



Beneficial and negative factors for the development of students' well-being in educational context

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Abstract

Students' school-related well-being (SWB) is of vital importance. Nevertheless, it is unclear how SWB develops in late adolescence, especially among students in high-achieving environments and which factors are associated with it. Based on a longitudinal dataset (T1: Grade 11, T2: Grade 12), we analyzed how SWB (school satisfaction, academic self-concept, stress experience, exam anxiety, peer satisfaction) develops and whether psychological needs (autonomy, competence, relatedness) and achievement pressure from teachers and parents were related to the development. 1,286 students from high-achieving high schools (46.7% female, $M_{\text{ageT1}} = 16.40$) answered sociodemographic questions and questions about key variables. From T1 to T2, particularly students' stress experience and peer satisfaction declined. Need fulfilment and perceived achievement pressure was related to changes. Implications for research and practice are discussed.

Keywords Achievement pressure · Parental pressure · Psychological needs · Self-determination theory · Subjective well-being

Introduction

Students' subjective well-being (SWB) is an important educational goal in addition to acquiring academic competencies (e.g., OECD, 2017; van Petegem et al., 2007). Students' positive school-related well-being, covering cognitions and emotions about school, is important due to its potential links to higher general life satisfaction and improved learning abilities (e.g., Seligman et al., 2009). However, despite its significance, not much is known about the temporal development of various aspects of SWB in the school context, especially during adolescence and for students in high-achieving environments. Moreover, existing results regarding the strength and direction of this development are heterogeneous. For example, some studies revealed that aspects of SWB decrease over the course of students' school years (Burke & Minton, 2019; Casas & González-Carrasco, 2019; Scherrer & Preckel, 2019), while other studies found a positive trajectory or stability (e.g., Steinmayr et al.,

2019). These inconclusive results can be partially explained by the focus on single aspects of SWB, which were not the same across studies. Additionally, there has been little focus on environmental influences. Self-determination theory (SDT; Ryan & Deci, 2000) and stage-environment fit theory (SEFT; e.g., Eccles et al., 1993), which take individuals' perception of and interaction with their environment into account, are fundamental theories to explain changes in SWB.

During adolescence, students face different challenges. In addition to coming of age, the expected transition from high school to tertiary education can also be demanding. SDT (e.g., Ryan & Deci, 2000) posits that fulfillment of the three psychological needs (autonomy, competence, relatedness) is beneficial for students' motivation, vitality, and SWB (e.g., Abidin et al., 2021; Neubauer et al., 2017; Tay & Diener, 2011). Moreover, in this phase of school, students may perceive pressure to perform. Achievement pressure from teachers and parents can lead to feelings of heteronomy (Deci & Ryan, 2013), meaning that the fulfillment of autonomy is negatively impacted. Consequently, SWB may be affected by perceived pressure. Pressure to perform can be seen as a stressor that is negatively related to SWB (e.g., Choi et al., 2019). Moreover, according to SEFT, perceived pressure from teachers and parents to exhibit certain behavior and the accompanying feelings of heteronomy can reflect a misfit

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between students' needs in a certain developmental stage and the environment. Therefore, the family and school environment can be very important for SWB. Further, the school context can differ with respect to, for example, location and/or achievement climate, which can influence SWB through such mechanisms as social comparison processes (Rathmann et al., 2018). Thus, it is essential to shed light on adolescent students in high-achieving environments.

Given the relevance of SWB, it is vital to understand how it develops, especially in the important phase of adolescence and in high-achieving environments. Moreover, it is relevant to determine which factors are associated with its trajectory. Consequently, this study focused first on the development of SWB among adolescents in high-achieving environments. Secondly, it analyzed potentially beneficial and negative factors for its developmental trajectory.

