manifestation of motivation and that engagement is a antecedent of students' learning and achievement. Following Skinner et al. (2008), this study distinguishes between behavioral and emotional, as well as engagement and disaffection dimensions. Accordingly, behavioral engagement is defined in terms of students' action initiations, efforts, attention in class, and absorption of information, whereas emotional engagement refers to students' emotional status during learning activities, such as interest, enjoyment, and enthusiasm (Skinner et al., 2008). Disaffection, in contrast, does not only refer to the absence of engagement, but also to behaviors and emotions that reflect maladaptive motivational states. Consequently, behavioral disaffection is defined as students' withdrawal, distraction, unpreparedness, and passivity during learning activities, and emotional disaffection as students' boredom, anxiety, and frustration (Skinner et al., 2008). The concept of engagement is hindered by lack of consensus in the number of subtypes. Researchers agree, however, that engagement entails, at least, participatory behavior and some affective/emotional components, reflecting the core components of engagement (Reschly & Christenson, 2012). Similarly, as postulated by the motivational model of engagement, engagement reflects "goal-directed emotion-infused behaviors" (Skinner & Pitzer, 2012). However, other scholars add cognitive engagement as a third dimension (tripartite model of engagement) referring to, among others, goals orientations, perceived relevance, self-regulation, and strategy use. Given the disjointed literature on cognitive engagement and considering that behavioral and emotional engagement are key aspects in the motivational model of engagement, this study did not include cognitive dimensions of engagement.

Although research have consistently shown decreasing school engagement trajectories over time (Fredricks, Blumenfeld, & Paris, 2004), only recently studies discovered differences in trajectories between the distinct engagement dimensions (Engels, 2018; Wang, Chow, Hofkens, & Salmela-Aro, 2015). For instance, a recent study by Engels et al. (2017) showed a relatively steeper decline of behavioral engagement as compared to the decline in emotional engagement during secondary school. Moreover, whereas behavioral disaffection showed steep increases between Grade 7 and 11, emotional disaffection remained stable during these years. These findings were in line with other research (e.g., Wang & Eccles, 2012a) and highlight the need to differentiate between dimensions of engagement and disaffection, and their unique developmental trajectories. Also, they raise the question if different developmental patterns of school engagement dimensions relate differently to adolescents' academic achievement trajectories (Fredricks, Filsecker, & Lawson, 2016).

1.3. Academic achievement

Academic achievement refers to students' academic competencies

and is frequently measured using students' grade point averages or standardized test scores (Bates, Shifflet, & Lin, 2013). In this study, we used standardized test scores in math, as teacher-assigned grades are more subjective than standardized scores and can vary at the teacher and school level (Bates et al., 2013). Previous research has evidenced the importance of students' behavioral engagement for successful learning and achievement (e.g., Fredricks et al., 2004; Hughes, Luo, Kwok, & Loyd, 2008). Moreover, students with early problems with behavioral engagement could experience long-lasting effects on their achievement (Ladd & Dinella, 2009). Yet, high- and low-achieving students can display both high and low levels of behavioral engagement (i.e., task avoidance; Mägi et al., 2013), resulting in a modest association between behavioral engagement and achievement. In contrast to behavioral engagement, there are relatively few studies focusing on emotional engagement and achievement. Yet, investigating this relation provides insights into the extent to which students' emotional states during learning, such as their enthusiasm, enjoyment, and interest, play a role in their achievement. Moreover, examining associations of behavioral and emotional engagement with achievement provides insights in the possible differential effects of the different engagement dimensions, which could strengthen the multidimensional framework on engagement. To date, the available research on emotional engagement and achievement provided some indications that higher levels of emotional engagement (i.e., school identification, belonging and value) are related to better test scores (Voelkl, 1997; Wang & Holcombe, 2010).

Up till now, most of the research on engagement and achievement, however, has been cross-sectional in nature leaving questions about temporal relationships unanswered, or did not distinguish between the various dimensions of engagement and disaffection (see Roorda et al., 2017 for an overview). Thus, examining multiple dimensions of engagement in relation to students' achievement provides insights which and to what extent behavioral and emotional indicators predict achievement in school.

1.4. The current study

This study investigates (a) the role of teacher-student closeness and conflict in adolescents' school engagement trajectories, and (b) whether these school engagement trajectories predict the development of students' math achievement from Grade 7 to 9. We hypothesize that more closeness in the teacher-student relationship contributes to students' engagement in school, whereas more conflict hampers students' school engagement (Roorda et al, 2011, 2017). We explore whether positive or negative aspects are more important for students' engagement in school (Baker, 2006; Hamre & Pianta, 2001; Ladd et al., 1999; Roorda et al, 2011, 2017). Moreover, we expect decreasing trajectories of behavioral and emotional engagement, increasing trajectories of behavioral disaffection, and rather stable trajectories of emotional disaffection (Engels, 2018; Wang et al., 2015). Furthermore, we hypothesize that higher initial levels of behavioral and emotional engagement would be related to higher initial achievement levels, whereas higher initial levels of behavioral and emotional disaffection would be associated with lower initial achievement levels during secondary education (Hughes et al., 2008; Wang & Holcombe, 2010). Similarly, we expect that changes in students' school engagement would predict changes in their achievement over time.

These hypotheses were examined using latent growth curve modeling in which teacher support and conflict served as time-varying predictors of the initial levels and trajectories of adolescents' school engagement, which in turn predicted the initial levels and trajectories of achievement. In addition, boys (e.g., Burns et al., 2019; Lietaert, Roorda, Laevers, Verschueren, & De Fraine, 2015) and students with lower socioeconomic backgrounds (Reschly & Christenson, 2012) generally have lower engagement, therefore gender and socioeconomic status (SES) were included as covariates.

2. Method

2.1. Participants

This study used data from the LiSO project (Educational Trajectories in Secondary Education), which is a large-scale longitudinal study investigating individual and contextual predictors of adolescents' school trajectories during secondary education. Data collection took part in the spring of each school year. The current study focuses on students followed from Grades 7 to 9 (data collected in 2014–2016). The sample consisted of 5,382 adolescents (49.6% boys) who were on average 13.06 years old at the first measurement wave (SD = 0.51; range between 11.50 and 15.50 years). Participants were from 342 classes across 46 secondary schools located in the Flemish community of Belgium. Of the participants, 87.5% were in the academic track (42 schools). Here the focus is on general education (e.g., math, languages, science). In addition to a largely shared general curriculum, students can choose to take classical languages, technical classes, arts classes, etc. In principle, all students who successfully completed primary education start in the general track. The other students (12.5%, 30 schools) were in the vocational track which involves practice-oriented education in addition to general education, and prepares students to the labor market. Schools can offer vocational tracks, general tracks, or both. The vast majority of the participants (i.e., 91.5%) and their parents (i.e., 79.4%) were born in Belgium. Each year, students are assigned to a class group, which is supervised by a homeroom teacher. These homeroom teachers were asked to rate the teacher-student relationship. Homeroom teachers (N = 298, 15.4% male) were on average 45.64 years old at the first measurement wave (SD = 0.55; range between 19 and 60 years) and had 20.54 years of teaching experience (SD = 0.57; range between 0 and 39 years). On average, teachers rated 16.41 students (SD = 5.03). Weekly contact hours between homeroom teachers and their students (collected in Wave 3) ranged between 1 (0.9%) and 16 or more hours (3.9%). Most homeroom teachers reported that they spend 4 (26.0%), 5 (18.1%) or 6 (13.4%) weekly hours with their students. Variety in contact hours depends on the subject taught by the homeroom teacher, with more contact hours for core subjects (e.g., Dutch language, math, or practical subjects in vocational education) and less contact hours for other subjects (e.g., music, geography). Students in secondary school have roughly between 5 and 14 different teachers.

