



Understanding shifts in students' academic motivation across a school year: the role of teachers' motivating styles and need-based experiences

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Abstract

Students' adaptive motivation to study tends to decrease over time. However, the reasons for this decline are not fully understood. Drawing on self-determination theory (SDT), we investigated whether changes in teachers' motivating style and students' associated need-based experiences could explain the motivational decline documented in the literature. A total of 472 Israeli seventh and eighth graders (in their first and second years of middle school) completed questionnaires at the beginning and end of the school year. Students reported their perceptions of their teachers' (de)motivating styles (i.e., autonomy support, structure, control, and chaos), the extent to which their psychological needs were satisfied or frustrated, and their motivation to study. There was a significant decrease from the beginning to the end of the school year in 7th- and 8th-grade students' perceptions of autonomy support and structure provided by their teachers, students' autonomous motivation, and their experienced need satisfaction. There was a significant increase from the beginning to the end of the school year in 7th and 8th graders' perception of their teacher as chaotic and the students' experience of need frustration, controlled motivation, and amotivation. A growth curve multilevel model (GCMLM) indicated that the perceived changes in teachers' motivating and demotivating styles, together with the changes in the students' reported need-based experiences from the beginning to the end of the year, could account for these changes in students' motivation. Teachers should develop and maintain a need-nurturing environment to prevent a drop in student motivation.

Keywords Students' motivation · Need satisfaction · Teacher motivating styles · Self-determination theory

The students were already one foot out the door, hardly ever attended classes, and even when they showed up, they were primarily interested in cramming for the upcoming exams or watching the entertainment programs. I felt more irrelevant than ever, but I still tried to

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teach ‘important things’, and I built up enormous frustration because of the growing gap between me and them (H.B. a secondary-school teacher blog, 2010).

Numerous longitudinal studies show that between grades (e.g., Gnambs & Hanfstingl, 2016; Lee & Kim, 2014; Otis et al., 2005) as well as within a given year (Bartholomew et al., 2018; Corpus et al., 2009; Opdenakker et al., 2012), students’ motivation tends to decrease. This drop comes with a host of negative cognitive, emotional, and behavioral repercussions that affect students’ engagement, achievement, and well-being (Vansteenkiste et al., 2006; Ryan et al., 2021) and is considered a fairly common phenomenon during adolescence (e.g., Katz et al., 2011; Otis et al., 2005).

Although the consequences of this motivational decline are well-researched (Ryan & Deci, 2016), it remains unclear why it occurs. The present study drew on the basic psychological needs theory, a sub-theory of self-determination theory (SDT; Vansteenkiste et al., 2020; Ryan & Deci, 2017; Ryan et al., 2021) to explore this understudied question. SDT is a central, well-validated theory in motivational research that provides a well-organized theoretical and operationally grounded perspective on the contextual factors and the psychological processes that promote and undermine motivation (Ryan & Deci, 2017). SDT posits that regardless of students’ cultural background or SES, the satisfaction of the three basic psychological needs for autonomy, competence, and relatedness are critical mechanisms that underlie and energize students’ motivation (Ryan & Deci, 2020). SDT argues that the broader educational climate and the practices teachers use (i.e., teachers’ motivating styles) are key factors influencing students’ quality of motivation via basic need experiences (Aelterman et al., 2019; Cohen et al., 2019). Given SDT’s fine-grained conceptual viewpoint on motivation, its underlying resources, and the availability of well-validated and reliable instruments, this theory is well-suited to shed light on the factors accounting for changes in motivation over the school year in 7th and 8th graders in Israel.

Specifically, we evaluate whether changes in students’ motivation could be accounted for by changes in their teachers’ (de)motivating teaching styles and the students’ associated need-based experiences across a school year. Unlike previous studies that have focused mainly on a single or a pair of motivating or demotivating styles (e.g., Vansteenkiste et al., 2012; Bartholomew et al., 2018), the present study examined the two motivating and the two demotivating teaching styles defined in SDT simultaneously to assess their predictive role in accounting for shifts in students’ need-based experiences and hence their motivation over the year. The findings should thus lead to a better understanding of the factors contributing to students’ decline in motivation and point to ways to avoid it, thus contributing to students’ greater psychological well-being and academic success.

Changes in students’ quality of motivation

SDT differentiates between five qualitatively different forms of motivation positioned along a self-determination continuum (Vansteenkiste et al., 2022; Ryan & Deci, 2020). *Intrinsic regulation* represents the hallmark of volitional functioning since students are naturally attracted to learning material that elicits their interest and curiosity. Even in the absence of intrinsic motivation, students can willingly put an effort into their studies because it aligns with their values, preferences, and goals (*integrated regulation*) or because of the perceived value and relevance for themselves (i.e., *identified regulation*). Although these students’ learning is still instrumental and extrinsically motivated, they volitionally commit to their studies because doing so is perceived as congruent with deeply held values and

convictions. These students are considered autonomously motivated. However, there are also other more controlled forms of extrinsic motivation when motivation stems from internal pressures such as guilt or ego-concerns (*introjected regulation*), or external pressures, such as the expectation of a reward or the avoidance of sanctions (*external regulation*). The absence of motivation is also known as a-motivation, where individuals engage passively in an activity with little intention to act (Ryan et al., 2021; Ryan & Deci, 2017).

Studies have shown that engaging in an activity for autonomous reasons predicts a wide range of adaptive cognitive (Guay et al., 2010), affective (Harvey et al., 2015), and behavioral (Fenton et al., 2014) outcomes. Although engaging in an activity for controlled reasons may predict some short-term persistence, controlled motivation has been found to predict ill-being (Sheehan et al., 2018), low self-efficacy (Shell & Husman, 2008), low academic performance (Ryan & Deci, 2017), and burnout (e.g., Lonsdale & Hodge, 2011). Research in the educational context (see Vansteenkiste et al., 2022, for a recent overview) suggests that autonomously motivated students are more persistent and cognitively involved in their tasks, experience more positive emotions, and obtain better grades, whereas students displaying controlled motivation or a-motivation are less persistent, more distracted, experience more negative emotions (e.g., anxiety, irritation), and have lower grades (Guay et al., 2008).

Fewer studies have assessed students' changes in motivation and indicate that over the course of multiple school years (Jaakkola et al., 2015; Lee & Kim, 2014; Otis et al., 2005) as well as within a given school year (Corpus et al., 2009; Opdenakker et al., 2012), students' autonomous motivation to study tends to decline. Lee and Kim (2014) reported that students' autonomous motivation in English and math decreased throughout the high school years. Opdenakker and colleagues (Opdenakker et al., 2012) found that 7th-grade students' autonomous motivation decreased during the academic year, whereas their controlled motivation increased slightly. These changes in students' motivation can be attributed to numerous factors, including individual or developmental differences. However, one of the key antecedents of students' motivation is their perception that their needs are considered and satisfied (Vansteenkiste et al., 2020; Moè & Katz, 2020).

Understanding motivational change: the role of need-based experiences

To foster autonomous motivation, students' basic psychological needs of autonomy, relatedness, and competence must be met (Vansteenkiste et al., 2020, 2022; Ryan & Deci, 2017). Autonomy refers to the experience of self-determination, willingness, and volition when carrying out an activity. Relatedness refers to the experience of intimacy and genuine connection with others, and competence refers to feeling effective and capable of achieving one's goals (Vansteenkiste et al., 2020; Moè & Katz, 2020).

Recent refinements of SDT have differentiated need frustration from a lack of need satisfaction (Vansteenkiste & Ryan, 2013). Specifically, low need satisfaction refers to low fulfillment of students' needs, whereas in need frustration, teachers actively thwart students' needs (Haerens et al., 2015). When students' psychological needs are frustrated, they experience a sense of pressure and obligation, failure and inadequacy, loneliness, and exclusion, all of which result in drops in motivation.

