

The longitudinal development of students' well-being in adolescence: The role of perceived teacher autonomy support

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Abstract

Although a decline in adolescents' well-being has repeatedly been reported, longitudinal evidence for this development is rare and time-varying factors like teacher autonomy support that could be associated with this trend have sparsely been investigated. Therefore, the present study examined how the temporal development of perceived autonomy support from their German language arts teachers is related to changes in four different facets of students' well-being. Longitudinal data from 3446 adolescents from Germany ($N_{\text{Schools}} = 178$) on five measurement points (Grades 5–9) were analyzed using latent growth curve models. Satisfaction with school, enjoyment of school, and self-rated health decreased over time, while social integration remained stable. Perceived teacher autonomy support also declined between Grades 5 and 9. Furthermore, baseline levels of perceived teacher autonomy support and facets of well-being were positively related. Finally and most importantly, our results indicated that changes in perceived teacher autonomy support were positively associated with the development of satisfaction with school, enjoyment of school, and self-rated health, but not social integration. The findings suggest that perceived teacher autonomy support plays an important role in the development of students' well-being in adolescence.

KEYWORDS

adolescence, longitudinal development, students' well-being, teacher autonomy support

INTRODUCTION

Numerous studies report a decrease in general (Casas & González-Carrasco, 2019; Shek & Liang, 2018) and school-specific (Hagenauer & Hascher, 2010; Tian et al., 2013) well-being during adolescence. According to stage–environment fit theory (Eccles et al., 1993; Eccles & Midgley, 1989), this worrisome trend might be at least partly explained by a mismatch between students' needs during the developmental phase and the opportunities provided by the school environment. Students' need for autonomy increases during adolescence due to physical and cognitive changes as well as shifts in and expansions of social relationships (Zimmer-Gembeck & Collins, 2003). As the fulfillment of students' basic psychological needs for competence, relatedness, and autonomy is central for their well-being (cf., Ryan & Deci, 2000), it is

important for the school context to provide opportunities for students to satisfy these needs. Autonomy support by teachers can be a means of preventing negative developments in students' well-being. Perceived teacher autonomy support has been empirically shown to address students' basic psychological needs (Yu et al., 2016) and to be positively related to students' well-being (Chirkov & Ryan, 2001; Diseth & Samdal, 2014; Ferguson et al., 2011). According to stage–environment fit theory, the decline in students' well-being might be theoretically explained by the school environment becoming less responsive to students' psychological needs, which would be reflected in a decline in perceived teacher autonomy support. However, existing research is not sufficient to answer this question: First, more longitudinal studies are needed to examine the development of students' well-being during adolescence. Second, a concurrent focus

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on the temporal development of factors relevant to the satisfaction of students' needs, especially the need for autonomy, could help us learn more about the conditions affecting the development of students' well-being. Therefore, based on stage–environment fit theory, the present study examined whether there is a negative trend in students' well-being during adolescence and whether it is related to changes in perceived teacher autonomy support.

THEORETICAL BACKGROUND

Students' well-being

In the past few decades, there has been increasing interest in students' well-being. This burgeoning field of research is based on established conceptualizations of adult well-being (e.g., Diener, 1984; Diener et al., 2018; Ryff, 2014; Ryff & Keyes, 1995). However, scholars within this line of research have argued for an explicit consideration of the school context (Kanonire et al., 2020; Liu et al., 2015; Tobia et al., 2019). This makes sense because children and adolescents spend a lot of time in school, meaning that their well-being is highly dependent on this socialization context. Furthermore, explicitly considering the school context may help to identify weaknesses of the school system when it comes to students' well-being, which could in turn be informative for policymakers (see Kanonire et al., 2020). Students' well-being in school can be broadly defined in terms of emotions and cognitions based on their experiences in school (Hascher, 2008; Putwain et al., 2020; van Petegem et al., 2007). Furthermore, according to Hascher (2008), students' well-being in school is an indicator of a learning environment that supports their cognitive, emotional, and social development and enables them to have a qualitatively good school life. Few models have been presented to operationalize adolescents' school-related well-being (e.g., Hascher, 2004; Long et al., 2012; Renshaw et al., 2015). Hascher (2004, 2008) defined students' well-being in terms of six facets capturing four overarching components: cognitive evaluations (positive attitudes toward school and positive academic self-concept) and emotions related to school (enjoyment of school and absence of worries about school), as well as physical (absence of physical complaints in school) and social (absence of social problems in school) aspects associated with a positive school reality. Drawing upon this model, in the current study, students' well-being was defined as a multifaceted construct comprising all four overarching components. Students' cognitive evaluation of school was measured by their satisfaction with school, while students' emotions related to this context were measured by their enjoyment of school. In addition, their physical well-being was measured by their self-rated health and their social well-being by the social integration into the school class.

Satisfaction with school can be seen as a “subjective, cognitive appraisal of the overall positivity of school experiences” (Huebner & Gilman, 2006, p. 140). It has been argued to be a key aspect of children's quality of life and to

serve as an indicator of their school adjustment (Huebner & Gilman, 2006). Research indicates that it is positively associated with school connectedness (Zullig et al., 2011), academic self-efficacy (Huebner & McCullough, 2000), general life satisfaction (Ferguson et al., 2011; Huebner & Gilman, 2006), and academic achievement (Huebner & Gilman, 2006). Enjoyment of school captures positive feelings and emotions toward school and learning. In the present study, this referred to how much students like going to school and how interested they are in learning at school (Goetz et al., 2006; Gorard & See, 2011). Positive emotions regarding school can affect students' school engagement (Reschly et al., 2008) and are also important for learning, motivation, and achievement (Durlak et al., 2011; Pekrun, 2016). Self-rated health captures the physical facet of students' well-being. Health status is thought to play a critical role in people's reports on their own well-being (Diener et al., 2018). Empirically, physical health has been shown to correlate moderately to strongly with overall well-being and life satisfaction (Butler & Kern, 2016). Furthermore, physical complaints related to school have been found to be associated with higher levels of school reluctance and school absenteeism (Hascher & Hagenauer, 2020). Conversely, the absence of physical complaints related to school has been shown to be associated with higher academic achievement (Obermeier et al., 2021). Social integration is defined here as integration into the class community. Social functioning in the school community can serve as an indicator for students' well-being (Noble et al., 2008), and connectedness with peers has been empirically found to be associated with well-being (Jose et al., 2012). Furthermore, positive relationships with peers are important for students' academic accomplishments and school adjustment (Ladd et al., 1996; Wentzel, 2017; Wentzel et al., 2004).

Development of students' well-being in early adolescence

Adolescence represents a crucial period of life, as it is characterized by changes on many different levels (e.g., physical, social–emotional, and cognitive; Eccles et al., 1993; Phillips, 2017; Sawyer et al., 2012). Early adolescence—which typically refers to ages 10–15 (Phillips, 2017; Sawyer et al., 2018)—coincides with the onset of puberty and is typically accompanied by the transition from elementary to secondary school. However, this life stage seems to threaten some key psychological constructs in the school context. Alongside intrinsic motivation and competence beliefs, which have been repeatedly found to decline in various domains (Gottfried et al., 2001; Wigfield et al., 2015), evidence suggests that students' well-being is at risk as well: Cross-sectional studies from several countries have found that students' well-being starts to decline at about age 10 (Casas & González-Carrasco, 2019; González-Carrasco et al., 2017; Schütz et al., 2019). Longitudinal studies could not only substantiate these findings for early adolescents (Shek & Liang, 2018), but also suggested an increase in indicators of students'