Students' subjective well-being and its development

Subjective well-being is a broad and multidimensional construct (Seligman, 2011). Till now, a clear definition is lacking. Nevertheless, the concept tends to refer to how a person thinks and feels about life in general and certain domains like school (Diener et al., 1999). Several theoretical approaches to well-being exist. One of these is the hedonic perspective, upon which the theory of subjective well-being is based (Diener, 1984; Eid & Larsen, 2008; Ryan & Deci, 2001). From this perspective, psychological well-being includes a cognitive and an affective component (Diener, 1984; Diener et al., 1999). The cognitive component encompasses global and domain-specific satisfaction (Diener et al., 2013; Kleinkorres et al., 2022), while positive and negative affect are facets of the affective component (Bradburn, 1969). School satisfaction and academic self-concept can be seen as domain-specific elements of the cognitive component, reflecting positive aspects regarding school (e.g., Morinaj & Hascher, 2019). Experience of school-related stress and exam anxiety are prominent examples of negative affect referring to school (e.g., Hoferichter et al., 2021). In addition to a psychological dimension, subjective well-being also comprises a physical and a social dimension (WHO, 2014). The physical dimension reflects satisfaction with one's health and the social dimension captures quality of relationships and stability of social networks. With respect to school, as it is where many of adolescents' interactions occur (e.g., Pollard & Lee, 2003; WHO, 2014), one example aspect of the social dimension is satisfaction with peers (e.g., Morinaj & Hascher, 2019; Ryff & Keyes, 1995).

In recent years, increased research attention has been paid to SWB. However, existing studies have largely focused only on a single aspect of SWB rather than taking

multiple facets into account and thus considering the complex structure of SWB (e.g., Heffner & Antaramian, 2016). Moreover, in addition to the question of how SWB is pronounced on average, the development of SWB over time is of particular interest. Unfortunately, most previous studies had cross-sectional designs. However, in general, for younger students, it is known that SWB develops negatively throughout children's school years. For most countries, the decline starts at around age 10 (e.g., Casas & González-Carrasco, 2019).

For *school satisfaction*, understood as a positive school-related attitude, studies found that secondary school students are, on average, satisfied with their school (e.g., Finland: Hoferichter et al., 2021; Southeastern US: Huebner et al., 2001). Referring to high-achieving students, Jin and Moon (2006) compared the psychological well-being of talented students attending two different schools in Korea (regular high school vs. science-focused high school). They found that the two groups did not differ significantly in their psychological well-being, but students from the science high school exhibited higher school satisfaction. In their study, school satisfaction encompassed satisfaction with such aspects as the curriculum and peer relationships. Regarding the development of satisfaction with school, Hoferichter et al. (2021) analyzed it for early adolescence from Grade 7 to 9 in a Finnish sample. On average, satisfaction with school remained stable. In contrast to this finding, Kleinkorres et al. (2020) found for a similar age group in Germany that average school satisfaction decreased from Grade 7 to 9. In a cross-sectional study focusing on 11-, 13-, and 15-year-old students in Slovakia, Norway, and Finland, Samdal et al. (1998) showed that older students were less satisfied with school compared to younger ones.

Concerning *academic self-concept*, which is defined as one's overall self-perception of one's general academic abilities (Shavelson et al., 1976), studies with adolescents reported mean academic self-concepts above the scale midpoint, indicating positive academic self-concepts on average (e.g., Germany: Kulakow, 2020; Switzerland: Hascher & Hagenauer, 2020; Morinaj & Hascher, 2019). Regarding high-achieving students, Preckel et al. (2019) analyzed whether ability grouping affects students' academic self-concepts. They found no evidence for grouping effects in a German sample. Moreover, average academic self-concepts lay above the scale midpoint for students in both gifted and regular classes. Concerning its development, Preckel et al. (2013) revealed that academic self-concept is largely stable from early to mid-adolescence, even though mean values decreased slightly (Grades 5 to 8; Germany). Green et al. (2012) showed for Australian high school students attending Grades 7 to 11 at first point of measurement and Grades 8 to 12 at second point of measurement that mean values decreased marginally.