2.2. Procedure

The sample was obtained using a multistage sampling approach. First, schools were selected based on their location. Subsequently, each student in the seventh-grade was considered to be a potential participant. Active informed consent was obtained from students' parents and teachers by signing the informed consent letter and/or the school regulation at the start of each school year. Prior to the data collection, all participants were informed about the general aim of the study and received instructions about the procedure. Questionnaires and math tests were administered within the classroom. The students' questionnaire took approximately between one and two hours for students to complete, whereas the teachers' questionnaire took approximately 5–10 min. per student to complete. After the data collection, participants' names were removed from the dataset, such that the participant could not be identified, directly or indirectly (e.g., through cross-referencing) from their data.

2.3. Measures

2.3.1. Teacher-student relationships

Teacher closeness and conflict were measured using a Dutch version of the Student-Teacher Relationship Scale (Leerling Leerkracht Relatie Vragenlijst; Koomen, Pianta, & Verschueren, 2007). The original questionnaire consisted of 28 items covering three dimensions: closeness (11

items; α = .88), conflict (11 items; α = .90) and dependency (6 items; α = .78) (Koomen et al., 2007). A shortened version of this questionnaire was used for this study covering two dimensions: closeness (3 items) and conflict (3 items). Items were selected based on their factor loadings in another large-scale longitudinal research project (i.e., STRATEGIES project). Homeroom teachers were selected for teacher-ratings, as they serve as a mentor for their students, and meet and monitor them regularly. Homeroom teachers are considered to be the primary teacher responsible for students' development. Prior research provided evidence of convergent, discriminant, and predictive validity of teacher reports in comparison to observers' and students' reports (Doumen, Koomen, Buyse, Wouters, & Verschueren, 2012; Hughes, 2011). Homeroom teachers answered items on a 5-point scale (1 = *completely disagree*; 5 = *completely agree*). Sample questions are: "*I share an affectionate, warm relationship with this student*" for closeness and "*Dealing with this child drains my energy*" for conflict. Internal consistency was acceptable to good: closeness α = .85, α = .74, and α = .77, and conflict α = .86, α = .81, and α = .82 for Grade 7, 8, and 9, respectively. Values for closeness and conflict were standardized and treated as time-varying covariates in the analyses. As teachers change between schoolyears and items of closeness and conflict reflect individual teacher-student relationships, changes in teachers' perception of closeness and conflict over time are assumed to be unsystematic and nonlinear (e.g., Ferreira et al., 2018; Muniz-Terrera et al., 2017). Consequently, values for closeness and conflict were standardized and treated as time-varying covariates.

2.3.2. School engagement

School engagement was measured using the Student Report on Engagement Versus Disaffection with Learning questionnaire (Skinner et al., 2008). For the subscales emotional engagement and emotional disaffection, a shorter version was used consisting of four and six items, respectively. Students answered 20 items on a 5-point scale (1 = *not true*; 5 = *true*). Sample questions are: "*When I am in class, I listen very carefully*" for behavioral engagement, "*When I am in class, I just act like I am working*" for behavioral disaffection, "*I enjoy learning new things in class*" for emotional engagement, and "*When I am doing work in class, I feel bored*" for emotional disaffection. Cronbach's alpha ranged between .81 and .83 for behavioral engagement, .74 and .80 for behavioral disaffection, .78 and .79 for emotional engagement, and was .62 for emotional disaffection. For the school engagement dimensions,[1] measurement invariance over time was tested. Two parcels were created for frustration and anxiety sub dimensions in the model of emotional disaffection. All engagement models revealed scalar invariance (by constraining intercepts and factor loadings across waves) (Chen, 2007) after allowing one or two error correlations within each wave (see Table 1 for details), indicating that the meaning of school engagement is consistent over waves.

2.3.3. Achievement

Academic achievement was measured using a standardized math test. To ensure content validity, items reflected the learning goals set in secondary education and were based on frequently used math books. Consequently, different math tests were used over the school years to reflect the learning goals set in that specific grade. The math test covered five topics (i.e., data and information processing, measuring, numbers, and geometry) with 35 items for the academic track and 36 items for the vocational track. Math tests were comparable between tracks regarding topics, reliability, validity and difficulty (Dockx, Stevens, & De Fraine, 2016). Item correlations revealed that scores on the math test were internally consistent. For the academic track alpha's ranged between .81 and .86, and for the vocational track between .80 and .83 across waves. Moreover, IRT-analyses (i.e., Item-Response Theory) revealed that the tests reflect a unidimensional math construct, indicating that the test is a valid measure of students' math skills over the different tracks and grades (Dockx, Van den Branden, Stevens, Denies, & De Fraine, 2017). As students accumulate math skills and knowledge over the school years, their math achievement levels are expected to increase over the grades. Item were scored with 0 = incorrect answer and 1 = correct answer. Item-Response Theory (IRT) was used to calculate an overall math achievement score, taking the difficulty of the items and students' performance into account (Dockx et al., 2017). Moreover, IRT-analyses revealed that the tests reflect a unidimensional math construct, indicating that the test is a valid measure of students' math skills over the different tracks and grades (Dockx et al., 2017). As students accumulate math skills and knowledge over the school years, their math achievement levels are expected to increase over the grades.

[1] Measurement invariance was not examined for teacher-student relationships as teachers and teacher-student dyads differed across waves. Consequently, these variables were treated as time-varying covariates instead of latent growth variables.

Table 1
Measurement invariance of school engagement dimensions.

	χ^2	*df*	*SD*	RMSEA	CFI	SRMR
Behavioral engagement[a]						
Configural	2762.35	84	49.59	.077	.914	.049
Metric	2849.08	92	51.71	.075	.911	.052
Scalar	3005.89	100	53.28	.073	.907	.056
Behavioral disaffection[b]						
Configural	3309.53	84	45.73	.084	.865	.059
Metric	3448.45	92	49.77	.082	.860	.062
Scalar	3650.24	100	51.21	.081	.852	.064
Emotional engagement[c]						
Configural	1772.44	48	32.28	.082	.919	.061
Metric	1853.75	54	33.79	.079	.916	.063
Scalar	1913.40	60	35.56	.076	.913	.063
Emotional disaffection[d]						
Configural	703.43	16	23.25	.089	.927	.058
Metric	732.00	20	23.26	.081	.925	.059
Scalar	1032.66	26	27.71	.088	.893	.065

Note. N = 5,383.