well-being (life satisfaction, mood) in their late adolescence (Salmela-Aro & Tuominen-Soini, 2010; Steinmayr et al., 2019). Concerning the school-related well-being facets included in the present study, previous research suggests a similar picture. Studies examining school-related cognitive well-being reported higher levels of school satisfaction among elementary school children than among secondary school children (Liu et al., 2016) and among younger adolescents compared with older adolescents (Tian et al., 2013). Furthermore, Kleinkorres et al. (2020) reported in a longitudinal study that satisfaction with school was lower in Grade 7 than in Grade 5 and lower in Grade 9 than in Grade 7.¹ Studies of school-related affective well-being found that elementary school children compared with secondary school students and younger adolescents compared with older adolescents had higher levels of school-related positive affect (Liu et al., 2016; Tian et al., 2013). Moreover, a longitudinal study by Hagenauer and Hascher (2010) showed a decrease in adolescents' learning enjoyment from sixth to seventh grade. Concerning school-related physical well-being, Hascher and Hagenauer (2011) found that the absence of physical complaints related to school decreased from Grade 5 to Grade 7 and increased from Grade 7 to Grade 8. For self-rated health, likewise conflicting results have been reported: Bredidablik et al. (2009) found a stable level over time in a 4-year longitudinal study of Norwegian adolescents aged 13–19 years. Following the view of other researchers (Boardman, 2006), the authors argued that self-rated health is rather defined by the general health-related self-concept of a person than by their bodily and environmental feedback. By contrast, a cross-sectional study by Wade and Vingilis (1999) uncovered a negative trend from Grade 7 to Grade 11. With regard to social well-being in school, a cross-sectional study by Tobia et al. (2019) comparing elementary and secondary school children reported a decrease in the quality of social relationships, while average scores for social integration and school connectedness did not exhibit a negative trend in a longitudinal study by Gunn et al. (2018). The latter finding could be explained by the increasing importance and stabilization of peer relationships during adolescence (Steinberg, 2010). Overall, previous findings suggest that general and school-related cognitive and affective well-being decline during early adolescence, while there are conflicting results concerning physical and social facets of students' well-being. However, the majority of the findings comes from cross-sectional studies; therefore, more longitudinal evidence is needed.

The role of teacher autonomy support for the development of students' well-being

The stage–environment fit theory provides a possible explanation for the worrisome phenomena described above.

This theory postulates a mismatch between adolescents' needs and the opportunities provided by their environment (Eccles et al., 1993; Eccles & Midgley, 1989; Gutman & Eccles, 2007). More specifically, it is assumed that both adolescents' developmental needs and the social contexts in which they live are changing. If the social environment is responsive to these changing needs, positive outcomes are likely to occur (Booker, 2018; Eccles et al., 1993; Gutman & Eccles, 2007). By contrast, if adolescents' needs are not addressed by their social environment, this can lead to undesirable outcomes, such as lower intrinsic motivation (Eccles, 2004; Gutman & Eccles, 2007). Autonomy is a particularly central need during adolescence in light of the developmental tasks associated with this phase. Together with competence and relatedness, it constitutes the three basic psychological needs formulated within the framework of self-determination theory (Ryan & Deci, 2000; Ryan & Deci, 2020), the satisfaction of which is associated with increased intrinsic motivation and well-being, whereas their frustration threatens these outcomes (Haerens et al., 2015; Ryan & Deci, 2020). Autonomy refers to the feeling of being able to determine one's own actions without being controlled by others (Ryan & Deci, 2020). This need is satisfied, for example, in environments that offer opportunities to follow one's own interests. As the school represents one of the main contexts of socialization in adolescence, teachers play a crucial role in supporting students' needs. One critical event that frequently coincides with the onset of adolescence is the transition from elementary to secondary school. This transition often goes along with lower-quality student–teacher relationships, even though students are particularly in need of close relationships to adults other than their parents during this phase (Darling et al., 2003; Eccles et al., 1993; Wang et al., 2013). Furthermore, stage–environment fit theory states that the school environment regularly fails to match students' increasing desire for self-determination and for participation in decision-making during adolescence (Eccles et al., 1993; Phillips, 2017).

A crucial factor related to this increasing desire for self-determination, and thus the students' need for autonomy, is autonomy support. Teacher autonomy support refers to the extent to which teachers encourage their students to participate in decision-making, provide choices, and take their students' perspective into account (Adie et al., 2008; Deci & Ryan, 1985; Diseth et al., 2018; Yu et al., 2016). Ryan and Solky (1996, p. 264) argue that autonomy support satisfies not only the need for autonomy but also the needs for relatedness and competence, as it “demonstrates a valuing of and confidence in the other person, and hence facilitates a depth and richness to perceived relatedness and competence that is unmatched under conditions of controlling and coercive forms of support”. Recent studies have empirically demonstrated that autonomy support is a predictor of basic psychological needs satisfaction (Adie et al., 2008; Yu et al., 2016). Due to the close connection between basic psychological needs satisfaction and well-being (cf., Ryan & Deci, 2000),

¹Drawing on data from the NEPS, as we do, Kleinkorres et al. (2020) analyzed reciprocal relations between students' well-being and academic achievement in Grades 5, 7, and 9. Therefore, their sample is similar to ours.

it seems plausible that teacher autonomy support may be a source of students' well-being as well.

Several cross-sectional studies have found a positive relation between perceived teacher autonomy support and general indicators of well-being, such as life satisfaction, among adolescents (Chirkov & Ryan, 2001; Diseth & Samdal, 2014; Ferguson et al., 2011). Furthermore, Lan and Zhang (2019) demonstrated that perceived teacher autonomy support is positively related to positive affect and negatively related to negative affect and that it can buffer against negative feelings in adolescents who have changed schools. Studies addressing the aspects of well-being focused on in the present study have found positive associations between perceived teacher autonomy support and school satisfaction (Ferguson et al., 2011) as well as learning enjoyment (Hagenauer & Hascher, 2010). Furthermore, one study reported a positive association between autonomy support by students' physical education teachers and their subjective evaluations of health-related quality of life (Tilga et al., 2021). To date, to our knowledge, there have been no studies examining the relationship between teacher autonomy support and social integration in the class. From a theoretical perspective, as teacher autonomy support satisfies the need for relatedness, it seems plausible that it is related to social integration. Otherwise, relations with peers become increasingly important during adolescence (Steinberg, 2010) so that students' social integration might be independent of teacher autonomy support.

Evidence that students' well-being decreases because their increasing need for autonomy is not satisfied by the school environment is rare. Way et al. (2007) used cross-domain growth modeling to examine the trajectories of students' school climate perceptions and psychological and behavioral adjustment. In accordance with stage–environment fit theory, they found that perceived teacher autonomy support declined over a 3-year period. Furthermore, this decline was associated with an increase in depressive symptoms. However, Way et al. (2007) focused mainly on negative psychological outcomes from which only one was related to the school context, so more evidence on school-related well-being is needed.

Overall, to date, evidence of declines in adolescents' well-being has come mainly from cross-sectional studies, and research on the longitudinal development of school-related well-being facets is particularly rare. Furthermore, there is a lack of research on the role of need support in the form of teacher autonomy support for temporal changes in students' school-related well-being. In line with stage–environment fit theory, which postulates that adolescents' needs are increasingly poorly met as they progress through secondary school, the present study sought to examine whether there is a decline in students' well-being that is related to a decline in perceived teacher autonomy support.

The present research

Due to the vital importance of students' well-being in school, the present study aimed to examine the longitudinal