Regarding *experience of stress*, which covers students' perception of worries, helplessness, and school-related stress, research has shown that adolescent learners tended to report academic-related worries and experienced academic-related stress (e.g., international: OECD, 2017; Switzerland: Hascher & Hagenauer, 2020). Focusing on high-achieving students, Suldo et al. (2008) revealed that students in the Southeastern US who were enrolled in an international baccalaureate program perceived more stress than students in a general education program. However, both groups felt stressed on average. Referring to the development, Hoferichter et al. (2021) showed in a study of Finnish early adolescent learners that perceived stress increased slightly over time. Other studies have likewise revealed that students' perception of school-related stress increases over their school years, especially during adolescence (e.g., international: Inchley et al., 2016). Stress experience seems to increase over the last three years of school and also after leaving school (e.g., Australia and UK: Winefield & Tigge-mann, 1993: Grades 10–12; Ireland: McCoy et al., 2014: post school transition).

Exam anxiety, a prominent example of negative school-related affect and school-related anxiety, captures how nervous and anxious students are with respect to schoolwork and exams. Anxiety can result from students' uncertainty regarding their own ability or fear of failure (e.g., Alpert & Haber, 1960). Internationally, the 2015 PISA wave focused on students' well-being, with a specific emphasis on anxiety. Feelings of schoolwork-related anxiety were found to be common among adolescent students, although differences between countries existed (OECD, 2017). Moreover, national studies focusing on elementary, secondary, and postsecondary students have found moderate levels of school- or academic-related anxiety in general, as well as exam anxiety in particular (e.g., Norway: Brandmo et al., 2019; India: Lohiya et al., 2021). With respect to high-achieving students, studies have shown that undergraduate and graduate students who are high-achievers have less test anxiety than low-achievers (Pakistan: Khalid & Hasan, 2009; US: Chapell et al., 2005). Longitudinal studies have found that exam anxiety and/or test anxiety seem to be stable, especially when trait anxiety is analyzed, which reflects a time point invariant individual characteristic (e.g., Hong, 1998). Thus, Steinmayr et al. (2016) revealed that test anxiety in a sample of 11th-grade students in Germany was stable over a time span of one year.

Satisfaction with peers captures students' quality of social integration and social interactions as well as the absence of social problems in school. On average, it seems that students experience a low frequency of social problems in school. Concerning sense of school belonging, which covers similar aspects as satisfaction with peers, the mean value in the United States was below the OECD average (e.g.,

Switzerland: Hascher & Hagenauer, 2020; Switzerland and Luxembourg: Morinaj & Hascher, 2019; international: OECD, 2017). Godor and Szymanski (2017) revealed with PISA 2012 data that a majority of gifted students in the EU reported equal or higher levels of sense of belonging compared to non-gifted students. Concerning its development, longitudinal or cross-sectional comparative studies have found declines in adolescence, especially with respect to school belonging as an indicator of satisfaction with peers. PISA data from 2000 to 2018 revealed that learners' sense of school belonging declined across the world. This expressly holds true for Sweden (e.g., Sweden: Högberg et al., 2021). Moreover, Goldbeck et al. (2007) found a tendency towards decreased satisfaction with friends over time in a sample of secondary school students in Germany.

Factors influencing the development of students' subjective well-being in adolescence