When students experience psychological need satisfaction, they are more autonomously motivated to study, report more well-being, and are more engaged in their schoolwork

(Aelterman et al., 2019; Ryan & Deci, 2017). When students experience need frustration, their energy is depleted (Cohen et al., 2019; Vansteenkiste & Ryan, 2013), and their motivation shifts towards controlled forms, which can result in a lack of interest in studying altogether (i.e., *a*-motivation) (Bartholomew et al., 2011; Haerens et al., 2015), negative emotion (Cohen & Slobodin, 2022) and even drop-out (Katz & Cohen, 2018). Thus, in real-life educational contexts, the extent to which students' need-based experiences are met throughout the school year is likely to be paralleled by changes in their motivation. Specifically, the extent to which teachers are perceived to increasingly thwart rather than support students' psychological needs throughout the school year may account for the gradual erosion of students' autonomous motivation.

Motivating and demotivating teaching styles

SDT defines four (de)motivating teaching styles: autonomy-support, structure, control, and chaos, which have recently been investigated from an integrative perspective (Aelterman et al., 2019). An autonomy-supportive teacher considers the students' perspective (Jang et al., 2016), offers meaningful choices (Patall et al., 2010), provides rationales for requests (Assor et al., 2002), and nurtures internal resources such as task interest (Patall et al., 2013). A structuring teacher offers help and guidance (Jang et al., 2010), provides positive feedback (Koka & Hein, 2005), and communicates expectations (Vansteenkiste et al., 2012). A controlling teacher uses directive, pressuring, and forceful language (Assor et al., 2005) and insists that students think, feel, and behave according to a specific agenda (Reeve, 2016) by using strategies such as threats, punishment, or guilt-induction and shaming (Katz et al., 2010). A chaotic teacher fails to successfully adjust the instruction to the students' developmental pace and growth potential and wavers in the requirements and expectations placed on the students (Aelterman et al., 2019).

The positive outcomes of need supportive teaching have been extensively researched. A review by Stroet et al. (2013) showed a clear positive association between need-supportive teaching and students' motivation and engagement. There is considerable literature on the deleterious effects of being exposed to a controlling teacher (Haerens et al., 2015). The potentially harmful effects of a chaotic teaching style are less often described (Bartholomew et al., 2011).

A more limited set of longitudinal studies have been conducted to investigate the associations between changes in teachers' behaviors or experiences and students' motivation (Bartholomew et al., 2018; Gnambs & Hanfstingl, 2016; Opdenakker et al., 2012; Reeve et al., 2004; Skinner et al., 2008; Van Ryzin et al., 2009). The findings indicate a strong association between students' motivation and teachers' styles and reinforce the claim that the processes which occur in one affect the other. The Bartholomew et al. (2018) study showed that students perceived their physical education teachers as more controlling at the end than at the beginning of the academic year. This was linked to a rise in students' experience of need frustration and controlled motivation. Corpus et al. (2009) reported that shifts in students' motivation could best be accounted for by changes in their perceptions of their teachers' goals, i.e., whether they espoused performance or mastery goals. Van Ryzin et al. (2009) and Reeve et al. (2004) found that changes in students' perception of their teachers' instructional style were associated with students' engagement and achievement. However, few longitudinal studies have investigated the nature of the mechanism that can explain these associated changes (Stroet et al., 2013).

The present study

The present study aimed to shed light on the effects of changes in teachers' motivating style on students' associated experiences of need satisfaction, frustration, and motivation over time in a sample of 7th and 8th graders. Israeli students transition from elementary to middle school in the 7th grade. This transition is characterized by a significant drop in students' motivation and well-being (Tuominen et al., 2020; Wigfield et al., 2006). We compared the 7th graders who recently entered middle school and were in this "critical time of transition" to 8th graders starting their second year in middle school.

In Israel, homeroom teachers are key figures responsible for their students' academic, social, and emotional adjustment and well-being. Each teacher is assigned 30 to 40 students and usually teaches only one subject (6–12 weekly hours). Homeroom teachers are required to contact their students daily and keep in touch with their parents. This intensive relationship between the students and their teachers can foster emotional bonds and mutual trust (Liew et al., 2010). Homeroom teachers' holistic role and intensive contact with students and parents make them socializing agents and valuable resources outside the students' home environment. Based on studies that have confirmed that homeroom teachers' styles impact students' motivation, emotion, and competence (e.g., Katz, 2017; d'Ailly, 2003; Liew et al., 2010; Pianta & Hamre, 2009), the students in the current study were asked to complete questionnaires on their homeroom teachers.

Schools in Israel that are under the auspices of the Israel Ministry of Education are divided into three streams: state-Jewish secular, state-Jewish religious, and the Arab sector. Students tend to enroll in schools as a function of their ethnic and religious identity. The participants in the current study were sampled from Jewish secular schools. Secular Jewish society in Israel is considered Western and individualistic (Sagy et al., 2001).

Consistent with Haerens and colleagues (2015), two paths between the variables were investigated: the *bright path* between students' perception of the teacher as need-supportive/structuring and students' greater autonomous motivation and the *dark path* between students' perception of the teacher as controlling/chaotic and students' controlled motivation.

Four hypotheses were formulated:

H1. Changes in students' motivation: Students' autonomous motivation (AM) will decrease (H1a), while students' controlled motivation (CM) (H1b) and a-motivation (H1c) will increase throughout the academic year and from 7 to 8th grades.

H2. Changes in students' perceived teachers' behavior: Students' perceptions of their teachers as autonomy-supportive and structuring will decrease (H2a), while students' perceptions of their teachers as controlling and chaotic will increase (H2b), throughout the academic year and from 7 to 8th grades.

H3. Changes in students' needs-based experiences: Students' experiences of need satisfaction will decrease (H3a), while students' experiences of need frustration will increase (H3b) throughout the academic year and from 7 to 8th grades.

H4. Changes in students' needs-based experience will mediate the association between changes in teachers motivating and demotivating styles and changes in students' motivation to study:

(H4a). The decrease in students' perceptions of their teachers as autonomy-supportive and structuring will be associated with a decline in students' experience of need satisfaction. This, in turn, will be associated with a decrease in students' autonomous motivation to learn.

(H4b). The increase in students' perception of their teachers as controlling and chaotic will be associated with an increase in their experience of need frustration. This, in turn, will be associated with an increase in students'-controlled motivation to learn.

(H4c). The increase in students' perception of their teachers as controlling and chaotic will be associated with an increase in their experience of need frustration. This, in turn, will be associated with an increase in students' a-motivation to study.

Method

Participants

The sample was composed of 472 seventh- and eighth-grade students from 12 7th grade classes ($n=276$) and 8 8th grade classes ($n=196$) (mean age=12.63, $SD=0.65$; 248 males, 213 females, 11 did not indicate gender) recruited from three secular Jewish middle schools located in middle SES neighborhoods in the southern part of Israel. The 20 homeroom teachers were Jewish, female, and had at least five years of teaching experience.

The data were gathered through convenience sampling. Only secular Jewish students whose mother tongue was Hebrew were included. No differences were found for any of the variables between the students in the three schools; hence, they were combined into one dataset. At the start of the year, data were collected from 501 students in the first data collection wave. Data were collected from 472 students in the second wave at the end of the year. The dropout was due to students' absence from school on the day when the second wave of data was collected.

Procedure

The Institutional Ethics committee (approval number 8697217) and the Israel Ministry of Education approved this study. The school administration, parents, and students gave their informed consent.

The students filled out the questionnaires at the beginning of the academic year (T1; mid-September–October) and at the end of the year (T2; May–June).

In the first wave, each student was asked to invent a personal code (participant number) by combining the first letter of their first name and the last four digits of their home or cell phone and then the first letter of their last name. The students entered the same code on the second wave data collection.

During class time in the absence of the teachers, students were asked to complete questionnaires on their perception of support and the motivation they experienced in their homeroom teachers' class. Teachers had no access to the surveys, and confidentiality was guaranteed.