development of four different well-being facets during adolescence using data from secondary schools in Germany. Furthermore, the concurrent development of teacher autonomy support was considered to investigate its role within this context. Adolescence represents a sensitive developmental phase characterized by cognitive, emotional, physical, and social changes and associated with identity formation (Sawyer et al., 2012). Against this background, we examined four research questions (RQ). First, we examined how (a) cognitive (satisfaction with school), (b) affective (enjoyment of school), (c) physical (self-rated health), and (d) social (social integration) well-being develop over time. Drawing on stage–environment fit theory as well as previous—albeit mainly cross-sectional—findings, we had specific hypotheses (H) concerning students' cognitive and affective well-being. More precisely, we expected students' satisfaction with school (H1a), and enjoyment of school (H1b) to decrease over time on average during adolescence. Examining students' physical well-being was exploratory, as there are different possible explanations for its development: While stage–environment fit theory would argue for a declining trend in self-rated health, some researchers have argued that development is stable due to an enduring self-concept of health (Boardman, 2006; Breidablik et al., 2009). Examining students' social well-being was exploratory for the same reason: while stage–environment fit theory would argue for a declining trend, the fact that peer relations gain importance and stabilize during adolescence (Steinberg, 2010) may mean the trend is stable. In addition, conflicting results have been found in the literature regarding the development of students' physical and social well-being. In our second RQ, we examined the trend in perceived teacher autonomy support. Following stage–environment fit theory, we expected the school environment to be less responsive to students' increasing need for autonomy with each progressing year, reflected in a decreasing trend in perceived teacher autonomy support (H2). In our third and fourth RQ, we examined the relation and parallel development of perceived teacher autonomy support and the individual facets of well-being, respectively. As teacher autonomy support promotes students' sense of self-determination (cf., Deci & Ryan, 1987; Ryan & Deci, 2000), which is essential for well-being, and as it has been shown to be directly related with students' cognitive, affective, and physical well-being (Ferguson et al., 2011; Hagenauer & Hascher, 2010; Tilga et al., 2021), we hypothesized that the baseline level of perceived teacher autonomy support would be positively associated with the baseline level of students' well-being. More precisely, we expected the intercepts of teacher autonomy support and satisfaction with school (H3a), enjoyment of school (H3b), and self-rated health (H3c) to be positively associated with each other. Examining the relation between teacher autonomy support and social integration was exploratory, due to different possible explanations: On the one hand, teacher autonomy support could be associated with social integration by satisfying the need for relatedness. On the other hand, as students' peer relations become more important during adolescence (Steinberg, 2010), their social integration might

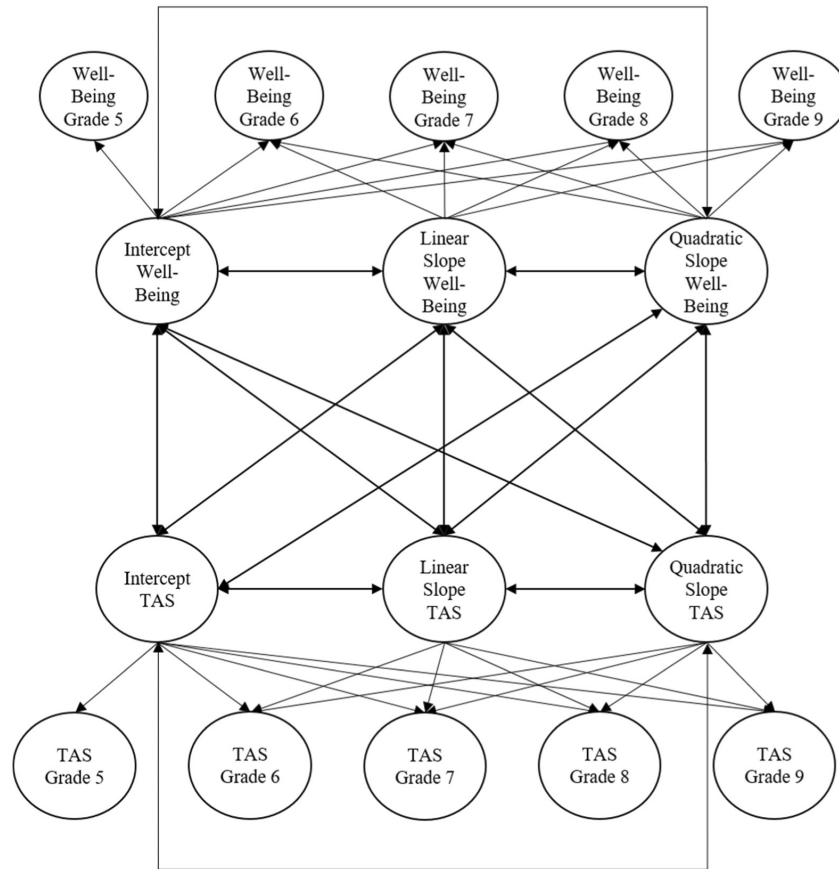


FIGURE 1 Example of the structure of the parallel process growth models. *Note:* Control variables have not been included in the figure for clarity purposes. TAS, perceived teacher autonomy support

be independent of their teacher's autonomy support. Finally and most importantly, we expected a relation between the changes over time in perceived teacher autonomy support and students' well-being. More specifically, we assumed that the longitudinal development of students' perceived teacher autonomy support would be positively associated with the longitudinal development of satisfaction with school (H4a) and enjoyment of school (H4b). Due to different explanations for the trends in self-rated health and social integration (see first RQ), examining whether changes in teacher autonomy support were related to changes in these facets of well-being was exploratory. Figure 1 shows an example of the structure of the parallel process growth models (PPGMs) used to examine our research questions and hypotheses.

METHOD

Participants

Our research questions were examined based on data from Starting Cohort 3 of the National Educational Panel Study (NEPS; Blossfeld & Roßbach, 2019), a German longitudinal study designed to investigate students' educational trajectories. We focused on students who attended Grades 5 through 9 from 2010 to 2015. The original NEPS sample for Starting

Cohort 3 consisted of 6112 individuals. We only examined students who attended the same school across all five measurement points ($t_1 = \text{Grade 5}$, $t_2 = \text{Grade 6}$, $t_3 = \text{Grade 7}$, $t_4 = \text{Grade 8}$, and $t_5 = \text{Grade 9}$) to ensure that the school environment remained stable over time. This restricted sample comprised 3572 individuals. For the same reasons, 126 students who skipped or repeated grades during the interval of interest were excluded. Thus, the final sample included 3446 students (49.8% female) from 178 schools, who were on average 10.77 ($SD = 0.49$) years old at t_1 .² The socioeconomic status of the students' families was measured with the highest *International Socio-Economic Index of Occupational Status* (ISEI; Ganzeboom, 2010) of the student's two parents, which can take a value between 10 and 90. In the present sample, it averaged 58.54, which is higher than in other representative

²The restricted sample did not differ significantly from the original sample in terms of the proportions of female students ($\chi^2(1) = 3.64$, $p = .056$) and of students born abroad ($\chi^2(1) = 0.54$, $p = .461$). However, the students' age ($t(7853.3) = 6.14$, $p < .001$) and the proportion of students with parents born abroad ($\chi^2(1) = 6.53$, $p < .05$) were slightly lower, while the highest ISEI was slightly higher ($t(3612.6) = 3.32$, $p < .001$) in the restricted sample compared with the original sample. The higher age in the original sample could be partially explained by students who repeated a grade in elementary school. Because grade retention in elementary school is associated with a higher risk of dropping out of school later on (Jimerson et al., 2002), some of these students may have been excluded from our analyses because we focused on students who attended the same school for all five years. Deviations from the original sample in the proportion of students with parents born abroad and socio-economic status (Ingrum, 2006) may also be due to this selection effect.

samples of students in Germany from this time period (Klieme et al., 2010). Among the included students, 3.5% were born in a country other than Germany, and 19.1% of students had at least one parent who was born abroad. These proportions are somewhat lower than in other representative samples of German secondary school students from this period (Klieme et al., 2010).

Materials

Students' well-being

Students' well-being was measured via multiple facets to address the complexity of this construct. *Satisfaction with school* was surveyed from t_1 to t_5 . Students responded to the item "How satisfied are you with your school situation?" on an 11-point scale ranging from 0 (= *completely dissatisfied*) to 10 (= *completely satisfied*). The item was developed for the NEPS and resembles common items for measuring general life satisfaction (e.g., Diener et al., 1985). Several studies indicate that satisfaction in specific domains can be reliably measured with single items (Gogol et al., 2014; Wanous et al., 1997). *Enjoyment of school* was measured with a scale based on items from Rauer and Schuck (2003). The scale was adapted for third-party assessment by parents in the NEPS framework and contains three items asking about the child's enjoyment of school and learning (e.g., "My child has a lot of fun learning at school"). Each item was rated on a 4-point scale ranging from 1 (= *does not apply at all*) to 4 (= *fully applies*). Parents provided information about their child's enjoyment of school at t_2 , t_3 , and t_4 . Internal consistencies were good at all three measurement points (see Table 1). *Self-rated health* was surveyed from t_1 to t_5 . It was measured with one item ("How would you describe your health status in general?") on a 5-point scale ranging from 1 (= *very poor*) to 5 (= *very good*). This item was modeled on traditional measures of self-rated health (e.g., Wannamethee & Shaper, 1991). *Social integration* in class was measured by two items based on questionnaires by Rauer and Schuck (2003) and Weinert et al. (2013). The items were formulated for third-party assessment by parents in the NEPS framework, asking them about their child's social connectedness in class (e.g., "My child is friends with many children in the class"). The items were answered on a 4-point scale ranging from 1 (= *does not apply at all*) to 4 (= *fully applies*). As with enjoyment of school, parents provided information about their child's social integration at t_2 , t_3 , and t_4 . Measurement invariance analysis was performed for the scales measuring enjoyment of school and social integration, because these were measured with more than one item. The corresponding results are reported in the "Data Analysis" section.