Changes in SWB can be theoretically explained by SDT (Ryan & Deci, 2000) and SEFT (Eccles et al., 1993). SDT holds that the (non-)fulfillment of basic needs (autonomy, competence, relatedness) can facilitate (hinder) motivation, vitality, and well-being in any learning environment (e.g., Levesque et al., 2004; Neubauer et al., 2017; Ryan & Deci, 2000; Tay & Diener, 2011). Basic psychological needs theory is a mini-theory within SDT which posits that people strive to satisfy their basic needs (e.g., Ryan & Deci, 2002). With respect to autonomy, autonomous learning situations can be distinguished from externally controlled conditions. Autonomous learning situations may fulfill the need to feel self-directed. The need for competence refers to being effective when exerting effort on a task. Relatedness encompasses positive social connectedness with others. Empirical results support the theoretically posited relations between basic needs and well-being. Tian et al. (2014) found within a sample of Chinese adolescent school students that need for autonomy, competence, and relatedness was positively associated with positive school-related well-being aspects such as school satisfaction and positive affect, but negatively with negative affect. Furthermore, especially autonomy and relatedness measured at time point 1 predicted changes in school satisfaction. Also, Kleinkorres et al. (in press) revealed within a longitudinal study with students attending Grade 5 to 9 that perceived teacher autonomy support was positively related to different facets of school-related well-being such as satisfaction with school or social integration as indicator for peer satisfaction. Additionally, changes in perceived autonomy support from teachers were positively associated with the development of school satisfaction, school enjoyment, but not to social integration. Moreover, Lepper et al. (2021) showed that feeling competent was positively related to elementary school students' academic self-concept. With respect to relatedness,

Schmidt et al. (2019) found in a sample of elementary school children that peer relatedness was especially positively associated with positive affect. Alongside internal factors, which lie within the person him- or herself, environmental factors may particularly affect the fulfillment of basic needs (e.g., Ryan & Deci, 2000, 2017).

SEFT (Duineveld et al., 2017; Eccles et al., 1993; Gutman & Eccles, 2007; Shubert et al., 2020) posits that important student characteristics like motivation or SWB might decrease as a result of (mis)fit between students' needs and the school or family environment. Several variables can impact this fit (e.g., Eccles & Midgley, 1989; Eccles et al., 1993). One important factor is students' relationships with their teachers and family, respectively. During the last years of school, before the transition to vocational training or university, students may perceive a higher amount of pressure to perform. Pressure can be applied by school as well as family (e.g., Phelan et al., 1994) and can lead to feelings of heteronomy (Deci & Ryan, 2013; Levesque et al., 2004) because these relationships can be perceived as controlling (Eccles et al., 1993; Gutman & Eccles, 2007). Most studies have focused on the importance of support rather than pressure (e.g., Chu et al., 2010; Koçkar & Gençöz, 2004; Orkibi et al., 2014). Perceiving academic support is positively related to students' mental health. In contrast, perceived pressure is related to a lack of confidence and greater experience of stress, anxiety, and depressive symptoms (e.g., Deb et al., 2015; Gherasim & Butnaru, 2012; Kulakow et al., 2021; Tennant et al., 2015). This also holds true for high-achieving students. Stiles et al. (2020) showed that parent achievement expectations were correlated with youth psychopathology.

The present study

SWB is of crucial importance for students' educational and subsequently occupational success. Both theoretical models and empirical results suggest that certain aspects of SWB may change over the course of students' school years. However, most prior studies relied only on cross-sectional data and did not apply longitudinal designs. In addition, how different SWB variables change over time among adolescent students in high-achieving environments remains unclear. There are theoretical reasons to believe that psychological needs and perceived pressure may be associated with the temporal development of SWB. However, it is still unknown how these variables are associated with different aspects of SWB, and to what extent these possible relations exist only on between-variation or also on within-variation of individuals in longitudinal data. Against this background, we formulated the following research questions:

(1) How do core aspects of SWB (school satisfaction, academic self-concept, experience of stress, exam anxiety,

satisfaction with peers) develop from Grade 11 to Grade 12?

(2) Are changes in (a) psychological needs (autonomy, competence, relatedness) and (b) pressure from teachers and parents respectively beneficial or obstructive for the development of different aspects of SWB?

Hypothesis 1. School satisfaction and satisfaction with peers will decrease over time, while experience of stress will increase. Academic self-concept and exam anxiety will be stable over time.