Measures

All the measures have exhibited strong validity in previous research (Vansteenkiste et al., 2012; Aelterman et al., 2019; Benita et al., 2020). Most have validated Hebrew versions (Cohen & Slobodin, 2022; Katz & Cohen, 2014, 2018; Benita et al., 2020).

Perceived teachers' motivating teaching style

Students' perceptions of their homeroom teachers' motivating styles were assessed on the SISQ-Education (Situation-In-School Questionnaire; Aelterman et al., 2019). This relatively new instrument assesses teachers' engagement in autonomy-support, structure, control, and chaos through a circular structure (i.e., a circumplex). Two independent English-Hebrew bilingual experts translated the SIS-q from English to Hebrew which was then backtranslated from Hebrew to English based on Brislin (1980).

The SISQ-Education comprises 12¹ vignettes depicting situations relating to the preparation, coursework, and the end of a lesson. The situations describe either a problem that requires the teacher to intervene to remedy the situation or a non-problematic situation in which the teacher takes a more proactive role. For each vignette, respondents are given a list of four different teacher behaviors corresponding to the autonomy supportive, structuring, controlling, and chaotic styles. Students respond on a Likert scale ranging from 1 (*does not describe my teacher at all*) to 7 (*describes my teacher extremely well*) to indicate to what extent each of these behaviors described what their homeroom teacher would do in that specific situation. Higher scores indicate students' perception of the teacher as more autonomy-supporting, structuring, controlling, or chaotic styles, respectively.

The students rated each teaching style at times 1 and 2 at the start and end of the academic year: autonomy-support (T1, $\alpha=0.80$; T2, $\alpha=0.83$); structure (T1, $\alpha=0.86$; T2, $\alpha=0.87$); control (T1, $\alpha=0.73$; T2, $\alpha=0.77$); and chaos (T1, $\alpha=0.81$; T2, $\alpha=0.77$).

Quality of motivation

Students' quality of motivation to study was assessed using the Self-Regulation Questionnaire-Academic questionnaire (SRQ-A; Vansteenkiste et al., 2012; Ryan & Connell, 1989). All items began with the stem "I study in my homeroom teacher's class because...." to tap the students' motivation to study. Autonomous motivations were composed of intrinsic and identified regulations (sample item: "because it is interesting to me"; eight items; T1, $\alpha=0.86$; T2, $\alpha=0.78$), controlled study motivation composed of external and introjected regulations (sample item: "because I would feel ashamed if I didn't do so"; eight items; T1, $\alpha=0.71$; T2, $\alpha=0.73$), and a-motivation to study (sample item: "I do not understand why I study, and I don't care"; 4 items; T1, $\alpha=0.76$; T2, $\alpha=0.82$). Using a Likert scale ranging from 1 (*Is not true of me at all*) to 5 (*very much true of me*), students reported the extent to which each item described the nature of their motivation to study. Higher scores indicated students' higher autonomous or controlled motivation, respectively. The Hebrew version was previously validated (see Katz & Cohen, 2014, 2018).

Need-based experiences

Students' experiences of need satisfaction and need frustration in class were measured with the 24-item Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS; Chen et al., 2015) of the validated Hebrew version (Benita et al., 2020). For the present study,

¹ A more recent version of this instrument has 15 vignettes.

the general need satisfaction scale was slightly adjusted by adding the stem: “During my homeroom teacher’s class I feel....” Each psychological need (autonomy, competence, and relatedness) was assessed by four items tapping need satisfaction and four items tapping need frustration. Using a Likert scale ranging from 1 (*Is not true at all*) to 5 (*very much true*), students reported the extent to which each item described their experience in their homeroom teacher’s class. Higher scores indicated higher need satisfaction or need frustration, respectively. Since the correlations between autonomy, relatedness and competence satisfaction were high ($r=0.62\text{--}0.69$), and the correlations between autonomy, relatedness, and competence frustration were also high ($r=0.57\text{--}0.63$). As in Moè and Katz (2020), we computed the mean scores of the items representing need satisfaction (sample item: “I feel that I have a choice and freedom in the things I do in class”; 12 items; T1, $\alpha=0.84$; T2, $\alpha=0.77$) to represent the need satisfaction variable, and the mean scores of the items representing need frustration (sample item: “Most of the things I do in class, I feel I have to”; 12 items; T1, $\alpha=0.85$; T2, $\alpha=0.83$) to represent need frustration.

Data analysis

Univariate and multivariate outliers were examined. No abnormality was observed. Thus, all participants were included in the data analyses. Descriptive statistics, and the zero-order correlations among the variables at time 1 (T1) and at time 2 (T2) were calculated. To examine the stability of students’ perceived teachers’ motivating and demotivating styles, needs-based experience, and motivation, as recommended in longitudinal designs (Little et al. (2007), we examined the rank-order stability of the variables through structural equation modeling (SEM), using AMOS24 (Arbuckle, 2006). Following Hoyle and Panter (1995), the model’s fit to the data was evaluated using four goodness of fit indices: the χ^2 statistic, and the root mean square error of approximation (RMSEA), the normed fit index (NFI), and the comparative fit index (CFI). A RMSEA below 0.06 in combination with NFI and CFI above 0.95 indicates excellent fit, whereas values below 0.08 and above 0.90 indicate adequate fit.

Next, separate two-way ANOVAs with repeated measures were used to test for changes in students’ motivation, teachers’ motivating style, and students’ need satisfaction and frustration from T1 to T2 and between 7 and 8th graders. The assumptions of sphericity, inter-correlation and homogeneity of the variances were tested using Mauchly, Box’s *M*, and Levene’s tests.

To examine the mediation hypotheses, we used a growth curve multilevel modeling (GCMLM) strategy, with restricted maximum likelihood estimation, using the SPSS-mixed procedure modeling (Peugh & Enders, 2005) dictated by the nested nature of the data (time within individuals). We examined the indirect effects through bootstrapping analyses using 10,000 resamples with a 95% confidence level. The indirect effect coefficient is significant when the confidence interval (CI) values do not include zero.

Results

Measurement model

A confirmatory factor analysis (CFA) tested the convergence of the items into factors. The measurement model was composed of 18 latent factors pertaining to the four teaching

styles, need satisfaction, need frustration, and the three constructs of motivation, at each time point. All the latent variables at T1 and T2 were assessed by two parcels of items. The motivation and needs-experience items were randomized into one of the two parcels. For the SIS-Q variables (autonomy support, structure, control, and chaos), we created 8 parcels according to the structure of these variables as recommended by Aelterman et al. (2019) so that each of these variables included two sub-scales. Items were assigned to the relevant parcels: autonomy supportive — participative and attuning; structuring — guiding and clarifying, controlling demanding and domineering; and chaotic — abandoning and awaiting. We used parcels to create a reasonable ratio of observed indicators with respect to the sample size (Bagozzi & Edwards, 1998; Bandalos & Finney, 2001). The results indicated an adequate fit to the data, $\chi^2(344)=1236.30$, $p<0.001$, NFI=0.90, CFI=0.93, RMSEA=0.07. Parcel loadings onto their respective factors were all strong and statistically significant and ranged from 0.57 to 0.98 (see Table 1), which validated the measurement model.

Descriptive statistics and preliminary analyses

The descriptive statistics and bivariate correlations are presented in Table 2.