To obtain more information about the validity of the facets of well-being, we examined factorial validity and construct validity. For examining factorial validity, we conducted a confirmatory factor analysis (CFA) assuming that

the five different scales used in this study (4 facets of well-being + teacher autonomy support) represented individual factors. The corresponding CFA showed acceptable fit ($\chi^2(540) = 1594.16$, CFI = .981, RMSEA = .024). To investigate construct validity, the facets of well-being were classified into a nomological network (cf. Cronbach & Meehl, 1955). For this purpose, three variables (self-esteem, prosocial behavior, and political interest) were identified from the data set. We expected self-esteem to be more closely related to the construct of well-being than prosocial behavior, and the latter in turn to be more closely related to well-being than political interest. The results from Table A.1 (see Appendix S1) are consistent with this assumption, supporting the validity of the facets of well-being.

Teacher autonomy support

Teacher autonomy support perceived by students was measured from t_1 to t_5 through a subset of the Learning Climate Questionnaire (LCQ; Williams & Deci, 1996). More precisely, the scale for the present study comprised German translations of three LCQ items modified by Hardre and Reeve (2003). These items asked students to what extent they perceived that their German language arts teacher supported their autonomy by encouraging them to ask questions or listening to their opinions (e.g., "My German teacher tries to understand how I see things before suggesting how she/he would handle a particular situation"). The German teacher's autonomy support is of particular importance because it is a core subject in German secondary schools that takes up a large portion of the weekly instruction compared with other subjects. Students rated each item on a 4-point scale ranging from 1 (= *does not apply at all*) to 4 (= *fully applies*). Internal consistencies were acceptable to good at each of the five measurement points (see Table 1). As with the other multiple item scales, measurement invariance analysis was conducted for the teacher autonomy support scale. The corresponding results are also reported in the "Data Analysis" section.

Control variables

We included age and gender (with boys as the reference group) as control variables. These variables were selected based on empirical research on differences in students' well-being. As described above, cross-sectional studies have shown that older students have lower scores on various well-being facets. Therefore, it seemed plausible to control for age. Regarding gender, several studies have found that girls report higher satisfaction with school than boys (Kleinkorres et al., 2020; Liu et al., 2016) and have more positive emotions like fun and enjoyment toward school (Palsdottir et al., 2012). Other studies have found that girls report physical symptoms more often (Wiklund et al., 2012).

TABLE 1 Descriptive statistics of the variables included in the present study

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	
1. SWS t ₁	–																							
2. SWS t ₂	.37***	–																						
3. SWS t ₃	.29***	.46***	–																					
4. SWS t ₄	.22***	.37***	.48***	–																				
5. SWS t ₅	.17***	.32***	.41***	.46***	–																			
6. EOS t ₂	.18***	.25***	.20***	.14***	.09***	–																		
7. EOS t ₃	.17***	.21***	.24***	.19***	.11***	.78***	–																	
8. EOS t ₄	.16***	.21***	.22***	.24***	.17***	.70***	.79***	–																
9. SH t ₁	.27***	.20***	.17***	.13***	.15***	.11***	.13***	.10***	–															
10. SH t ₂	.19***	.29***	.26***	.19***	.20***	.10***	.11***	.06*	.55***	–														
11. SH t ₃	.14***	.20***	.31***	.23***	.22***	.06*	.08**	.07**	.45***	.60***	–													
12. SH t ₄	.15***	.20***	.26***	.33***	.25***	.08**	.09**	.06*	.43***	.56***	.67***	–												
13. SH t ₅	.13***	.17***	.22***	.21***	.29***	.05	.06*	.05*	.38***	.48***	.53***	.73***	–											
14. SI t ₂	.14***	.18***	.15***	.10***	.07**	.52***	.37***	.31***	.10**	.11***	.06*	.08**	.05	–										
15. SI t ₃	.14***	.16***	.16***	.08**	.08**	.42***	.44***	.33***	.11***	.14***	.10**	.10***	.05	.76***	–									
16. SI t ₄	.12***	.14***	.14***	.08**	.06*	.35***	.36***	.38***	.10**	.10***	.07**	.12***	.00	.69***	.81***	–								
17. TAS t ₁	.25***	.18***	.19***	.13***	.13***	.17***	.16***	.14***	.15***	.10***	.10***	.11***	.11***	.13***	.13***	.08**	–							
18. TAS t ₂	.14***	.18***	.13***	.10***	.08**	.16***	.15***	.14***	.11***	.13***	.10***	.08**	.06*	.16***	.17***	.17***	.41***	–						
19. TAS t ₃	.14***	.17***	.25***	.16***	.18***	.13***	.17***	.15***	.08**	.11***	.15***	.14***	.08***	.07*	.09***	.06*	.27***	.35***	–					
20. TAS t ₄	.14***	.17***	.21***	.20***	.18***	.11***	.13***	.16***	.08**	.09***	.10***	.13***	.09***	.10**	.07**	.08***	.19***	.22***	.37***	–				
21. TAS t ₅	.13***	.13***	.14***	.15***	.18***	.10***	.13***	.11***	.05*	.07**	.05	.11***	.11***	.06*	.05	.06	.14***	.18***	.21***	.38***	–			
22. Gender ^a	.08***	.05**	.05*	.02	.00	.16***	.17***	.16***	.03	–0.00	–0.05*	–0.11***	–0.12***	.11***	.11***	.06*	.04*	.05*	.04	.06*	.01	–		
23. Age t ₁	–0.05**	–0.06***	–0.03	–0.04*	–0.04*	.02	.03	.02	–0.00	–0.02	–0.04	–0.05*	–0.04	.04	.03	.04	.05*	.06**	.02	.02	.00	–0.07***	–	
M	7.97	7.24	7.05	7.03	6.88	3.26	3.15	3.08	4.34	4.22	4.25	4.18	4.13	3.51	3.52	3.51	3.66	3.39	3.37	3.33	3.35	3.35	.50	10.77
SD	2.32	2.40	2.34	2.25	2.28	0.56	0.61	0.60	0.71	0.80	0.78	0.74	0.81	0.54	0.55	0.54	0.94	0.99	0.95	0.97	0.95	0.95	.50	0.59
Skewness	–1.52	–1.13	–0.98	–1.00	–0.93	–0.80	–0.73	–0.65	–0.79	–0.85	–0.89	–0.66	–0.77	–1.12	–1.15	–1.03	–0.55	–0.43	–0.40	–0.43	–0.52	.01	0.75	
Missing	.08	.05	.06	.05	.08	.35	.36	.40	.06	.07	.07	.05	.08	.36	.37	.41	.15	.12	.12	.08	.11	.00	.00	
α	–	–	–	–	–	.81	.85	.84	–	–	–	–	–	–	–	–	.79	.81	.83	.83	.84	–	–	

Note: Correlations are based on a CFA with the latent variables (Model fit: $\chi^2(540) = 1594.16$, CFI = .981, RMSEA = .024), while the descriptive other statistics were calculated using the manifest variables. Abbreviations: EOS, enjoyment of school; M, mean; missing, proportion of missing values (range = 0–1); SD, standard deviation; SH, self-rated health; SI, social integration; SWS, satisfaction with school; t₁, measurement in Grade 5; t₂, measurement in Grade 6; t₃, measurement in Grade 7; t₄, measurement in Grade 8; t₅, measurement in Grade 9; TAS, perceived teacher autonomy support; α, Cronbach's α.