Hypothesis 2. Changes in psychological needs as well as perceived pressure from teachers and parents will be related to the temporal development of different SWB aspects. More precisely, increases in needs fulfillment will be associated with positive changes in positive SWB aspects, but negatively with changes in negative SWB aspects (H2a). An increase in perceived teacher and parental pressure should be negatively related to changes in positive SWB aspects and positively associated with changes in negative SWB aspects (H2b).

Method

Participants and procedure

Analyses are based on 1,286 high school students (46.7% female). At the first point of measurement (Grade 11), students were 16.40 years old on average ($SD=0.44$). We excluded one student from the analysis due to a very young age (12 years old). After one year, students participated in the study again (Grade 12). 814 students participated twice in the Be Well at School (BELLs) study conducted by the Center for Research on Education and School Development (IFS) at the TU Dortmund University together with the Walnut Valley Unified School District. 472 students participated only once (T1: 214, T2: 258). Students were enrolled in two large, high-achieving suburban schools located in the same school district in the United States. Socio-economic background was operationalized with the International Socio-Economic Index (ISEI; Ganzeboom & Treiman, 2003). The family's highest ISEI (HISEI) averaged $M=62.48$ ($SD=18.16$). Students' ethnic background was distributed as follows: 42.3% Chinese, 16.5% Hispanic, 10.6% Korean, 9.7% White and 21.0% other. A total of 19.0% of participants were born outside the US. Average GPA at the end of Grade 10 was 3.36 ($SD=0.57$). Data collection took place in September 2017 and 2018 via an online survey and took 45 min. Students participated voluntarily. Ethical approval was not required as it was a survey study.

Measures

All constructs were measured with established instruments. Scale characteristics (M , SD , α) for all measures and both measurement points are displayed in Table 1. Information concerning answer formats are given at the end of the Measures section. Confirmatory factor analyses (CFA) were specified to analyze whether our well-being measures all loaded on the same latent model or were separable dimensions of well-being (see Statistical Analyses section).

SWB

Aspects of SWB were measured with five established instruments. To assess school-related cognitions, students answered items concerning *school satisfaction* and *academic self-concept*. School satisfaction was measured with seven items (Huebner, 2001) covering how often students enjoy going to or learning at school (e.g., “How often do you think of yourself in the following way? There are many things about school I do not like.”). Academic self-concept was measured with five items (Marsh & O’Mara, 2008) addressing students’ self-perceptions of their academic abilities (e.g., “To what extent do the following statements apply to you? I learn things quickly in most school subjects.”). To capture students’ school-related affect, they answered items concerning *experience of stress* and *exam anxiety*. Experience of academic stress (Struthers et al., 2000) concerned how worried, helpless, and stressed students felt about their school performance (e.g., “In general, how do you feel when thinking about your school performance? I feel worried.”) and was assessed with three items. *Exam anxiety* was assessed with four items (Martin, 2001) capturing students’ worries related to exams, assignments, tests, or schoolwork (e.g., “I worry about failing exams and assignments.”). *Satisfaction with peers*, as an important aspect of the social dimension of SWB, was measured with nine items (Huebner, 2001) addressing whether students are satisfied with their schoolmates (e.g., “How often do you think of yourself in the following way? My school peers are great.”). All SWB measures had good reliability at both measurement points (see Table 1).

Psychological needs

The three psychological needs *autonomy*, *competence*, and *relatedness* were measured with 4 items each (Chen et al., 2015), addressing whether students’ psychological needs were satisfied (e.g., autonomy: “I feel I have been doing what really interests me.”, competence: “I feel confident that I can do things well.”, relatedness: “I feel that the people I care about also care about me.”). Reliability scores were satisfactory to good (see Table 1).

Achievement pressure

Perceived achievement pressure from teachers was assessed with four items (Daniels, 2008) addressing how demanding teachers’ academic expectancies were (e.g., “If we do not study at the weekends, it is hardly possible to meet the requirements.”). Parental pressure was measured with five items (Hagenauer, 2011) capturing students’ perception of achievement pressure applied by parents (e.g., “My parents tell me again and again that it is important to get good grades.”). Scale reliabilities were satisfactory to good (see Table 1).