Rank order stability

To examine the rank-order stability of the research variables over time, we conducted path analyses using AMOS24 (Arbuckle, 2006). The model included all variables at T1 and T2. All variables were correlated separately at T1 and also at T2. A direct path from each variable at T1 and T2 was also added to the model. The model fit to the data was acceptable ($\chi^2(344)=1236.30$, $p<0.001$; CFI=0.90; RMSEA=0.07). Overall, the model indicated rank-order stability of all the variables: perceived autonomy support ($\beta=0.65$, $B=0.56$, $SE=0.05$, $t=10.41$, $p<0.001$), perceived structure ($\beta=0.64$, $B=0.53$, $SE=0.04$, $t=13.71$, $p<0.001$), perceived control ($\beta=0.68$, $B=0.51$, $SE=0.05$, $t=10.73$, $p<0.001$), perceived chaos ($\beta=0.62$, $B=0.24$, $SE=0.04$, $t=5.61$, $p<0.001$), need satisfaction ($\beta=0.36$, $B=0.37$, $SE=0.05$, $t=7.92$, $p<0.001$), need frustration ($\beta=0.58$, $B=0.82$, $SE=0.10$, $t=8.39$, $p<0.001$), autonomous motivation ($\beta=0.74$, $B=0.90$, $SE=0.08$, $t=10.46$, $p<0.001$), controlled motivation ($\beta=0.66$, $B=0.86$, $SE=0.09$, $t=9.32$, $p<0.001$), and a-motivation ($\beta=0.38$, $B=0.30$, $SE=0.03$, $t=9.42$, $p<0.001$).

Mean level changes

To investigate changes in students' motivation, experiences of need satisfaction, and perceptions of their teachers' motivating styles from the beginning to the end of the year and between the two grades, we performed two-way ANOVAs with repeated measures with *group* (7th graders vs. 8th graders) as the between variable and *time* (the beginning of school year (T1) vs. the end of year (T2)) as the within variable for each of the variables (see Table 3). The results indicated that the assumptions of homogeneity of the variances, intercorrelations, and sphericity were not violated because the Mauchly, Box *M*, and Levene tests were not significant.

Table 1 Results of Confermatory Factor Analyses

			β	B	S.E	t	p
Controlled motivation T1	→	Parcel 1 controlled motivation T1	.66	.79	.06	12.05	<.001
Controlled motivation T1	→	Parcel 2 controlled motivation T1	.73	1.25	.10	12.05	<.001
Need satisfaction T1	→	Parcel 1 need satisfaction T1	.79	.97	.05	16.32	<.001
Need satisfaction T1	→	Parcel 2 need satisfaction T1	.98	1.02	.06	16.36	<.001
Need frustration T1	→	Parcel 1 need frustration T1	.57	.69	.07	10.23	<.001
Need frustration T1	→	Parcel 2 need frustration T1	.87	1.43	.14	10.23	<.001
Perceived autonomy support T1	→	Parcel 1 perceived autonomy support T1	.89	1.14	.07	15.23	<.001
Perceived autonomy support T1	→	Parcel 2 perceived autonomy support T1	.63	.87	.05	15.23	<.001
Perceived control T1	→	Parcel 1 perceived control T1	.77	1.30	.10	12.88	<.001
Perceived control T1	→	Parcel 2 perceived control T1	.68	.77	.06	12.88	<.001
Perceived structure T1	→	Parcel 1 perceived structure T1	.85	1.16	.05	23.27	<.001
Perceived structure T1	→	Parcel 2 perceived structure T1	.85	.85	.03	23.27	<.001
Autonomous motivation T1	→	Parcel 1 autonomous motivation T1	.74	.82	.06	14.10	<.001
Autonomous motivation T1	→	Parcel 2 autonomous motivation T1	.76	1.20	.08	14.10	<.001
Perceived chaos T1	→	Parcel 1 perceived chaos T1	.96	2.20	.33	6.63	<.001
Perceived chaos T1	→	Parcel 2 perceived chaos T1	.42	.45	.06	6.63	<.001
Controlled motivation T2	→	Parcel 1 controlled motivation T2	.76	1.18	.09	12.21	<.001
Controlled motivation T2	→	Parcel 2 controlled motivation T2	.68	.84	.06	12.20	<.001
Need satisfaction T2	→	Parcel 1 need satisfaction T2	.98	1.11	.10	10.96	<.001
Need satisfaction T2	→	Parcel 2 need satisfaction T2	.66	.90	.08	10.96	<.001
Need frustration T2	→	Parcel 1 need frustration T2	.81	1.55	.16	9.62	<.001
Need frustration T2	→	Parcel 2 need frustration T2	.55	.64	.06	9.61	<.001
Perceived autonomy support T2	→	Parcel 1 perceived autonomy support T2	.54	.87	.07	12.82	<.001
Perceived autonomy support T2	→	Parcel 2 perceived autonomy support T2	.88	1.14	.09	12.81	<.001
Perceived control T2	→	Parcel 1 perceived control T2	.71	.87	.07	12.62	<.001
Perceived control T2	→	Parcel 2 perceived control T2	.73	1.14	.09	12.74	<.001
Perceived structure T2	→	Parcel 1 perceived structure T2	.79	.77	.08	14.28	<.001
Perceived structure T2	→	Parcel 2 perceived structure T2	.87	1.30	.06	21.58	<.001
Autonomous motivation T2	→	Parcel 1 autonomous motivation T2	.67	.83	.06	12.14	<.001
Autonomous motivation T2	→	Parcel 2 autonomous motivation T2	.70	.88	.07	12.29	<.001
Perceived chaos T2	→	Parcel 1 perceived chaos T2	.64	.79	.06	11.34	<.001
Perceived chaos T2	→	Parcel 2 perceived chaos T2	.91	2.90	.49	5.81	<.001

Table 2 Descriptive statistics and correlations between the research variables

	Mean (sd)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Autonomy supportive style T1	4.74 (1.24)	1																	
2. Autonomy supportive style T2	4.49 (1.28)	.51**	1																
3. Structuring style T1	4.91 (1.18)	.83**	.48**	1															
4. Structuring style T2	4.71 (1.19)	.48**	.81**	.52**	1														
5. Controlling style T1	4.26 (1.13)	.34***	.11**	.39***	.16***	1													
6. Controlling style T2	4.25 (1.08)	.15***	.22***	.17***	.30***	.45***	1												
7. Chaotic style T1	3.01 (1.12)	.02	-.03	-.05	-.07	.35***	.23***	1											
8. Chaotic style T2	3.19 (1.03)	-.04	-.01	-.07	-.13**	.26***	.39***	.45**	1										
9. Need satisfaction T1	3.92 (.73)	.33**	.15**	.35**	.16**	.09	.01	-.02	-.08	1									
10. Need satisfaction T2	3.82 (.74)	.22**	.29**	.17**	.30**	-.01	.09	-.02	-.05	.33**	1								
11. Need frustration T1	2.47 (.83)	-.04	.01	-.07	-.04	.21***	.16***	.38**	.31**	-.37**	-.21**	1							
12. Need frustration T2	2.63 (.88)	-.07	.02	-.09	-.02	.13**	.27***	.20**	.39**	-.25**	-.30**	.40**	1						
13. Autonomous motivation T1	3.73 (.80)	.43**	.30**	.48**	.30**	.01	.11	-.02	-.06	.49**	.26**	-.18**	-.16**	1					
14. Autonomous motivation T2	3.62 (.88)	.23**	.39**	.22**	.43**	.05	.12	-.04	-.13**	.31**	.44**	-.17**	-.19**	.54**	1				
15. Controlled motivation T1	2.44 (.89)	.09	.05	.09	.05	.34***	.30**	.35***	.27***	-.04	-.11*	.45**	.30**	.09	-.01	1			
16. Controlled motivation T2	2.53 (.96)	-.05	.07	-.05	.07	.13**	.33**	.16**	.36**	-.06	-.02	.19**	.43**	.02	.04	.50***	1		
17. A-motivation T1	1.78 (1.05)	-.07	-.01	-.13**	-.07	.13**	.12**	.37**	.32**	-.25**	-.15**	.46**	.27**	-.38**	-.27**	.39***	.18**	1	
18. A-motivation T2	1.95 (1.02)	-.11*	-.09	-.15**	-.14**	.13**	.23***	.16**	.44**	-.25**	-.27**	.26**	.52**	-.32**	-.41**	.19***	.42**	.33**	1