^aGender is a dichotomous variable (0 = male, 1 = female). Significance levels: * $p < .05$, ** $p < .01$, *** $p < .001$.

Data analysis

Data preparation and calculation of descriptive statistics were conducted using the statistical software *R* (Version 4.1.0; R Core Team, 2021). Missing data were treated with multiple imputation. Using the *R* package “mice” (van Buuren & Groothuis-Oudshoorn, 2011), 10 different data sets were created. For this purpose, we first identified variables that correlated at least $r = .10$ with the variables of interest. Then, predictive mean matching was applied. All subsequent analyses were conducted based on the imputed data sets. Correlations, means, standard deviations, and skewness were calculated using the *R* packages “BIFIEsurvey” (Robitzsch & Oberwimmer, 2019) and “miceadds” (Robitzsch et al., 2017). To examine the research questions and hypotheses, we used *Mplus* version 8.6 (Muthén & Muthén, 1998–2017).

Prior to the analyses, we tested measurement invariance across measurement points (overall and separately by gender) of all constructs measured with scales comprising at least two items (i.e., enjoyment of school, social integration, and perceived teacher autonomy support). Furthermore, we tested measurement invariance across gender within measurement points for scales comprising at least three items (i.e., enjoyment of school and perceived teacher autonomy support). We also examined for these scales whether scalar invariance by age could be assumed within the measurement points. To do this, we specified models with and without direct paths from age to the intercepts of the items. These were then compared with each other, assuming scalar invariance if the model fit was not significantly improved by adding the direct paths. Following recommendations by other authors (Putnick & Bornstein, 2016; Widaman & Reise, 1997), we successively tested four increasingly restrictive levels of measurement invariance (configural, metric, scalar, and residual invariance). We compared these differently restricted models with ΔCFI ($\text{CFI}_{\text{More restricted Model}} - \text{CFI}_{\text{Less restricted Model}}$), because the chi-square difference test is very sensitive to sample size. We followed Cheung and Rensvold's (2002) recommendation to prefer the restricted model if ΔCFI is equal to or greater than -0.01 . For the enjoyment of school scale, we found metric invariance across the three measurement points (overall and separately by gender), whereas scalar invariance was not supported (see Appendix S2: Tables B.1). The analysis of measurement invariance with respect to gender separately for each measurement point revealed a similar result (see Appendix S2: Table B.2). The fit for partial scalar invariance was just outside the range of acceptability. Regressions of item intercepts on age did not significantly worsen model fit at individual measurement points, indicating scalar measurement invariance for age (see Appendix S2: Table B.3). Measurement invariance analysis for the social integration scale revealed scalar and also residual invariance across the three measurement time points (overall and separately by gender; see Appendix S2: Table B.4). Finally, measurement invariance analysis for the teacher

autonomy support scale revealed metric invariance across all five measurement points (overall and separately by gender), whereas scalar invariance was not supported (see Appendix S2: Table B.5). However, measurement invariance analysis revealed acceptable fit when the intercepts of two items were estimated freely, indicating partial scalar invariance. The analysis with respect to gender separately for each measurement point revealed scalar and also residual measurement invariance (see Appendix S2: Table B.6). Furthermore, regressions of item intercepts on age did not significantly worsen model fit at individual measurement points, indicating scalar measurement invariance for age (see Appendix S2: Table B.7).

The longitudinal trends in perceived teacher autonomy support and the individual facets of students' well-being (see RQ1 and RQ2) were examined by means of univariate latent growth curve models (LGCM). These were specified for each facet of well-being and perceived teacher autonomy support separately. The effects-coding method described by Little et al. (2006) was used for model identification. We explored the functional form of the changes over time by specifying linear and quadratic growth models. Because enjoyment of school and social integration were only measured on three occasions, nonlinear changes were not estimated in these models. To examine RQ3 and RQ4, we specified PPGMs. Within these PPGMs, we modeled the longitudinal development of the individual well-being facets and perceived teacher autonomy support in parallel. The baseline association between perceived teacher autonomy support and students' well-being (see RQ3) was examined via the correlations between the latent intercept factors. The correlations between the slope factors were used to evaluate the association between the trends in perceived teacher autonomy support and each facet of students' well-being (see RQ4). In the PPGMs for enjoyment of school and social integration, which were only measured at t_2 , t_3 , and t_4 , we adjusted the time coding of perceived teacher autonomy support so that t_2 represented the intercept. All univariate LGCMs and PPGMs were calculated both without and with the inclusion of gender and age as time-invariant covariates of the intercept and slope factors. In analyses that referred to directional hypotheses, the p -values of the correlation coefficients were halved.

All constructs measured via scales comprising at least two items were modeled as latent variables in the LGCMs and PPGMs. Constructs measured with single items were modeled using a single-indicator approach. This was done to avoid treating these constructs as perfectly reliable. In accordance with other research applying a single-indicator approach, we modeled a latent variable for each single-item measure and specified a reliability value of .85 (Jöreskog & Sörbom, 1982; Petrescu, 2013).

The data were hierarchically structured, as students were nested within schools. To take into account the dependence between observations (ICCs within schools ranged from .01 to .08; see Appendix S3: Table C.1), student affiliation with

TABLE 2 Parameter estimates of the univariate LGCMs

Measure	Intercept (I)		Linear slope (LS)		Quadratic slope (QS)		Covariance		
	Mean	Variance	Mean	Variance	Mean	Variance	I, LS	I, QS	LS, QS
SWS ^a	7.90***	2.40***	-0.61***	1.07***	0.09***	0.04**	-0.45	0.02	-0.19***
EOS ^b	3.26***	0.25***	-0.09***	0.04***	-	-	-0.03***	-	-
SH ^c	4.33***	0.27***	-0.06***	0.12***	0.00	0.01***	-0.06**	0.01	-0.02***
SI ^d	3.51***	0.33***	0.00	0.04**	-	-	-0.03*	-	-
TAS ^e	3.64***	0.45***	-0.23***	0.23***	0.04***	0.01***	-0.17***	0.02**	-0.05***

Note: The table contains unstandardized estimates.

Abbreviations: EOS, enjoyment of school; SH, self-rated health; SI, social integration; SWS, satisfaction with school; TAS, perceived teacher autonomy support.

^aThe fit of the model with SWS was good: $\chi^2(6) = 54.26, p < .001$; CFI = .978; RMSEA = .048.

^bThe fit of the model with EOS was good: $\chi^2(20) = 104.71, p < .001$; CFI = .995; RMSEA = .035.

^cThe fit of the model with SH was good: $\chi^2(6) = 53.19, p < .001$; CFI = .984; RMSEA = .048.

^dThe fit of the model with SI was good: $\chi^2(3) = 8.89, p < .05$; CFI = .999; RMSEA = .024.

^eThe fit of the model with TAS was good: $\chi^2(64) = 154.91, p < .001$; CFI = .995; RMSEA = .020.

Significance levels: † $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

a school was considered in the analyses.³ Based on this information, the model parameters were calculated using maximum likelihood estimation with standard errors that are robust to nonnormality and nonindependence of observations. The resulting chi-square test statistic was asymptotically equivalent to the Yuan-Bentler test statistic (Muthén & Muthén, 1998–2017).

RESULTS

Descriptive results

Descriptive statistics in the form of correlations, means, standard deviations, skewness, and reliabilities for the well-being measures and for perceived teacher autonomy support can be found in Table 1. Satisfaction with school, enjoyment of school, self-rated health, social integration, and perceived teacher autonomy support were positively—and predominantly statistically significantly—related to each other. The correlations between these variables were small- to medium-sized (Cohen, 1992). The statistically significant correlations of gender with the other measures indicated that female students reported higher levels of satisfaction with school between Grades 5 and 7, and had higher scores on enjoyment of school and social integration in class between Grades 6 and 8 compared with male students (see Table 1). They also perceived higher teacher autonomy support in Grades 5, 6, and 8. However, they rated their health more negatively than male students between Grades 7 and 9. Students' age at the first measurement point was significantly negatively correlated with satisfaction with school in Grades 5, 6, 8, and 9 and self-rated health in Grade 8 (see Table 1). In addition, age was significantly positively related to perceived teacher

autonomy support in Grades 5 and 6. The reported correlations were small in size (Cohen, 1992).