[a] Allowing error correlations between "I listen carefully in class" and "I pay attention in class" at all waves.

[b] Allowing error correlations between "When I'm in class, my mind wanders" and "When I'm in class, I think of other things" at all waves.

[c] Allowing error correlations between "I like to be in class" and "When I'm in class, I feel good" at all waves.

[d] Parcels were created for frustration and anxiety items. Allowing error correlations between frustration-parcels and "When I'm working on a task in class, I feel bored" and the frustration-parcels at all waves, and between "When I'm working on a task in class, I feel bored" at wave 1 and 2, and 2 and 3.

2.3.4. Covariates

Students' sex (0 = girl; 1 = boy) and socio-economic status (i.e., a single composite reflecting parental education, occupation, employment situation, and family income; Vandenbroeck et al., 2017) were used as covariates in the analyses.

2.4. Statistical analyses

2.4.1. Attrition analyses

Missing values ranged between 0.1% for emotional engagement and disaffection in Grade 7 and 32.1% for closeness and conflict in Grade 8. Data were not missing completely at random: $\chi^2(2852) = 8086.22$, $p < .001$ (normed chi-square was 8086.22/2852 = 2.84). Attrition analyses showed that participants who missed one or two waves had generally lower levels of closeness (Grade 7: $t(1450.42) = 7.17$, $p < .001$, $d = .26$; Grade 8: $t(733.60) = 7.01$, $p < .001$, $d = .34$; Grade 9: $t(4390) = 2.61$, $p = .009$, $d = .15$), achievement (Grade 7: $t(1653.03) = 17.52$, $p < .001$, $d = .60$; Grade 8: $t(5015) = 14.65$, $p < .001$, $d = .45$; Grade 9: $t(590.59) = 11.32$, $p < .001$, $d = .56$), and SES ($t(1492.21) = 11.94$, $p < .001$, $d = .43$), and higher levels of conflict (Grade 7: $t(1416.73) = -12.49$, $p <$

.001, $d = .42$; Grade 8: $t(776.05) = -7.22$, $p < .001$, $d = .33$; Grade 9: $t(373.26) = -6.11$, $p < .001$, $d = .36$) and were generally older ($t(1659.37) = -8.57$, $p < .001$, $d = .30$). To deal with the missing data in school engagement, teacher-student relationships, and achievement variables, we used multiple imputation in Mplus and imputed a total of 20 data sets (Graham, Olchowski, & Gilreath, 2007; Jeličić et al., 2009). These imputed datasets were pooled together for further analyses using the "type = Imputation" command in Mplus, which multiplies imputed data sets and invokes pooling rules. Consequently, statistical analysis is based on the average results over 20 data sets.

2.4.2. Descriptive analyses

For descriptive purposes and to gain insight in the longitudinal and within-time associations of the main variables, bivariate correlations were calculated. A correlation coefficient of around .10 represents a weak or small association, around .30 is considered as a moderate association, and around .50 reflects a strong or large association (Cohen, 1988).

2.4.3. Latent growth curve models

Latent growth curve models were specified for each school engagement dimension separately. First, five unconditional growth models were estimated including the intercept (i.e., the initial level), linear slope (i.e., the rate of change), and variability in intercept and linear slope of the four school engagement dimensions and of achievement. Intercept and slope at Time 1 were fixed to 0 in order to ensure that the intercept is interpreted as the average of individuals in the outcome variable at time 0 (Grade 7). Subsequent linear slope was fixed at 1 and 2 for T2 and T3, respectively. These models provide insight in the development of adolescents' school engagement and achievement between Grade 7–9. Because there were only three time points, nonlinear change was not estimated. Second, four latent growth models were fitted to the data with teacher closeness and conflict as time-varying covariates of adolescents' engagement at each time point. Closeness and conflict were treated as time-varying covariates assuming changes in teachers' perception of closeness and conflict over time are unsystematic and nonlinear (e.g., Ferreira et al., 2018; Muniz-Terrera et al., 2017), as teachers change between schoolyears and items of closeness and conflict reflect individual teacher-student relationships. Concurrent correlations between closeness and conflict were specified to model their unique effects on engagement. Paths from closeness and conflict to engagement were constrained to be equal over time (e.g., Muniz-Terrera et al., 2017). Moreover, the intercept and slope of the particular school engagement dimensions were specified to predict the intercept and slope of adolescents' achievement, as engagement is considered to be a antecedent of achievement (Christenson et al., 2012; Roorda et al, 2011, 2017). By doing so, we can examine the magnitude of the association between (a) individual differences in the initial levels of engagement and achievement, and (b) the linear rate of change in engagement and the linear rate of change in achievement (Bollen & Curran, 2006; Robitaille, Muniz, Piccinin, Johansson, & Hofer, 2012). Also, we included sex and socio-economic status as time-invariant covariates of the intercept and slope of engagement and achievement.

Mplus version 8.1 (Muthén & Muthén, 2017) was used to conduct the analyses. To take the clustering of students in classes into account, we used the "Type = Complex" feature in conjunction with the "Cluster" option (i.e., clusters are classrooms in Grade 7). This adjusts the standard errors of the estimated path coefficients and the Chi-Square test of model fit for clustering (Williams, 2000). Non-normality was addressed using full information maximum likelihood estimation with robust standard errors (Muthén & Muthén, 2017). The fit of each model was evaluated by means of the robust S–B χ^2 statistic (Satorra & Bentler, 2001), SRMR, average CFI (Hu & Bentler, 1999), and the RMSEA (Steiger, 1990). Generally, S–B χ^2 values as small as possible are considered indicative of good fit (Kline, 2005). CFI values $\geq .90$ are considered indicative of acceptable fit and CFI values $\geq .95$ of good fit.