N = 472

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

Table 3 Mean level of research variables between groups at T1 and T2

Variable	Mean (<i>s.d.</i>)				$F^*, p (q^2, p)$		
	T1		T2		Main effect — time	Main effect — group	Interaction
	7th graders	8th graders	7th graders	8th graders			
Motivation							
Autonomous motivation	3.84 (.74)	3.62 (.84)	3.70 (.82)	3.54 (.89)	$F = 7.96, p = .005 (.03)$	$F = 6.86, p = .009 (.01)$	$F = .55, p = .45 (.001)$
Controlled motivation	2.66 (.85)	2.49 (.86)	2.69 (.87)	2.61 (.91)	$F = 2.90, p = .08 (.01)$	$F = 2.88, p = .09 (.01)$	$F = 1.36, p = .24 (.003)$
A-motivation	1.73 (.96)	1.85 (1.17)	1.86 (1.00)	2.04 (1.04)	$F = 7.75, p = .006 (.02)$	$F = 3.29, p = .07 (.01)$	$F = .25, p = .61 (.000)$
Need-based experiences							
Need satisfaction	4.01 (.69)	3.83 (.77)	3.91 (.73)	3.73 (.76)	$F = 4.79, p = .02 (.02)$	$F = 8.81, p = .003 (.03)$	$F = .008, p = .92 (.000)$
Need frustration	2.42 (.83)	2.54 (.83)	2.57 (.91)	2.71 (.85)	$F = 11.65, p < .001 (.03)$	$F = 3.13, p = .07 (.01)$	$F = .02, p = .86 (.000)$
Teaching styles							
Autonomy supportive style	4.82 (1.22)	4.62 (1.28)	4.44 (1.38)	4.57 (1.12)	$F = 13.81, p = .001 (.03)$	$F = .12, p = .72 (.001)$	$F = 8.08, p = .005 (.02)$
Structuring style	5.03 (1.17)	4.74 (1.18)	4.72 (1.22)	4.69 (1.15)	$F = 40.48, p = .001 (.02)$	$F = 5.80, p = .10 (.001)$	$F = 5.61, p = .02 (.01)$
Controlling style	4.42 (1.13)	4.05 (1.10)	4.35 (1.05)	4.08 (1.09)	$F = .09, p = .75 (.001)$	$F = 13.13, p = .000 (.03)$	$F = .66, p = .42 (.000)$
Chaotic style	3.04 (1.16)	2.97 (1.05)	3.24 (1.06)	3.12 (.98)	$F = 10.97, p = .001 (.03)$	$F = 1.34, p = .25 (.001)$	$F = .29, p = .59 (.000)$

* DF of ANOVA was (1, 463)

Changes in students' motivation

Consistent with H1a, students' autonomous motivation (AM) showed a significant main effect for time and for group, with higher AM in 7th graders and a significant decrease in students' AM during the school year for both 7th and 8th graders. No significant interaction effect was found. However, disconfirming H1b, students' controlled motivation (CM) showed a non-significant main effect for time, for group and no interaction effect. Partially consistent with H1c, students' a-motivation showed a significant main effect for time, with a significant increase in students' a-motivation during the school year. No significant main effect for group and no interaction effect were found.

Changes in perceived teachers' motivating styles

Partially consistent with H2a, students' perception of their teacher as autonomy-supportive or structuring decreased significantly during the school year. No significant main effect for group was found. Although not hypothesized, two interesting group \times time interaction effects were significant. There was a greater decrease in perceived teachers' autonomy-supporting style during the school year for 7th graders than for 8th graders (see Fig. 1). In addition, although 7th graders reported a significant decrease in their perception of their teacher as providing structure during the school year, 8th graders did not (see Fig. 2). H2b was also partially confirmed. Students' perception of their teacher as chaotic increased significantly over the course of the school year, but students' perception of their teacher as controlling did not change significantly during the academic year. A significant main effect for group was only found for students' perception of their teacher as controlling, where 7th graders perceived their teacher as more controlling than 8th graders.

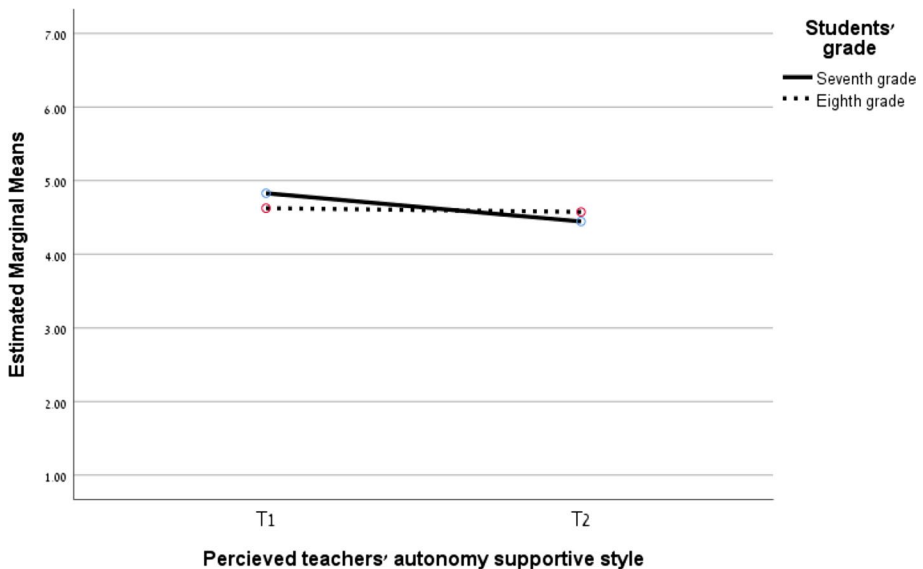


Fig. 1 Mean changes in perceived teachers' autonomy supportive style as a function of grade

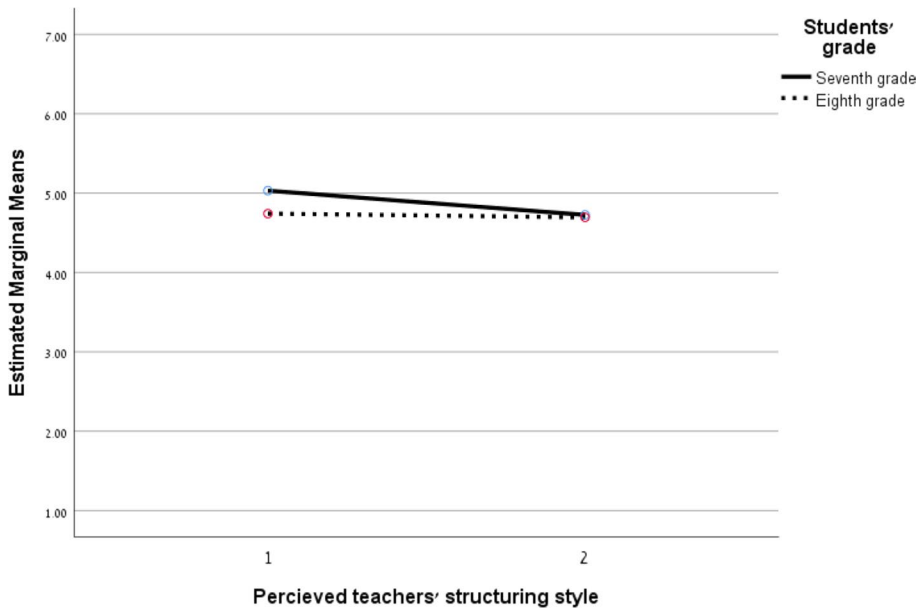


Fig. 2 Mean changes in perceived teachers' structuring style as a function of grade

Changes in students' need-based experience

Consistent with H3a, students' experience of need satisfaction showed a significant main effect for time and for group, with higher needs satisfaction in 7th graders, and a significant decrease in students' needs satisfaction during the school year for both 7th and 8th graders. No significant interaction was found. Partially consistent with H3b, students' experience of need frustration significantly increased during the academic year. No significant main effect for group or interaction effect was found.