Development of students' well-being in adolescence

The development of students' well-being was examined using LGCMs. Table 2 contains the coefficients of these models. Furthermore, Figure 2 provides a graphical representation of the growth curves of the individual well-being facets.

Satisfaction with school

The examination of the functional form of growth showed that a model with both linear and quadratic slope factors fit the data well ($\chi^2(6) = 54.26, p < .001$; CFI = .978; RMSEA = .048). As can be seen in Table 2, the linear slope was negative and statistically significant, suggesting that satisfaction with school scores decreased over time. More precisely, the results indicated that average satisfaction with school was 7.90 at t_1 and decreased by 0.61 scale points per year thereafter (see Figure 2 for a graphical representation). The statistically significantly positive quadratic slope indicated a mitigation of the negative trend in satisfaction with school toward the end of the time interval. The model with gender and age (see Appendix S4: Tables D.1 and D.2) showed that the control variables were only associated with the intercept factor: The path estimate from gender to the intercept was statistically significantly positive ($\beta = .12, p < .001$), indicating that girls were, on average, more satisfied with school than boys initially. The path estimate from age to the intercept was significantly negative ($\beta = -.08, p = .003$), suggesting that comparatively older students within the cohort were initially less satisfied with school. As the results indicated a decrease in satisfaction with school over time, H1a was retained.

³The classroom level could not be included because the data did not contain usable information on it.

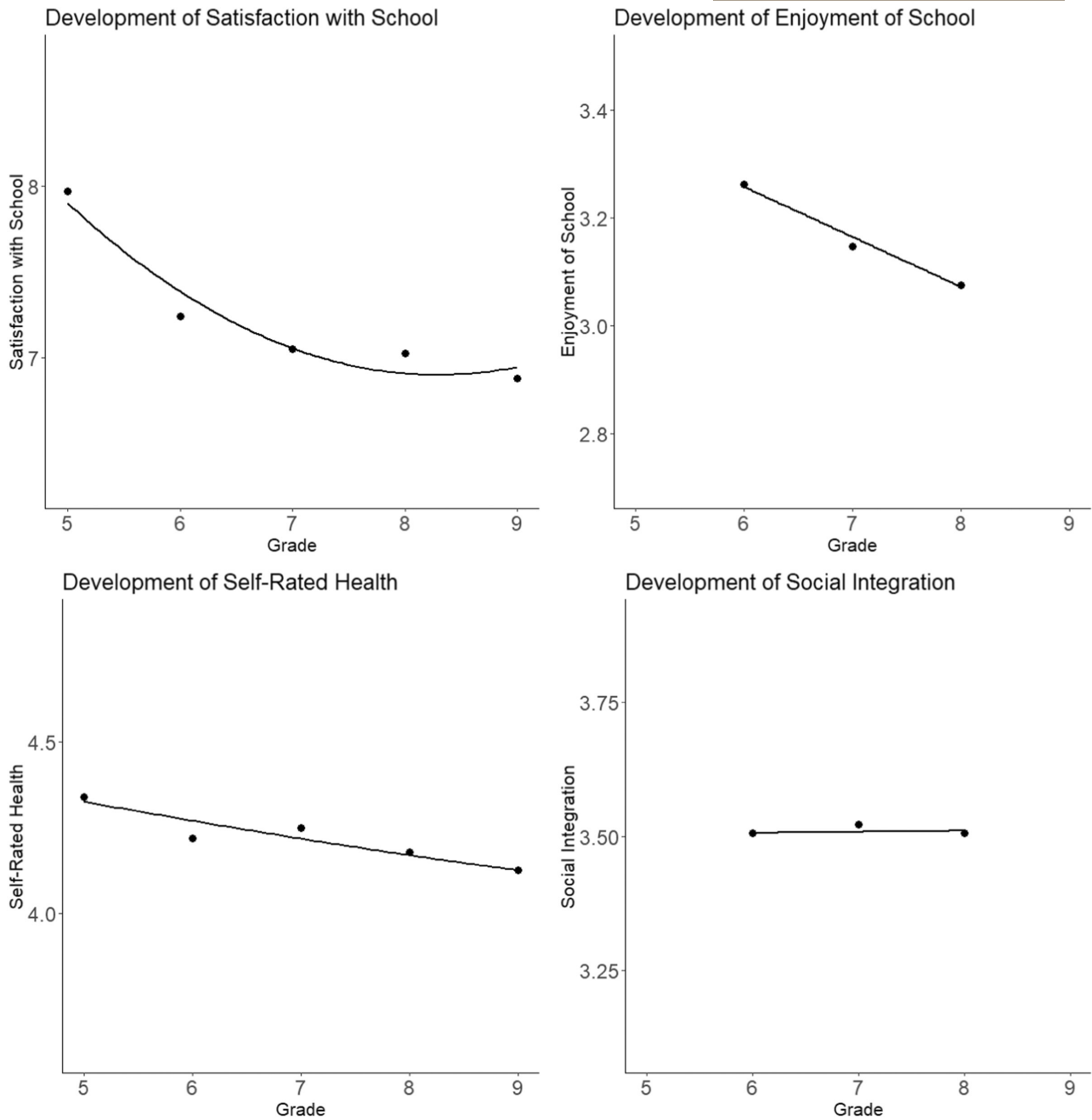


FIGURE 2 Growth curves of the four well-being facets

Enjoyment of school

The LGCM showed a statistically significantly negative linear slope, suggesting that enjoyment of school decreased between Grades 6 and 8 (see Table 2). More precisely, average enjoyment of school was 3.26 at t_2 and decreased by 0.09 scale points per year thereafter (see Figure 2 for a graphical representation). While the model with control variables (see Appendix S4: Table D.1 and D.2) indicated that age was not associated to any of the latent factors, the path estimate from gender to the intercept factor was significantly positive ($\beta = .16, p < .001$), meaning that, on average, girls initially enjoyed school more than boys according to their parents. As

the results indicated a decrease in enjoyment of school over time, H1b was retained.

Self-rated health

The examination of the functional form of growth in self-rated health showed that a model with both linear and quadratic slope factors fit the data well ($\chi^2(6) = 53.19, p < .001$; CFI = .984; RMSEA = .048). As can be seen in Table 2, the linear slope was negative and statistically significant, suggesting that self-rated health scores decreased over time. More precisely, the results indicated that average self-rated

health was 4.33 at t_1 and decreased by 0.06 scale points per year thereafter (see Figure 2 for a graphical representation). The model with control variables (see Appendix S4: Tables D.1 and D.2) showed that while age was not associated with any of the latent factors, the path estimate from gender to the slope factor was significantly negative ($\beta = -.09, p = .010$), suggesting that girls' health developed more negatively than that of boys. Furthermore, because the slope factor was not significantly negative for boys (see Appendix S4: Table D.1), this result implies that only girls' self-rated health declined over time. In summary, the results for RQ1, which was exploratory in nature regarding students' physical well-being, indicated that self-rated health decreased over time, with this decline mainly due to girls' development.

Social integration

The LGCM suggested that social integration remained stable between Grades 6 and 8, as the linear slope was slightly positive and statistically nonsignificant (see Table 2). Figure 2 shows a graphical representation of the trend. The model with control variables (see Appendix S4: Tables D.1 and D.2) showed that while age was not associated to any of the latent factors, the path estimate from gender to the intercept factor ($\beta = .12, p < .001$) was significant. This finding can be interpreted as indicating that—according to their parents—girls' social integration in class was initially higher compared with that of boys. In summary, the results for RQ1, which was exploratory in nature regarding students' social well-being, indicated a stable level of social integration over time.