Table 2
Correlations and means of teacher-student relationships, school engagement, and achievement.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1.Closeness G7	1																						
2.Closeness G8	.29*	1																					
3.Closeness G9	.23*	.29*	1																				
4.Conflict G7	-.38*	-.19*	-.13*	1																			
5.Conflict G8	-.20*	-.42*	-.15*	.35*	1																		
6.Conflict G9	-.17*	-.20*	-.39*	.33*	.35*	1																	
7.BehEng G7	.25*	.20*	.16*	-.21*	-.22*	-.21*	1																
8.BehEng G8	.21*	.26*	.19*	-.18*	-.27*	-.25*	.60*	1															
9.BehEng G9	.16*	.20*	.25*	-.14*	-.17*	-.24*	.51*	.64*	1														
10.BehDis G7	-.22*	-.19*	-.14*	.24*	.25*	.26*	-.65*	-.48*	-.40*	1													
11.BehDis G8	-.20*	-.23*	-.16*	.20*	.28*	.27*	-.51*	-.71*	-.52*	.61*	1												
12.BehDis G9	-.14*	-.19*	-.22*	.16*	.19*	.26*	-.44*	-.55*	-.72*	.51*	.63*	1											
13.EmoEng G7	.21*	.17*	.13*	-.17*	-.15*	-.16*	.59*	.44*	.38*	-.51*	-.42*	-.37*	1										
14.EmoEng G8	.17*	.21*	.15*	-.14*	-.21*	-.18*	.43*	.62*	.45*	-.39*	-.54*	-.43*	.58*	1									
15.EmoEng G9	.15*	.16*	.22*	-.11*	-.13*	-.20*	.34*	.43*	.61*	-.31*	-.38*	-.55*	.47*	.56*	1								
16.EmoDis G7	-.09*	-.05*	-.05*	.14*	.08*	.13*	-.16*	-.13*	-.10*	.41*	.30*	.25*	-.29*	-.21*	-.21*	1							
17.EmoDis G8	-.06*	-.06*	-0.02	.09*	.10*	.11*	-.10*	-.13*	-.09*	.27*	.36*	.24*	-.19*	-.27*	-.20*	.56*	1						
18.EmoDis G9	-0.02	-.05*	-.04*	.06*	.06*	.10*	-.08*	-.09*	-.08*	.23*	.25*	.30*	-.15*	-.17*	-.25*	.47*	.57*	1					
19.Achiev. G7	.09*	.14*	.10*	-.26*	-.27*	-.26*	.10*	.06*	-0.01	-.23*	-.14*	-.09*	.08*	.08*	0.03	-.16*	-.13*	-.10*	1				
20. Achiev. G8	.11*	.18*	.12*	-.24*	-.29*	-.27*	.11*	.09*	0.02	-.24*	-.19*	-.12*	.08*	.11*	.05*	-.16*	-.13*	-.10*	.78*	1			
21. Achiev. G9	.11*	.17*	.13*	-.26*	-.29*	-.28*	.11*	.09*	0.02	-.23*	-.18*	-.12*	.08*	.11*	.06*	-.17*	-.14*	-.11*	.83*	.82*	1		
22.Sex[1]	-.16*	-.17*	-.12*	.15*	.15*	.13*	-.11*	-.11*	-.11*	.12*	.11*	.11*	-.08*	-.07*	-.04*	-0.02	-0.02	-.06*	0.02	-0.00	.06*	1	
23.SES	.14*	.17*	.11*	-.21*	-.21*	-.19*	.04*	0.02	-0.03	-.14*	-.09*	-.04†	0.01	.04*	0.01	-.10*	-.07*	-.04†	.46*	.48*	.51*	.01	1
Mean	3.60	3.46	3.41	1.82	2.06	2.10	3.91	3.72	3.56	2.02	2.21	2.40	3.63	3.49	3.36	2.42	2.41	2.43	.99	1.01	1.06	.50[2]	.00
SE	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.00	.00	.00	.01	.01

Note. $N = 5{,}383$. G7, G8, and G9 = Grade 7, 8, and 9. Beh/Emo = Behavioral/Emotional. Eng/Dis = Engagement/Disaffection. Achiev. = Achievement. [1]girls = 0; boys = 1. [2] Percentage of girls. $^*p < .001$. †$p < .05$.

SRMR values of ≤ .08 are indicative of good model fit. RMSEA values ≤ .06 are considered indicative of good fit, ≤.08 of fair fit, between .08 and .10 of mediocre fit, and >.10 of poor fit (Hu & Bentler, 1999).

3. Results

3.1. Descriptive statistics

Descriptive statistics and correlations of the main variables are presented in Table 2. Concurrent correlations between closeness and conflict were negative and moderate to strong (rs = -.38 to -.42, $p < .001$). Closeness was weakly to moderately related to behavioral engagement (rs = .25 to .26, $p < .001$), behavioral disaffection (rs = -.22 to -.23, $p < .001$), emotional engagement (rs = .21 to .22, $p < .001$), emotional disaffection (rs = -.04 to -.09, $p < .001$), and achievement (rs = .09 and .18, $p < .001$). Conflict was weakly to moderately correlated with behavioral engagement (rs = -.21 to -.27, $p < .001$), behavioral disaffection (rs = .24 to .28, $p < .001$), emotional engagement (rs = -.17 to -.21, $p < .001$), emotional disaffection (rs = .10 to .14, $p < .001$), and achievement (rs = -.26 to -.29, $p < .001$). Furthermore, behavioral and emotional engagement were weakly correlated with achievement (behavioral engagement in Grade 7 and 8, respectively r = .09 and r = .10, $p < .001$; emotional engagement: rs = .06 to .11, $p < .001$). Behavioral and emotional disaffection were weakly to moderately associated with achievement (rs = -.12 to -.23 and rs = -.11 to -.16, $p < .001$, respectively). Boys generally had less teacher closeness (rs = -.12 to -.17, $p < .001$), behavioral engagement (rs = -.11, $p < .001$) and emotional engagement (rs = -.04 to -.08, $p < .001$), and more teacher conflict (rs = .13 to .15, $p < .001$) and behavioral disaffection (rs = .11 to .12, $p < .001$) compared to girls. Higher levels of SES were positively related to closeness (rs = .11 to .17, $p < .001$) and achievement (rs = .46 to .51, $p < .001$), and negatively associated with conflict (rs = -.19 to -.21, $p < .001$) and disaffection from school (behavioral disaffection: rs = -.04 to -.14, $p < .001$; emotional disaffection: rs = -.04 to -.10, $p < .05$). All correlations were in the expected direction.

3.2. Latent growth curve models

3.2.1. Unconditional models

The unconditional models for the school engagement dimensions and achievement revealed good model fit (Table 3). Intercept and slope were significantly different from zero for behavioral engagement (M_I = 3.91, $p < .001$; M_s = -.17, $p < .001$), behavioral disaffection (M_I = 1.91, $p < .001$; M_s = .19, $p < .001$), emotional engagement (M_I = 3.63, $p < .001$; M_s = -.14, $p < .001$), and achievement (M_I = 0.99, $p < .001$; M_s = .04, $p < .001$; slope variance was fixed at zero due to negative residual variance). This suggests that adolescents decreased in their behavioral and emotional engagement over time, and increased in their behavioral disaffection and achievement from Grade 7 to Grade 9. The slope of emotional disaffection was not significant (M_I = 2.42, $p < .001$; M_s = .003, p = .563). Variance around the intercept and slope were also significant for behavioral engagement (D_i = 0.33, $p < .001$; D_s = 0.06, $p < .001$), behavioral disaffection (D_i = 0.32, $p < .001$; D_s = 0.06, $p < .001$), emotional engagement (D_i = 0.41, $p < .001$; D_s = 0.05, $p < .001$), emotional disaffection (D_i = 0.26, $p < .001$; D_s = 0.03, $p < .001$). This indicates that there is variation in the initial levels and trajectories of all school engagement dimensions. Although the slope of emotional disaffection was not significant, significant variance around the slope indicated that not all individuals developed at the same rate. Therefore, proceeding with latent growth modeling, allows us to examine which predictors explain individual differences in the intercept and slope of emotional disaffection. Regarding the intercept-slope correlation, correlations were significant for behavioral engagement (r = -0.04, $p < .001$), behavioral disaffection (r = -0.04, $p < .001$), emotional engagement (r = -0.07, $p < .001$), and emotional disaffection (r = -0.04, $p < .001$). This suggests that students with higher initial levels of these engagement dimensions in Grade 7 generally had lower slope scores or less growth in engagement over time.