Growth curve multilevel modeling to assess the hypothesized mediation model

A growth curve model was tested using time as a time-invariant predictor. Time was centered to the first measurement time point to improve the interpretation of the intercept. Slopes for time were allowed to vary across individuals.

We conduct 3 GCMLM analyses (see Figs. 3, 4 and 5), one for each dependent variable: autonomous motivation, controlled motivation, and a-motivation. Because the correlation between autonomy supportive and structure was too high (above 0.80), including both in the analyses simultaneously would have caused multicollinearity problems. Therefore, we decided to average these two motivating types into a combined variable dubbed "motivating style." We also combined the controlling and chaotic motivating styles into one variable refers to "demotivating styles." Each analysis included teachers' motivating and demotivating styles as the independent variables. Needs satisfaction and need frustration were the mediating variables and motivation to study was the outcome variable. To examine the mediating role of students' needs-based experience, we examined whether changes in

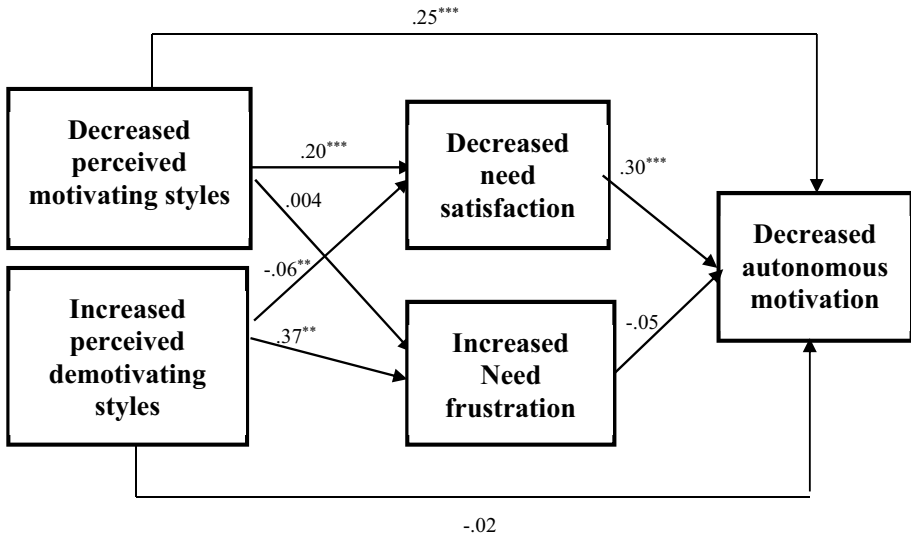


Fig. 3 Results of growth curve MLM to predict autonomous motivation. Note: unstandardized coefficients are displayed. $*p < .05$, $**p < .01$, $***p < .001$

teachers' motivating and demotivating styles predicted changes in students' need experience (a path). Next, we performed a series of analyses to determine whether significant changes occurred across time in students' autonomous, controlled and a-motivation. Then, we evaluated the direct effect between changes in teachers' motivating styles and the changes in students' motivation to study (c path). Finally, we examined whether changes in

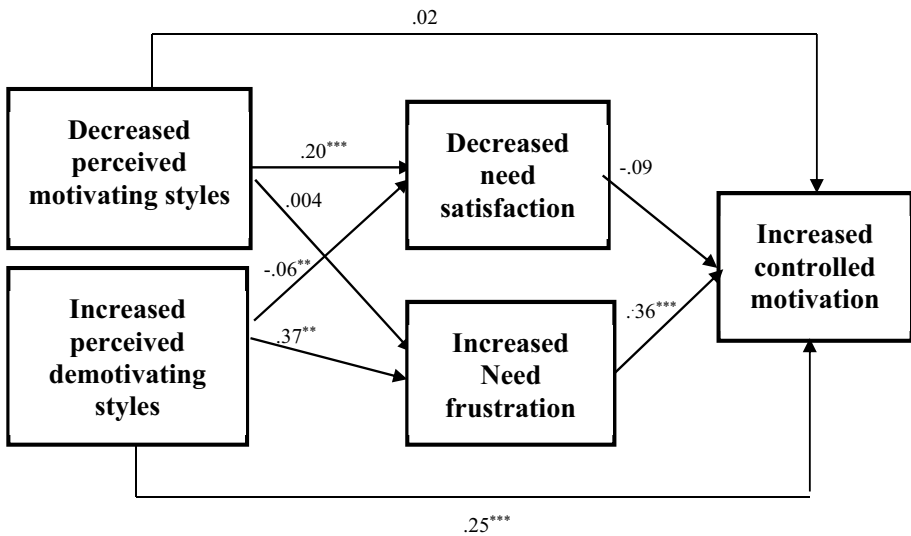


Fig. 4 Results of growth curve MLM to predict controlled motivation. Note: unstandardized coefficients are displayed. $*p < .05$, $**p < .01$, $***p < .001$

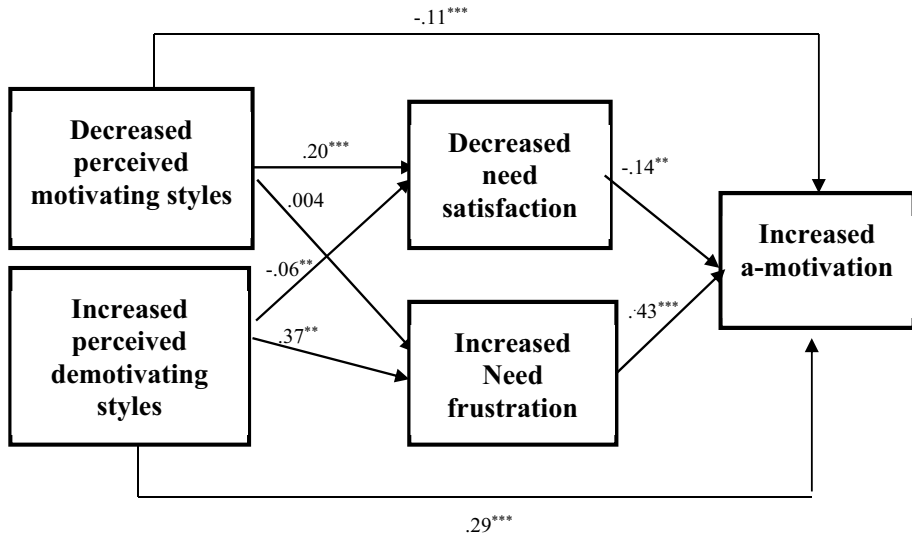


Fig. 5 Results of growth curve MLM to predict a-motivation. Note: unstandardized coefficients are displayed. * $p < .05$, ** $p < .01$, *** $p < .001$

teachers' motivating styles and changes in students' needs-based experience were associated with changes in students' motivation (b and c' paths). We examined the significance of the indirect effect of the mediation model using bootstrapping methods by calculating the CI.

First, we tested the ICC of each dependent variable. We examined an unconditional model (models without predictors) to examine the percentage of variance resulting from differences between students' autonomous, controlled, and a-motivation. The ICC analyses revealed that individual differences between students accounted for 52% of the autonomous motivation variance ($\tau = 0.36$, Wald $Z = 9.52$, $p < 0.001$), 48% of the controlled motivation variance ($\tau = 0.37$, Wald $Z = 9.05$, $p < 0.001$), and 32% of the a-motivation variance ($\tau = 0.35$, Wald $Z = 6.39$, $p < 0.001$).

Next, we examined all a-paths. We examined whether changes in teachers' motivating and demotivating styles predicted changes in students' needs-based experience. The analyses showed that the decrease in teachers' motivating styles was positively associated with the decrease in students' need satisfaction ($B = 0.20$, $SE = 0.02$, $t = 0.01$, $p < 0.001$); however, the increase in teachers' demotivating styles was not significantly associated with the decrease in students' needs satisfaction ($B = -0.004$, $SE = 0.02$, $t = -0.15$, $p = 0.87$). The analyses indicated a significant positive association between the increase in teachers' demotivating styles and the increase in students' need frustration ($B = 0.37$, $SE = 0.03$, $t = 11.57$, $p < 0.001$) and a significant negative association between the decrease in teachers' motivating styles and the increase in students' needs frustration ($B = -0.06$, $SE = 0.02$, $t = -2.57$, $p = 0.01$).