The role of perceived teacher autonomy support for the development of students' well-being in adolescence

Development of perceived teacher autonomy support over time

The examination of the functional form of growth showed that a model with both linear and quadratic slope factors fit the data well ($\chi^2(64) = 154.90, p < .001$; CFI = .995; RMSEA = .020). As can be seen in Table 2, the linear slope was negative and statistically significant, suggesting that perceived teacher autonomy support decreased over time. More precisely, average perceived teacher autonomy support was 3.64 at t_1 and decreased by 0.23 scale points per year thereafter. The statistically significantly positive quadratic slope indicated a mitigation of this negative trend in perceived teacher autonomy support toward the end of the time interval. The model with gender and age (see Appendix S4: Tables D.1 and D.2) showed that these control variables were only associated to the intercept factor. The path estimate of gender was statistically significantly positive ($\beta = .05, p = .043$), indicating that, on average, girls initially perceived

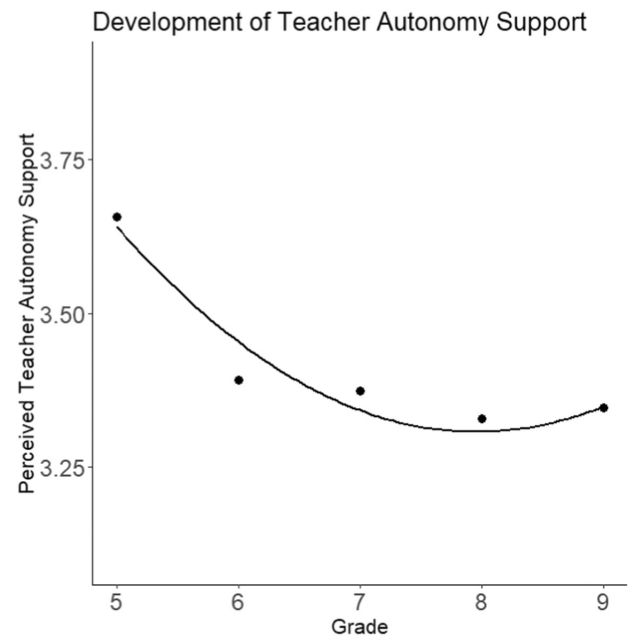


FIGURE 3 Growth curve of perceived teacher autonomy support

their teachers as more supportive of their autonomy than boys. The path estimate from age to the intercept factor was also positive ($\beta = .06, p = .010$), suggesting that older students initially perceived their teachers as more supportive of their autonomy. Because the results showed a decline in perceived teacher autonomy support over time, H2 was retained. Figure 3 shows a graphical representation of the growth curve of perceived teacher autonomy support.

The role of perceived teacher autonomy support for the development of satisfaction with school

The model for satisfaction with school and perceived teacher autonomy support is shown in Figure E.1 (See Appendix S5; for the model with control variables see Appendix S6: Figure F.1). As can be seen, the association between the intercept factors was statistically significantly positive ($r = .43, p < .001$), suggesting that a higher baseline level of perceived teacher autonomy support was associated with a higher baseline level of satisfaction with school. H3a was therefore retained. Furthermore, the linear slope factors were statistically significantly positively related ($r = .39, p < .001$), which means that a negative trend in perceived teacher autonomy support was accompanied by a negative trend in satisfaction with school. This result was in accordance with our hypothesis. Therefore, H4a was retained. Figure E.1 also shows that the intercept and slope factors of both variables are interrelated. More specifically, we observed negative correlations between the intercept of satisfaction with school and the slope of perceived teacher autonomy support ($r = -.18, p = .001$) and between the intercept of perceived teacher autonomy support and the slope of satisfaction with school ($r = -.15, p = .013$). This means that higher initial satisfaction with school was

associated with greater decreases in perceived teacher autonomy support, and vice versa.

The role of perceived teacher autonomy support for the development of enjoyment of school

The model specifying parallel processes between perceived teacher autonomy support and enjoyment of school is displayed in Figure E.2 (See Appendix S5; for the model with control variables see Appendix S6: Figure F.2). The association between the intercept factors was statistically significantly positive ($r = .25, p < .001$), suggesting that perceived teacher autonomy support was positively associated with enjoyment of school at baseline. This finding was in line with H3b, which was therefore retained. The relation between the linear slope factors was also positive ($r = .13, p < .001$), which indicated that a negative trend in perceived teacher autonomy support was associated with a negative trend in enjoyment of school between Grades 6 and 8. As this finding was in accordance with H4b, it was retained.

The role of perceived teacher autonomy support for the development of self-rated health

Figure E.3 (See Appendix S5) depicts the PPGM for self-rated health and perceived teacher autonomy support (for the model with control variables see Appendix S6: Figure F.3). As indicated by the statistically significantly positive relation between the intercept factors ($r = .22, p < .001$), higher baseline levels of perceived teacher autonomy support were associated with higher initial self-rated health. This finding was in line with H3c, which was retained. For RQ4, which was exploratory in nature regarding students' physical well-being, we found that the relation between the linear slope factors was also positive ($r = .29, p < .001$), indicating that students whose perceptions of autonomy support from their teacher changed over time also changed in terms of their self-rated health.

The role of perceived teacher autonomy support for the development of social integration

As can be seen in Figure E.4 (See Appendix S5; for the model with control variables see Appendix S6: Figure F.4), the relation between the intercept factors of perceived teacher autonomy support and social integration was statistically significantly positive ($r = .23, p < .001$). Thus, for RQ3, which was exploratory in nature regarding students' social well-being, the results indicated that baseline levels of these variables were positively associated with each other. However, for RQ4, which was also exploratory in nature regarding students' social well-being, the association between the slope factors was statistically nonsignificant ($r = .09, p = .301$), meaning that perceived teacher autonomy support and

social integration did not develop similarly between Grades 6 and 8.

DISCUSSION

Students' well-being is seen as an important educational goal (Kanonire et al., 2020; Organisation for Economic Co-operation and Development [OECD], 2017). Accordingly, it is important to monitor its development over the course of students' school years. Previous research has shown that students' well-being decreases during early adolescence, but most prior studies applied cross-sectional designs and focused on only one or a few facets of well-being. It seems plausible that this negative trend could be related to the school environment being increasingly less responsive to students' needs. However, little is known about time-varying factors that may be related to the trend in students' well-being. Therefore, the present study analyzed longitudinal data collected in German secondary schools to examine the temporal trend of students' well-being and how it is related to changes in perceived teacher autonomy support during adolescence.

Development of students' well-being over time

In accordance with previous studies investigating the development of general (Casas & González-Carrasco, 2019; González-Carrasco et al., 2017; Schütz et al., 2019; Shek & Liang, 2018) and school-specific well-being (Hagenauer & Hascher, 2010; Tian et al., 2013), our results pointed to a decline in different facets of students' well-being (i.e., satisfaction with school, enjoyment of school, and self-rated health) over early adolescence. Although the results have to be interpreted with caution as satisfaction with school and self-rated health were measured by single items, and enjoyment of school was only measured from Grade 6 to Grade 8, these declines are similar to negative trends in other school-related variables in adolescence, such as intrinsic motivation and competence beliefs (Gottfried et al., 2001; Wigfield et al., 2015). Moreover, they fit within stage-environment fit theory framework (Eccles et al., 1993; Eccles & Midgley, 1989) that theoretically explains these declines. Concerning self-rated health, results showed different trends depending on gender: results for girls indicated a negative trend, which is consistent with stage-environment fit theory and previous research findings (Tobia et al., 2019). By contrast, the trend for boys' self-rated health was stable, which is consistent with the notion that adolescents have an enduring self-concept of health (Boardman, 2006; Breidablik et al., 2009); also for this finding, the literature provides examples with similar empirical results (Breidablik et al., 2009). Apparently, boys' self-rated health is less affected during adolescence than that of girls. Given this finding, it appears that the overall negative trend is mainly driven by girls' self-reports of their

health. The results might have been different if school-related health had been assessed, although our findings are descriptively similar to Hascher and Hagenauer (2011), who found a decline in school-related physical well-being between fifth and seventh grade, followed by an increase from seventh to eighth grade. Furthermore, it should be noted that self-rated health was measured by a single item, which limits the reliability of this finding. The results concerning social integration were unambiguous, indicating no change over time. While this result is in conflict with studies finding a decrease from elementary to secondary school (Tobia et al., 2019), it is in line with research reporting stable values for social integration over time (Gunn et al., 2018). The high baseline level and stability of social integration over time might be explained by the increasing importance of peers during adolescence (Steinberg, 2010). It should be noted, however, that social integration, like enjoyment of school, was measured between Grades 6 and 8, and the results might have been different if the entire period from Grade 5 to Grade 9 had been considered.