In addition, multigroup analysis was performed to examine possible differences the initial levels and trajectories of school engagement between educational tracks. The academic and vocational track did not differ in intercept and slope for behavioral, emotional engagement, and emotional disaffection. Nevertheless, students in the vocational track generally had higher initial levels of behavioral disaffection (M_I = 2.04, $p < .001$; M_s = .19, $p < .001$) compared to students in the academic track (M_I = 1.89, $p < .001$; M_s = .19, $p < .001$). However, for model simplicity and comparability between the engagement dimensions, educational track was not included as a covariate in subsequent analysis.

3.2.2. Latent growth curve models

The latent growth models for the school engagement dimensions are presented in Figs. 1–4. All models showed acceptable model fit (Table 3). R^2 for the engagement intercepts ranged between 0.9% (behavioral engagement, p = .010) and 4% (behavioral disaffection, $p < .001$), for the engagement slopes between 0.9% (behavioral engagement, p = .042) and 1.5% (emotional disaffection, p = .026). R^2 for the intercept and slope of emotional engagement was not significant. For the achievement intercepts, R^2 ranged between 27.7% (in the behavioral and emotional engagement model, $p < .001$) and 30.9% (in the behavioral disaffection model, $p < .001$). In a latent growth curve model without covariates (i.e., gender, SES, teacher conflict and closeness), R^2 for the achievement intercepts ranged between 1.4% (in the behavioral engagement model, p = .001) and 7.8% (in the behavioral disaffection model, $p < .001$). Thus, by adding covariates a larger proportion of the intercept variance is explained.

Results revealed that, over time, more teacher-student conflict was consistently associated with less behavioral (βs = -.08 to -.09, $p < .001$) and emotional (βs = -.08, $p < .001$) engagement, and more behavioral (βs = .08 to .09, $p < .001$) and emotional (βs = .05, $p < .001$) disaffection. In contrast, more teacher-student closeness was related to more behavioral (β = .11 to .12, $p < .001$) and emotional (βs = .09 to .10, $p < .001$) engagement, and less behavioral (βs = -.09 to -.10, $p < .001$) and emotional (βs = -.02, $p < .05$) disaffection. In all models, the concurrent correlation between conflict and closeness was r = -.38 for Grade 7, r = -.42 for Grade 8, and r = -.39 for Grade 9.

Furthermore, the intercepts of school engagement dimensions predicted the intercept of achievement. Specifically, higher levels of students' behavioral (β = .09, $p < .001$) and emotional (β = .09, $p < .001$) engagement in Grade 7 predicted higher levels of achievement in the same school year. The association with the initial levels of achievement seems to be particularly strong for students' behavioral (β = -.21, $p < .001$) and emotional (β = -.15, $p < .001$) disaffection; the more behavioral and emotional disaffection, the lower students' achievement in the standardized math test. Moreover, we found that increases in behavioral

Table 3
Model fit indices of the latent growth curve models.

	χ^2	*df*	*SD*	RMSEA	CFI	SRMR
Behavioral engagement						
Unconditional model	4.35	1	1.21	.025	.999	.006
Latent growth model	1675.69	61	38.91	.070	.924	.118
Behavioral disaffection						
Unconditional model	0.32	1	0.29	.000	1.00	.002
Latent growth model	1630.48	61	33.53	.069	.926	.120
Emotional engagement						
Unconditional model	0.64	1	0.46	.001	1.00	.002
Latent growth model	1504.11	61	32.70	.066	.928	.111
Emotional disaffection						
Unconditional model	4.50	1	1.59	.025	.999	.006
Latent growth model	1361.30	61	26.76	.063	.936	.105
Achievement						
Unconditional model	128.16	3	2.94	.088	.990	.097

Note. N = 5,383.

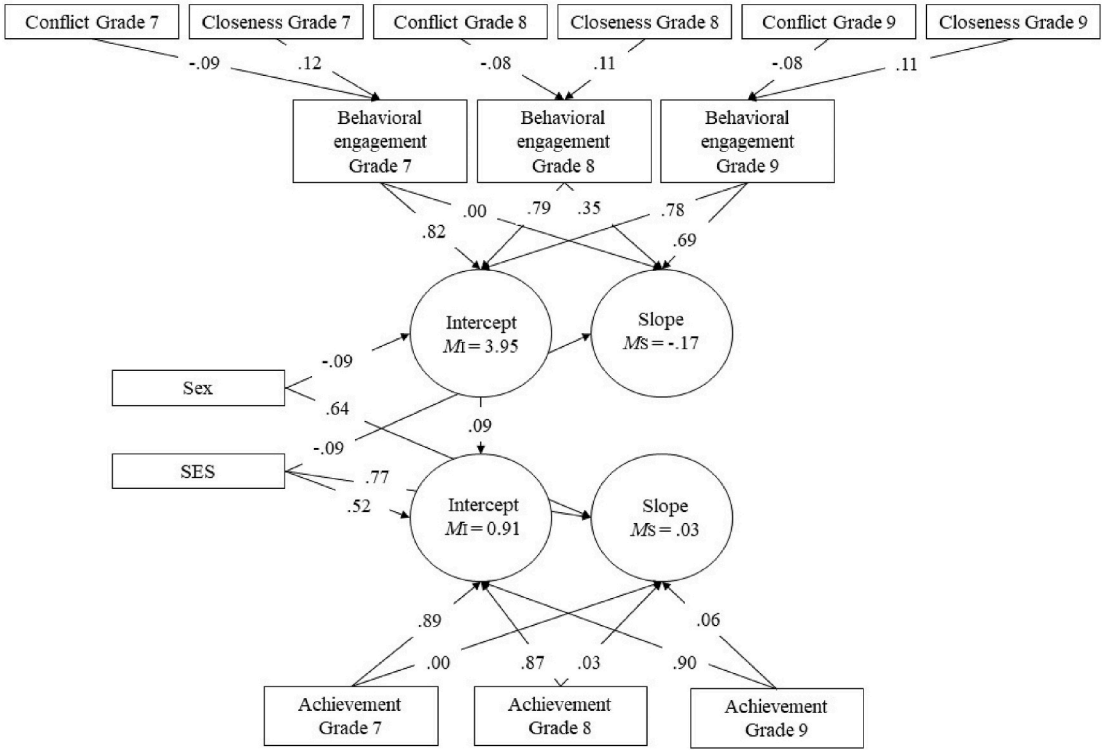

Fig. 1. Latent Growth Model for Behavioral Engagement.
Note. $N = 5{,}832$. †$p \leq .05$. All other presented standardized estimates are significant at $p < .001$.