Students rated the items concerning school satisfaction, academic self-concept, satisfaction with peers, and achievement pressure on a 4-point scale ranging from 1 (*Strongly disagree/Not true/Never*) to 4 (*Strongly agree/Exactly true/Almost always*). For stress experience, responses were made on a 10-point scale (1 – *Not at all* to 10 – *A great deal*). A 7-point scale (1 – *Strongly disagree* to 7 – *Strongly agree*) was used for exam anxiety and a 5-point scale for psychological needs (1 – *Completely disagree* to 5 – *Completely agree*). Negatively phrased items in the school satisfaction and satisfaction with peers scales were reverse-coded.

Statistical analyses

All analyses were conducted with the statistical program R (R Core Team, 2021). We mainly relied on the R-package `lavaan` (Rosseel, 2012) to model the latent variables in structural equation models. Missing data were accounted for by applying full information maximum likelihood estimations (FIML; Graham & Coffman, 2012; Little, 2013). We used heteroskedasticity-robust and individual-level clustered standard errors, and residual correlations between items and over time to improve model fit in the structural equation models. To answer Research Question 1, we latently modeled the well-being outcome variables each separately and used a dummy variable equal to one at the second measurement point to capture changes over time. The advantage of this method over a simple ANOVA with repeated time measurement is the use of structural equation models and the more sophisticated standard errors.

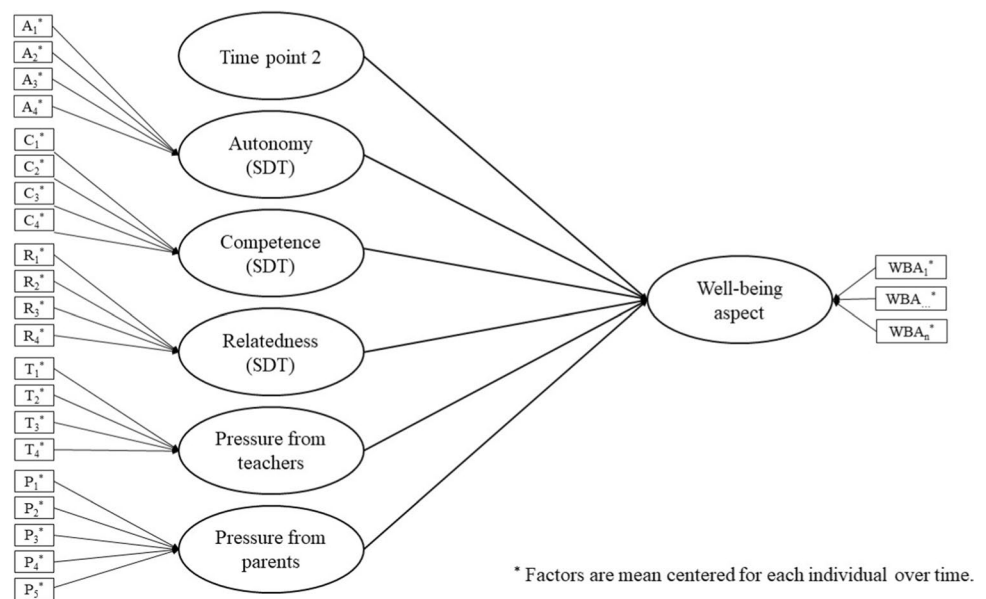
For Research Question 2, in addition to the time measurement dummy, we included the latent variables autonomy (SDT), competence (SDT), relatedness (SDT), pressure from teachers and pressure from parents into the structural equation model, as these potentially influence various aspects of SWB (school satisfaction, academic self-concept, experience of stress, exam anxiety, satisfaction with peers) (see Fig. 1). Additionally, before estimating the respective coefficients in structural equation models for each outcome variable, we centered the data (indicators for the latent variables as well as manifest