The role of perceived teacher autonomy support for the development of students' well-being over time

Perceived teacher autonomy support exhibited a negative trend over the course of adolescence, which is in line with previous research (Way et al., 2007) and the theoretical notion that the school environment becomes less responsive to adolescents' needs with each successive school year (Eccles et al., 1993; Eccles & Midgley, 1989). Furthermore, it was positively related to different facets of students' well-being. This is consistent with previous studies demonstrating positive associations between perceived teacher autonomy support and school-specific well-being facets such as satisfaction with school and learning enjoyment (see Ferguson et al., 2011; Hagenauer & Hascher, 2010). This finding could be explained by the importance of teacher autonomy support for satisfying students' basic psychological needs (Adie et al., 2008; Ryan & Solky, 1996; Yu et al., 2016), which are associated with higher levels of well-being (Ryan & Deci, 2000). Moreover, our results indicated that the development of perceived teacher autonomy support was positively associated with the development of the well-being facets satisfaction with school, enjoyment of school, and self-rated health. In accordance with stage–environment fit theory (Eccles et al., 1993; Eccles & Midgley, 1989), these findings could be interpreted as indicating that students' needs—especially the need for autonomy—are not addressed sufficiently by their environment, resulting in a decline in their well-being. It should be noted, however, that both the LGCM and PPGM indicated a stable trend in boys' self-rated health, so the significant relation between trends in perceived teacher autonomy support and self-rated health should be interpreted in light of this. In contrast to the other facets of students' well-being, the development of

social integration was not associated with the development of perceived teacher autonomy support. This could be due to the stability of social integration over the focused time interval. Furthermore, it seems plausible that the development of social integration among peers is independent of the development of autonomy-supportive behaviors by teachers. However, it remains unclear why the baseline levels of these two variables are associated with each other. Overall, the results point to the importance of the learning environment, that is, autonomy support, during the phase of early adolescence, when the psychological need for autonomy is crucial for the development of important student characteristics.

Limitations and strengths

Although the current study provides important insights into the development of adolescents' well-being and its correlates, some limitations must also be considered. One such limitation concerns the operationalization of students' well-being. More specifically, some of our constructs were measured with single items only. This problem was countered by a single-indicator approach, in which reliability of these items was set to a certain value. However, using single items may cause both random and nonrandom errors (Bollen, 1989), which can affect the results. Furthermore, scalar invariance for the enjoyment of school scale across measurement time points could not be empirically ensured. This implies that the intercepts of the items vary over time, which could be due to structural changes in the latent construct across the years (cf. Frenzel et al., 2012). Consequently, the change in latent variable scores over time for this variable should be interpreted with caution. Another limitation concerns the generalizability of our study. First, we focused on adolescents from Germany, so it remains unclear how the results can be generalized to other educational systems and other cultural contexts, especially to Eastern societies that are more collectivist in structure. Second, our sample only included students who attended the same school and class throughout early adolescence. The rationale behind this was to hold the school environment constant. Nevertheless, other relations and trends in the variables are possible for students who change or repeat grades or have to change schools, which would be interesting to investigate. A further limitation was that we did not include variables concerning the satisfaction of students' basic psychological needs (see Ryan & Deci, 2000, 2020). Therefore, our results do not provide empirical insight into a possible mediation of the relationship between teacher autonomy support and students' well-being via need satisfaction. Finally, students only rated the autonomy support provided by their German language arts teachers. As German language arts is a core subject in German secondary schools, students spend multiple hours per week with their German teachers; hence, interaction with this teacher is very important for students' experiences at school. Nevertheless, it remains unclear how autonomy support by other teachers is related to students'

well-being at school and its temporal development. Dietrich et al. (2015) showed that a classroom's shared perception of teacher support in one subject (German or math) was positively associated with intrinsic value and effort in the same subject, but negatively associated with intrinsic value and effort in the other subject, which they explained with respect to dimensional comparison theory (Möller & Marsh, 2013). Thus, the findings were interpreted as indicating that students compared their teachers for different subjects to one another (Dietrich et al., 2015). Something similar is plausible with respect to teachers' autonomy-supportive behavior; therefore, students' perception of autonomy support in one subject could be biased by teachers from other subjects being more or less autonomy-supportive.

However, the study's limitations are also offset by a number of strengths. First, to the best of our knowledge, our study is the first to examine the development of multiple facets of students' well-being and a time-varying covariate of the school context (i.e., perceived teacher autonomy support) simultaneously. This was done by examining longitudinal data with three to five different measurement points across five years of adolescence. As much of the research on students' well-being and its development is based on cross-sectional or short-term longitudinal designs, this represents an important extension to the literature. Second, as we used data from the NEPS (Blossfeld & Roßbach, 2019), we were able to draw on a large sample. Therefore, the results of the present study promise high external validity. Third, we considered multiple facets of students' well-being. It has been emphasized that students' well-being is a multifaceted construct that needs to be measured using multiple aspects (Liu et al., 2015; Long et al., 2012; Renshaw et al., 2015). The present study addresses this requirement and provides a fine-grained picture of different facets of students' well-being and how they develop over time.

Implications for future research and educational practice

The current study shed light on the temporal development of various facets of students' well-being and their longitudinal relations with perceived teacher autonomy support. However, more research is needed to support and complement the presented findings. One aspect that should be explored in future studies is whether there are different patterns of results for different subgroups. For example, because our findings suggest that gender is related to some of the intercept and slope factors, a multi-group analysis of gender differences in the development of well-being during adolescence would be a useful complement to comprehensive analyses of the entire student population such as those presented in this study. It would also be interesting to compare groups of students who repeated a grade or changed schools with those who did not. Another desideratum might be to examine autonomy support not only by German language arts teachers, but also by

teachers of other (core) subjects, such as mathematics. This would make it possible to control for biases in the perception of autonomy support that arise from students comparing their teachers for different subjects (Dietrich et al., 2015). In this context, it would also be conceivable to operationalize well-being on a subject-specific basis in order to examine relations between perceived teacher autonomy support and students' well-being within and across subjects. Furthermore, other potentially relevant variables for the development of students' well-being could be considered. According to stage–environment fit theory (Eccles et al., 1993), the transition from primary to secondary school is accompanied by a decline in the quality of student–teacher relationships and a mismatch between the level of the learning materials and students' cognitive capacities. Therefore, it would be interesting to consider variables capturing these changes in the school environment when examining the development of students' well-being. Moreover, in future analyses, it may be reasonable and important to include controlling teaching behavior alongside teacher autonomy support when examining relations to students' well-being and its development. Looking at motivation, Haerens et al. (2015) found evidence that a dark motivational pathway should be examined separately from a bright motivational pathway. Perceived teacher autonomy support and controlling teaching behavior had low negative correlations with each other and were differently related to various types of motivation, suggesting that they are separate constructs. Based on these results, it is conceivable that they are also individually related to students' well-being.

The results of the present study also provide important implications for educational practice. Given that our study suggests a decline in perceived teacher autonomy support and, possibly as a result, students' well-being, it would be useful to raise in-service and preservice teachers' awareness of the critical period of adolescence. More specifically, they should be sensitized to the fact that students need particular support during this phase in order to experience school well-being. In addition, teachers' competence to perceive students' individual need for autonomy could be strengthened, and they could be equipped with tools to increase students' autonomy. This is important, as autonomy-supportive behavior is relevant not only for well-being but also for other outcomes, such as intrinsic motivation (Ryan & Deci, 2020).

CONCLUSION

The present study provided new insights into the development of students' well-being during adolescence. To the best of our knowledge, this is the first study to examine the development of students' well-being under consideration of a time-varying covariate (i.e. teacher autonomy support) by means of PPGMs. Using this approach, we were able to show that various facets of students' well-being (school satisfaction, enjoyment of school, and self-rated health) decreased over time and that this decline was associated with a decline in teacher autonomy support.

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CONFLICT OF INTEREST

None.


SOURCE OF DATA

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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