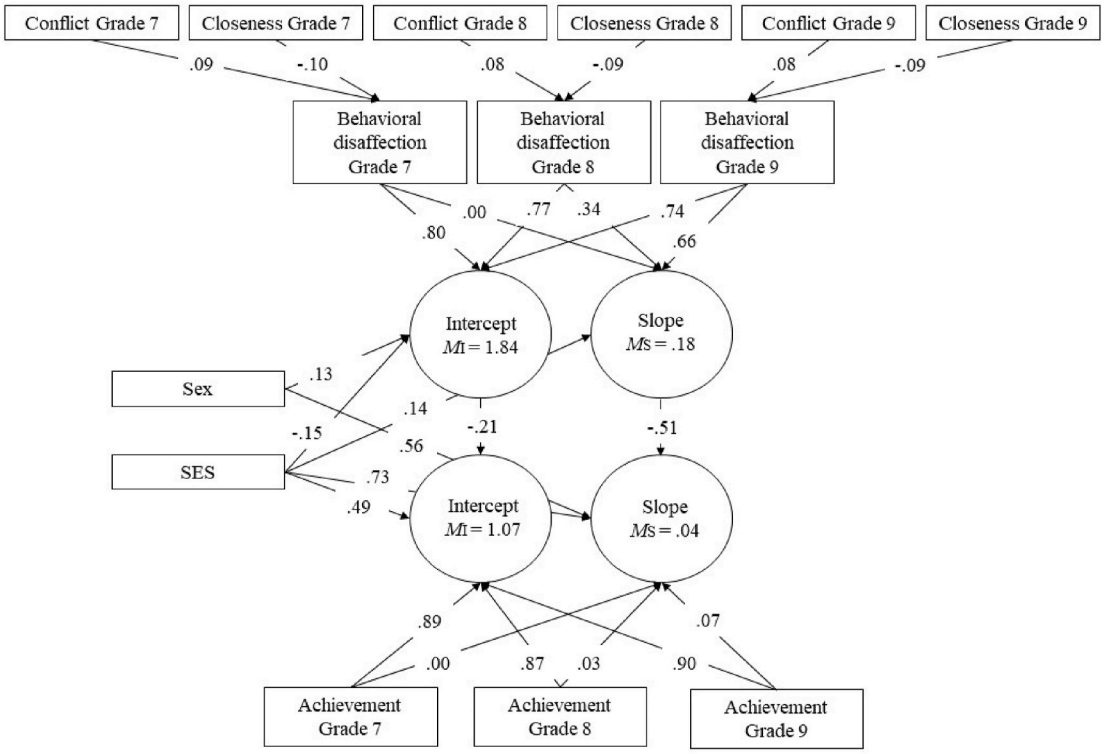

Fig. 2. Latent Growth Model for Behavioral Disaffection.
Note. $N = 5{,}832$. †$p \leq .05$. All other presented standardized estimates are significant at $p < .001$.

disaffection predicted less steep increases in achievement ($\beta = -.51$, $p = .001$), whereas increases in emotional engagement predicted steeper increases in achievement over time ($\beta = .39$, $p \leq .05$). We found no significant effect from the slope of behavioral engagement and emotional disaffection to the slope of achievement.

In addition, results showed that boys had, on average, less behavioral

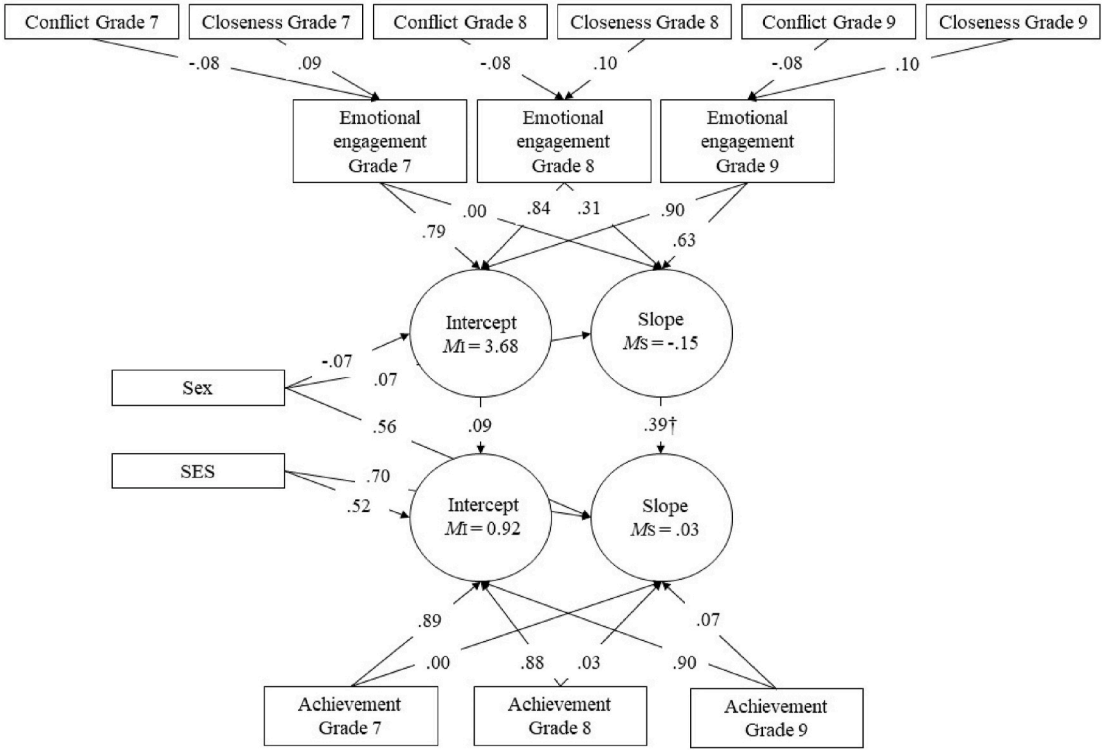

Fig. 3. Latent Growth Model for Emotional Engagement.
Note. $N = 5{,}832$. †$p \leq .05$. All other presented standardized estimates are significant at $p < .001$.