The first analyses to predict students' changes in autonomous motivation indicated a significant decrease in students' autonomous motivation across time ($B = -0.11$, $SE = 0.03$, $t = -2.94$, $p = 0.003$). The direct effect between the decrease in motivating styles and the decrease in autonomous motivation was found to be significant ($B = 0.31$, $SE = 0.02$, $t = 13.74$, $p < 0.001$); however, the direct effect between teachers' demotivating styles and

students' autonomous motivation was not significant ($B = -0.003$, $SE = 0.02$, $t = -0.11$, $p = 0.91$).

The decrease from the beginning to the end of the school year in students' perception of their teacher as using motivating styles ($B = 0.25$, $SE = 0.02$, $t = 11.31$, $p < 0.001$) and students' needs satisfaction ($B = 0.30$, $SE = 0.03$, $t = 8.75$, $p < 0.001$) was positively associated with the decrease in their autonomous motivation. The increase in teachers' demotivating styles ($B = 0.02$, $SE = 0.02$, $t = 0.65$, $p = 0.51$) and students' needs frustration ($B = -0.05$, $SE = 0.03$, $t = -1.90$, $p = 0.06$) were not significantly associated with the decrease in students' autonomous motivation. There were no significant differences between 7 and 8th graders ($B = -0.10$, $SE = 0.06$, $t = -1.14$, $p = 0.09$). The increase in teachers' motivating styles and students' need satisfaction explained 50% of the autonomous motivation variance ($\tau = 0.19$, Wald $Z = 6.16$, $p < 0.001$).

Then, we tested the indirect effects of teachers' motivating styles on students' autonomous motivation via students' needs satisfaction. Bootstrapping analyses with 10,000 resamples were used to calculate the CIs of the indirect effect distributions to determine whether the indirect effect was unlikely to be zero. The analyses revealed that the indirect association between the decrease in motivating styles and the decrease in autonomous motivation via the decrease in needs satisfaction was significant (unstandardized indirect effect = 0.06, 95% CI [0.04, 0.10]). Accordingly, H4a was confirmed. The decrease in students' need satisfaction partially mediated the association between the decrease in teachers' motivating styles and students' autonomous motivation.

The second analysis to predict students' changes in controlled motivation indicated a non-significant increase in students' controlled motivation across time ($B = 0.06$, $SE = 0.04$, $t = 1.58$, $p = 0.11$). The direct effect between the increase in demotivating styles and controlled motivation was found to be significant ($B = 0.38$, $SE = 0.03$, $t = 11.83$, $p < 0.001$); however, the direct effect between teachers' motivating styles and students' controlled motivation was not significant ($B = -0.02$, $SE = 0.02$, $t = -0.90$, $p = 0.36$). The increase from the beginning to the end of the school year in students' perception of their teacher as using demotivating styles ($B = 0.25$, $SE = 0.03$, $t = 7.55$, $p < 0.001$) and students' needs frustration ($B = 0.36$, $SE = 0.03$, $t = 10.79$, $p < 0.001$) was positively associated with controlled motivation. The decrease in teachers' motivating styles ($B = 0.02$, $SE = 0.02$, $t = 0.92$, $p = 0.36$) and students' needs satisfaction ($B = -0.09$, $SE = 0.03$, $t = -1.66$, $p = 0.07$) were not significantly associated with students' controlled motivation. There was no significant difference between 7 and 8th graders ($B = -0.06$, $SE = 0.06$, $t = -1.10$, $p = 0.27$). The increase in teachers' demotivating styles and students' needs frustration explained 43% of the controlled motivation variance ($\tau = 0.21$, Wald $Z = 5.79$, $p < 0.001$).

Tests of the indirect effect revealed that the indirect association between the increase in demotivating styles and the increase in controlled motivation via the increase in needs frustration was significant (unstandardized indirect effect = 0.13, 95% CI [0.09, 0.17]). Accordingly, H4b was confirmed. The increase in needs frustration partially mediated the association between teachers' demotivating styles and students' controlled motivation.

The third analysis to predict students' changes in a-motivation indicated a significant increase in students' a-motivation across time ($B = 0.16$, $SE = 0.05$, $t = 2.72$, $p = 0.007$). The direct effect between the increase in demotivating styles and the increase in a-motivation was found to be significant ($B = 0.45$, $SE = 0.03$, $t = 11.49$, $p < 0.001$). In addition, the direct effect between teachers' motivating styles and students' a-motivation was also significant ($B = -0.16$, $SE = 0.02$, $t = -5.47$, $p < 0.001$).

The increase from the beginning to the end of the school year in students' perception of their teacher as using demotivating styles ($B = 0.29$, $SE = 0.03$, $t = 7.43$, $p < 0.001$) and

students' needs frustration ($B=0.43$, $SE=0.03$, $t=10.86$, $p<0.001$) was positively associated with the increase in their a-motivation. The decrease in teachers' motivating styles ($B=-0.11$, $SE=0.02$, $t=-3.88$, $p<0.001$) and students' needs satisfaction ($B=-0.14$, $SE=0.04$, $t=-3.08$, $p=0.002$) were negatively associated with the increase in students' a-motivation. In addition, there was a significant difference between 7 and 8th graders ($B=0.15$, $SE=0.06$, $t=2.35$, $p=0.02$). Eighth grade students reported a greater increase in their a-motivation than 7th grade students. The increase in teachers' motivating and demotivating styles and students' needs satisfaction and frustration explained 28% of the a-motivation variance ($r=0.25$, Wald $Z=5.27$, $p<0.001$).

Tests of the indirect effect revealed that the indirect association between the increase in demotivating styles and the increase in a-motivation via the increase in needs frustration was significant (unstandardized indirect effect = 0.16, 95% CI [0.14, 0.24]). The indirect association between the decrease in motivating styles and the increase in a-motivation via the decrease in needs satisfaction was significant (unstandardized indirect effect = -0.03, 95% CI [-0.10, -0.04]). The indirect association between the decrease in motivating styles and the increase in a-motivation via the increase in needs frustration was not significant (unstandardized indirect effect = -0.02, 95% CI [-0.04, 0.01]). Accordingly, H4c was confirmed. The increase in students' needs frustration partially mediated the association between the increase in teachers' demotivating styles and the increase in students' a-motivation. Furthermore, the decrease in students' need satisfaction partially mediated the decrease in teachers' motivating styles and the increase in their a-motivation.

Discussion

A decrease in students' motivation quality can have various negative cognitive, emotional, and behavioral consequences. This study explored the patterns of change within and between grades in students' motivation, their perception of their teachers' style, and the extent to which they experienced their needs as satisfied or frustrated. We then investigated possible mechanisms accounting for changes in students' motivation. We posited that changes in teachers' motivating style would be associated with students' experiences of their needs as satisfied or frustrated, which in turn would be associated with the quality of motivation they manifested in class.

Changes throughout the school year

Students reported a significant decrease in their autonomous motivation and an increase in a-motivation, from the beginning to the end of the academic year. There were also significant changes in the students' perception of their teachers' style and their experiences of need satisfaction and frustration. Students perceived their teachers as less autonomy-supportive, providing less structure, and being more chaotic at the end of the year than at the beginning. The students also reported lower levels of need satisfaction and higher levels of need frustration at the end of the year. These results suggest that overall, the class climate and students' motivational functioning worsened by the end of the year. The only variable that was very high at the beginning of the year in both age groups and did not change at the end of the year was students' perception of their teachers as controlling. This may suggest that teachers are perceived as (highly) controlling by students in these two age groups starting from the very beginning of the year, and as the school year progresses, the

teachers do not become more (or less) controlling. One possible explanation is the continuous stress teachers face, regardless of the time of the year or grade, which may lead them to use controlling strategies with their students (Pelletier et al., 2002). Another explanation is related to adolescent development since adolescents naturally demand more autonomy and respond more strongly to controlling behavior from adults (Jensen & Dost-Gözkın, 2015; Pérez et al., 2016).