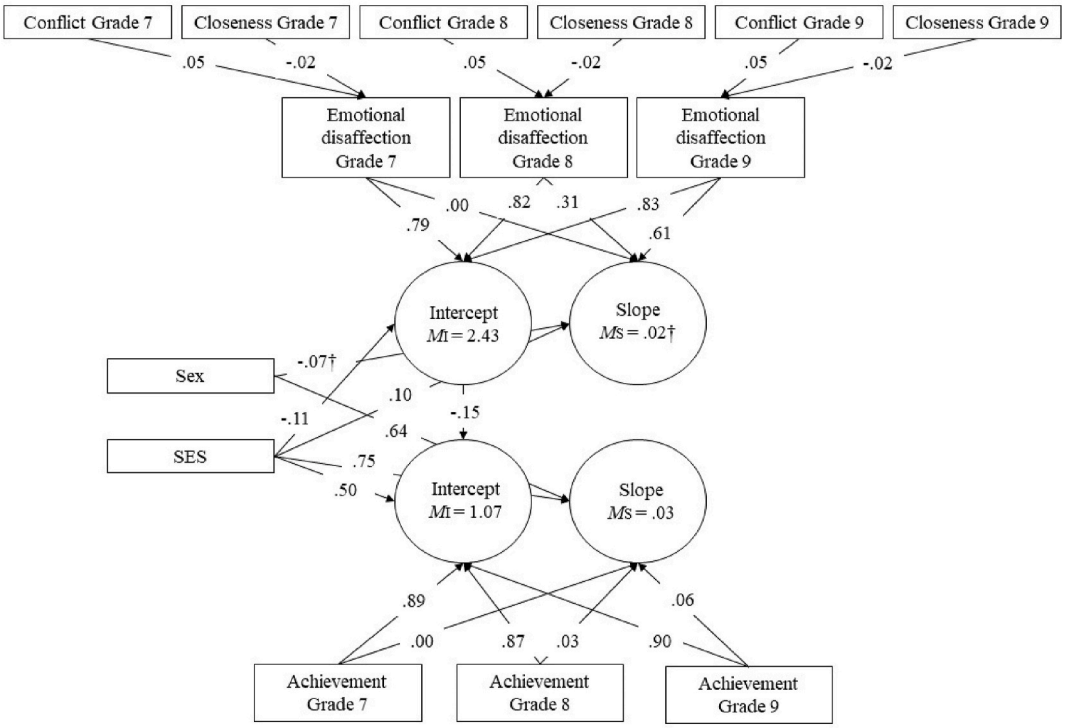

Fig. 4. Latent Growth Model for Emotional Disaffection.
Note. $N = 5{,}832$. †$p \leq .05$. All other presented standardized estimates are significant at $p < .001$.

(β = -.09, $p < .001$) and emotional (β = -.07, $p < .001$) engagement, and more behavioral disaffection (β = .13, $p < .001$) in Grade 7 compared to girls. Boys and girls had similar initial levels of emotional disaffection, but boys tended to have steeper decreases in emotional disaffection (β = -.07, $p \leq .05$), and less steep decreases in emotional engagement (β = .07, $p < .001$) over time than girls. We found no significant differences for boys and girls in the trajectories of behavioral engagement and disaffection. Nevertheless, although boys and girls had, on average,

similar initial levels of achievement, boys had steeper increases in achievement in math (β = .56 to .64 $p < .001$).

Furthermore, results revealed that higher levels of SES related to less behavioral (β = -.15, $p < .001$) and emotional (β = -.11, $p < .001$) disaffection, and higher achievement (β = .49 to .52, $p < .001$) in Grade 7. SES was not significantly related to initial levels of behavioral and emotional engagement. Yet, higher levels of SES were associated with steeper decreases in behavioral engagement (β = -.09, $p < .001$), and steeper increases in behavioral (β = .14, $p < .001$) and emotional (β = .10, $p < .001$) disaffection, and achievement (β = .70 to .77, $p < .001$). SES was not related to the intercept of behavioral engagement and the intercept and slope of emotional engagement.

4. Discussion

This longitudinal study extended prior research by taking a multidimensional approach in investigating teacher-student closeness and conflict as simultaneous precursors of students' behavioral and emotional engagement as well as disaffection. Moreover, we examined the role of school engagement trajectories in the development of adolescents' math achievement during Grade 7, 8, and 9.

In line with attachment theory and our hypotheses, our findings revealed that warm and close teacher-student relationships positively contributed to adolescents' engagement in school over time, whereas conflictual relationships hampered students' school engagement (Roorda et al., 2011, 2017; Verschueren, 2015). Thus, also for adolescents, teachers can serve as a source of support, who help them to engage behaviorally and emotionally in learning activities. Also, we found that both positive and negative aspects of affective teacher-student relationships have a similar and unique impact on students' school engagement, as suggested by some prior research (Baker, 2006; Hamre & Pianta, 2001; Ladd et al., 1999; Roorda et al, 2011, 2017). However, evidence from prior research on the relative impact of teacher closeness and conflict stems predominantly from studies that investigated these dimensions separately, and thus cannot accurately determine the relative impact. In general, findings from our study using teacher-ratings of the teacher-student relationship and its effect on students' engagement are in line with prior research using student perceptions of this relationships. Our study revealed that different individual affective relationships with homeroom teachers over time predicted students' behavioral and emotional (dis)engagement in school, which in turn, predicted students' achievement on a standardized math test. This implies that homeroom teachers affect students' general engagement in school and subject specific achievement. Consequently, in order to understand students' achievement in math, it is important not merely focus on the teacher-student relationship with students' math teachers, but also investigate whether students have a safe and secure relationship base at school with their homeroom teacher. Supporting attachment theory, this suggests that homeroom teachers who create warm, safe, and supportive relationships with their students can serve as important non-parental attachment figures and role models (Bergin & Bergin, 2009).

Furthermore, as expected, adolescents decreased in their behavioral and emotional engagement, and increased in their behavioral disaffection from Grade 7 to 9 (Engels, 2018; Wang et al., 2015). This suggests that students become less actively involved in learning activities during secondary school, but also do so with less and less enthusiasm and enjoyment. Also, students increased in their unpreparedness and passivity over time. Yet, there was no increase of emotions that reflect maladaptive motivational status (i.e., emotional disaffection), which implies that students reported similar levels of boredom, frustration, and anxiety during Grade 7 to 9. This finding is consistent with prior research (Engels, 2018; Wang et al., 2015). Despite this general stability, it might be that the underlying dimensions of emotional disaffection, such as boredom, anxiety, and frustration, develop differently over time (Engels, 2018). In general, findings of this study revealed differences in the trajectories of students' engagement and disaffection in school.

In line with prior research (e.g., Hughes et al., 2008; Wang & Holcombe, 2010) and our hypotheses, favorable levels and trajectories of behavioral and emotional engagement in school seem to align with favorable achievement levels and trajectories. In addition, we extended prior research by showing that the role of school engagement in students' initial achievement levels was particularly strong for students' behavioral and emotional disaffection. This suggests that the negative school engagement dimensions, which reflect maladaptive motivational states, are generally more detrimental for students' initial achievement levels compared to the positive dimensions. With respect to the role of school engagement in achievement trajectories, we found that upward trajectories of students' behavioral disaffection seem to go hand in hand with reduced growth in achievement over time. Yet, positive trajectories of emotional engagement were found to align with steeper increases in achievement between Grade 7 and 9. Thus, results showed that behavioral disaffection and emotional engagement in particular predicted students' math achievement trajectories. In contrast to prior research which often suffered from single-method variance, these associations were found using student reports on their engagement in school and standardized achievement tests.

In addition, consistent with prior research (Engels et al., 2017; Wang & Eccles, 2012b) boys generally had more unfavorable school engagement trajectories compared to girls. These maladaptive engagement trajectories constitute a disadvantage for boys' general academic development compared to girls (Freudenthaler, Spinath, & Neubauer, 2008; Lietaert et al., 2015). Although our results revealed that boys had more positive trajectories in math achievement than girls, prior research found that girls outperform boys in other domains, such as languages (Voyer & Voyer, 2014). A disadvantage was also present for students from low-SES families, as lower SES levels were related to more behavioral and emotional disaffection in Grade 7, and lower initial levels and trajectories of achievement. This finding was consistent with prior research showing the risk associated with low SES levels for students' educational outcomes (Rumberger & Lim, 2008). However, over time, higher levels of SES were associated with less favorable trajectories of behavioral engagement, and behavioral and emotional disaffection. It could be that high SES students disengage more rapidly from school as they experience more support and pressure from parents and teachers to achieve academically (Demaray, Malecki, Rueger, Brown, & Summers, 2009), which could lead to school related stress and less favorable engagement trajectories (e.g., Raufelder, Hoferichter, Ringeisen, Regner, & Jacke, 2015).

4.1. Limitations and future directions

A few limitations should be considered when interpreting the findings of this study. First, the study relied on teacher reports of the teacher-student relationship. Although research has shown moderate congruence between teacher, student, and peer perceptions of teacher-student relationships (Doumen et al., 2009; Li, Hughes, Kwok, & Hsu, 2012), future studies should consider multiple perceptions of these affective relationships. This could result in a more complete understanding of the role of affective teacher-student relationships in adolescents' school engagement and achievement. Furthermore, we used homeroom teachers' perceptions of their relationship with students, as they are the primary teacher responsible for students' development. Yet, in secondary school students have multiple teachers, and may share different relationships with different teachers. For instance, recent research has shown that students generally have a more favorable relationship, in terms of closeness and conflict, with their homeroom teacher as compared to teachers of students' hardest and easiest subject. This underscores the unique relationship between students and their homeroom teacher. However, despite these mean-level differences, associations between relationship quality and engagement did not differ across teachers (Roorda, Jorgensen, & Koomen, 2019). In addition, our study

focused on the relationship between students and their homeroom teachers and its association with domain-general engagement in school. Future research, however, could consider investigating the link between students' relationship with their subject teacher and their subject-specific engagement.

Second, the effects of teacher support and conflict in our study were generally not large, but were consistent with what could be expected based on prior research and were not inflated by shared-method or shared-informant variance (Murray, Murray, & Waas, 2008). As such, student perceptions of the availability of teacher support and conflict could be stronger predictors of their student-reported engagement in school compared to teacher perceptions (Hughes & Cao, 2018). However, by using teachers' perceptions of the teacher-student relationship and adolescent-rated engagement, we were able to avoid single-source bias and inflated relations, which is a common problem in research on these relations in secondary education.

Third, we examined the role of teacher-student relationships relying on an attachment-based framework. However, other theoretical frameworks and related relationship dimensions might be interesting to study as well, such as autonomy support and structure (i.e., social-motivation theory), or agency and communion (i.e., interpersonal theory). Especially the integration of these different perspectives is considered to be a fruitful avenue for future research, as each of these traditions may strengthen each other (Wubbels, Brekelmans, Mainhard, den Brok, & van Tartwijk, 2016).

Fourth, this study focused on students' general engagement in school and their performance on a standardized math test. However, it may also be interesting to investigate the role of subject-specific engagement, such as students' liking for math or language, in relation to their academic achievement in that particular domain. When students are interested in and like a specific subject, it is expected that this will positively predict students' achievement as well. Consequently, the role of subject specific engagement might be more pronounced in students' achievement compared to students' general engagement in school. The same applies for the role of teacher support and conflict from the perception of homeroom teachers, who teach different subjects, as done in the current study. It might be that stronger associations occur when students' relationship with their subject teacher, subject-specific engagement and achievement are used (Hamre & Pianta, 2001; Roorda et al, 2011, 2019). Moreover, information on the number of contact hours between students and their teachers could provide insights in relation to the teacher-student relationship.

In addition, this study focused on behavioral and emotional engagement, reflecting adolescents' behavioral investment and emotional states during learning activities in the classroom. Yet, future research could consider to examine cognitive engagement as well, which provides insights in, for instance, adolescents' willingness to participate in learning activities. Furthermore, the current three-wave study used linear growth curve models for engagement trajectories, but it might be interesting to estimate quadratic growth as well because these models can identify more complex trajectories than linear growth models (Singer & Willett, 2003). Moreover, although directional links can be expected based on contextual and motivational models of engagement and disaffection (Skinner & Pitzer, 2012), our analyses only confirmed the predictive power of engagement, not any causal effect. Future research should explore these options more thoroughly.

4.2. Practical implications

Our findings highlight the importance of students' school engagement for their achievement. Teachers could promote students' behavioral and emotional engagement, as expressed through student attention, participation, enthusiasm and interests in learning activities, as a way to stimulate their academic achievement. Moreover, teachers may use signs of student disaffection as a diagnostic tool signaling that a student needs more support and involvement from the teacher. Especially in secondary school, teachers need to be aware of the impact of individual affective relationships on students instead of treating the whole class a 'collective student'. This is particularly important as secondary school teachers generally believe that they are less important for their students in fulfilling an emotionally supportive role (Hargreaves, 2000; Lynch & Cicchetti, 1997). Yet, as supported by recent meta-analyses, individual affective teacher-student relationships are just as important, for the engagement of secondary school students as for primary school students (Roorda et al, 2011, 2017). Furthermore, students' relationships with homeroom teachers matter for their general engagement in school and subject-specific achievement. As a result, all teachers, but especially, homeroom teachers should strive for warm, safe, and supportive relationships with their students.

4.3. Conclusions

Our study demonstrated the importance of affective teacher-student relationships with homeroom teachers for adolescents' school engagement. We found no support that positive or negative affective dimensions are more important for students' engagement in school. Moreover, adolescents' behavioral and emotional engagement declined, whereas their behavioral disaffection and achievement increased from Grade 7 to 9. Furthermore, adolescents' school engagement, and disaffection in particular, played an important role in their achievement within the same schoolyear. Moreover, results denoted that increases in behavioral disaffection and emotional engagement go hand in hand with reduced and steeper increases in achievement over time, respectively. To conclude, results indicated that the relationship with one teacher in secondary school (i.e., homeroom teacher) affects students' overall engagement trajectories in school, which in turn impacted students' achievement trajectories in math.

Author statement

MCE and KV conceived the research idea of this study. MCE performed the statistical analysis and took the lead in writing the manuscript. JS and KD provided feedback on the intellectual content of the manuscript. KD coordinated the data collection of the overarching project. KV supervised this research project and helped shape the research, analysis, and manuscript. All authors discussed the results and contributed to the final manuscript.

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