The mediating role of need satisfaction and frustration

When students reported a decrease (from the beginning to the end of the year) in their perception of their teachers as using motivating styles, they also reported a decrease in the satisfaction of their needs for relatedness, competence, and autonomy and, in turn, a decrease in their autonomous motivation and an increase in their a-motivation. When students reported an increase in their perception of their teachers as using demotivating styles, they also reported an increase in the frustration of their needs for relatedness, competence, and autonomy and in turn, an increase in a-motivation and controlled motivation.

The present study is innovative in that it simultaneously investigated the “bright” and “dark” pathways of motivation (Vansteenkiste & Ryan, 2013). The findings showed that each path makes a separate and significant contribution to students' quality of motivation. When teachers actively behave in a demotivating manner, this generates greater need frustration in their students and undermines their need satisfaction. When teachers force students to behave in a certain way, they actively deny students' true sense of autonomy, competence, and relatedness, thereby weakening a significant source of volitional motivation naturally required for quality learning. Furthermore, when teachers behave in a less motivating manner, it undermines students' need satisfaction, but it does not predict high need frustration.

These results underscore the importance of changes in teachers' motivating styles when accounting for changes in students' quality of motivation. It is not surprising that teachers are less supportive at the end of the year since teachers tend to experience high psychological exhaustion (Fernet et al., 2012; Pas et al., 2012), which leaves them with few resources to support their students (Klaeijns et al., 2018). They may react to pressures from the school administration to complete the curriculum and meet performance standards (Pelletier et al., 2002; Taylor et al., 2009) and in response to students' disruptive behaviors and (lack of) motivation (Pelletier et al., 2002; Shen et al., 2015) and, thus, engage in less autonomy-supportive and more chaotic behaviors (Pelletier et al., 2002). Because homeroom teachers in Israel are often responsible for 30–40 students, they are exposed to high levels of stress. This may lead to greater burnout and greater use of de-motivating styles (Moè & Katz, 2020).

At the end of the year, students no longer feel obligated to commit to the learning process, have less energy to invest in learning, they feel tired, and are eager for the summer vacation, making them invest even less in learning (e.g. Bartholomew et al., 2018; Gnambs & Hanfstingl, 2016; Opendakker et al., 2012). During this time, teachers find it challenging to motivate students, because they are tired themselves and feel depleted. These may lead them to feel that they have lost control over the situation and lead them to give up more easily, thus adopt a chaotic teaching styles (e.g. (Vansteenkiste & Ryan, 2013; De Meyer et al., 2016), and use less motivating styles.

Differences between 7 and 8th grades

There were few mean-level differences between the 7th- and 8th-grade students. As reported in previous studies, 7th graders reported more autonomous motivation and less a-motivation than 8th graders. However, 7th graders also reported higher controlled motivation than 8th graders, which contradict the assumption of a decline in motivational quality. This may be explained by 7th graders' transition from elementary to middle school. The new educational environment is considered less supportive, more controlling, and much more stressful than elementary school (Katz et al., 2010). They experience pressure from the high expectations and demands that differ from what they were used to in elementary school (Grills-Taquechel et al., 2010). When entering middle school, 7th graders may expect a familiar kind of autonomy-support and structure as in elementary school, which may explain the greater decrease in their perception of the teacher as less autonomy-supportive and structured as the year progresses. The 8th graders start the year with a more realistic perception of support provided by the teacher, which was reflected in their perception of support provided and in the lesser decrease throughout the academic year. Eighth graders reported lower need satisfaction and higher need frustration than 7th graders. Much like the decrease in autonomous motivation and the increase in a-motivation between 7 and 8th graders, it was also reflected in the students' experience of need satisfaction and frustration. This can be explained in terms of the decreases in students' perception of the teacher as autonomy-supportive and structuring, whereas their perception of the teacher as chaotic increased throughout the year in 7th and 8th grade, mirrored in overall less need satisfaction and greater need frustration in 8th grade.

The hypothesized mediation model was found to be equivalent for students in 7th and 8th grades, suggesting that although there were some differences between these groups, the pattern of relations between these variables was similar. Thus, the decline in teachers' supportive behaviors towards their students account to some extent for the students' drop in motivation since the students experienced their needs as less satisfied.

Theoretical and practical implications

The findings confirm previous studies highlighting the importance of keeping students' needs satisfied throughout the school year because need satisfaction is closely associated with level of motivation (Bartholomew et al., 2018) engagement (Aelterman et al., 2019) and emotional adjustment (Ryan & Deci, 2020). This study is innovative by showing that *the shifts* in teachers' behavior account for the unwanted decline in students' motivation. The results point to the need for interventions to keep teachers better motivated and thus motivating throughout the school year, especially at the end of the year when the stressors are high, and their resources get increasingly more depleted. As suggested in previous studies (Aelterman et al., 2019; Vansteenkiste et al., 2020; Moè & Katz, 2020; Eyal & Roth, 2011; Reeve, 2009), these interventions should focus on teachers' own experiences of need satisfaction. When teachers' needs are satisfied, they have more resources to support their students' needs and motivate them (Moè & Katz, 2020). Thus, teachers' emotional challenges must be acknowledged, and they may be provided with opportunities for consultation and consistent backup from peers and the school administration. Peer-support groups may be one good solution since, in these

groups, teachers have the opportunity to open up with colleagues, discuss their feelings and thoughts, feel supported and reduce stress and burnout. The burden of dealing with 30–40 students must be acknowledged. A broader system of support for students beyond the homeroom teacher could help alleviate the time, and effort teachers must devote to their students. This support could be provided by peer-mentors, educational counselors, or psychologists.

Limitations and future studies

This study has limitations that should be acknowledged. Although students' perceptions of their teachers' behavior are considered the most proximal predictors of motivational outcomes, in future studies, multiple sources (teachers or observers) could be used to gain greater insights into teachers' motivating styles. The results were based on a sample of 7th and 8th grade secular Israeli homeroom teachers and their students. While the participants were all recruited from secular Jewish communities considered Western and individualistic, future studies should consider other cultural orientations to achieve increased generalizability. Future studies could also include students from a broader range of classes, such as high school and primary school. The first wave of data was collected at the beginning of the school year, which raises the possibility that students were not yet fully acquainted with their teacher's behavior. It would thus be advisable to collect the data later in the year to allow students to become more familiar with their teacher.

Another limitation is the measure used to assess the SDT motivational continuum: the items did not differentiate between integrated and identified regulation. Since studies have suggested that integrated regulation has a specific strong effect on adaptive outcomes (Burgueño et al., 2017; Silva et al., 2018), future studies should include it as a separate predictor. Finally, the results should be interpreted with caution given that all the participating teachers were women and the fact that no social-desirability measure was used to control for self-presentation concerns or social desirability bias.

Conclusion

The current findings suggest that the decrease in students' motivation may be explained by changes in their teachers' motivating behaviors in the classroom. This insight should encourage teachers to be more aware of their changes in behavior and the effects that these changes can have on their students' motivation.

The findings contribute to a better understanding of changes in students' motivation. The two-point measure and cross-sectional data collection allow an in-depth look at changes over time. Unlike previous studies, we tested a comprehensive model incorporating the four SDT teaching styles, students' experience of need satisfaction and frustration, and autonomous and controlled motivation, which shed new light on the relationships between these variables.

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Data availability The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Conflict of interest The authors declare no competing interests.

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Cohen, R., Kanat-Maymon, Y., Shoshani, A., Moed, A., & Roth, G. (2019). Teachers' positive and negative conditional regard: the association to students' need satisfaction and agentic engagement. *Journal of Youth and Adolescence*. 1-14.

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