Table 1 Descriptive statistics, scale reliabilities and intercorrelations

	M (SD)	α	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1) ScS_I	2.52 (0.59)	.80	-																							
2) ScS_II	2.38 (0.59)	.79	.58*	-																						
3) ASC_I	2.53 (0.64)	.88	.30*	.24*	-																					
4) ASC_II	2.53 (0.66)	.90	.25*	.32*	.59	-																				
5) ES_I	6.30 (2.45)	.85	-.31*	-.21*	-.22*	-.24*	-																			
6) ES_II	6.04 (2.40)	.84	-.19*	-.25*	-.18*	-.29*	.51*	-																		
7) EA_I	5.09 (1.45)	.88	-.12*	-.11*	-.14*	-.16*	.58*	.40*	-																	
8) EA_II	5.00 (1.49)	.88	-.06	-.08*	-.12*	-.22*	.40*	.55*	.50*	-																
9) PS_I	3.10 (0.56)	.86	.37*	.21*	.19*	.18*	.18*	.15*	.06	-.05	-															
10) PS_II	3.01 (0.54)	.85	.27*	.37*	.23*	.27*	.16*	-.25*	-.12*	-.12*	.54*	-														
11) Aut_I	3.41 (0.76)	.73	.36*	.31*	.14*	.08*	.21*	-.09*	-.04	.01	.21*	.18*	-													
12) Aut_II	3.38 (0.71)	.71	.22*	.34*	.14*	.16*	.11*	-.18*	-.02	-.02	.11*	.27*	.42*	-												
13) Co_I	3.47 (0.77)	.83	.31*	.28*	.33*	.28*	-.32*	-.19*	-.18*	-.08*	.25*	.19*	.60*	.31*	-											
14) Co_II	3.37 (0.78)	.84	.28*	.35*	.33*	.42*	-.25*	-.34*	-.17*	-.15*	.22*	.34*	.36*	.57*	.50*	-										
15) Rel_I	3.83 (0.78)	.86	.27*	.22*	.18*	.14*	-.10*	-.04	.03	.08*	.44*	.44*	.46*	.25*	.48*	.29*	-									
16) Rel_II	3.77 (0.81)	.87	.16*	.27*	.17*	.18*	-.02	-.07*	.02	.10*	.29*	.48*	.23*	.47*	.19*	.48*	.46*	-								
17) PT_I	2.79 (0.62)	.73	-.18*	-.11*	-.08*	-.09*	.40*	.26*	.46*	.27*	-.14*	-.14*	-.04	-.03	-.05	-.04	.01	.03	-							
18) PT_II	2.74 (0.61)	.73	-.13*	-.17*	-.14*	-.13*	.26*	.42*	.23*	.38*	-.12*	-.16*	.01	-.05	-.06	-.09*	-.02	-.01	.42*	-						
19) PP_I	2.62 (0.79)	.85	-.08*	-.06	-.04	.02	.17*	.16*	.17*	.15*	-.11*	-.13*	-.08*	-.05	-.04	-.07*	-.08*	-.13*	.19*	.16*	-					
20) PP_II	2.40 (0.84)	.86	-.05	-.05	.01	-.02	.18*	.26*	.15*	.22*	-.06	.13*	-.06	-.07*	-.02	-.08*	-.05	-.13*	.16*	.29*	.63*	-				
21) For	0.19 (0.39)	-	.12*	.13*	.07*	.05	-.11*	-.10*	-.06	-.05	.02	.04	.00	.01	-.03	-.01	-.06*	-.07	-.04	-.03	-.03	-.02	-			
22) Fem	0.47 (0.50)	-	-.01	-.05	-.06*	-.10*	.18*	.20*	.18*	.23*	-.02	.01	.00	.03	-.11*	-.12*	.09*	.14*	.10*	.08*	-.12*	-.12*	.00	-		
23) HISEI	62.48 (18.16)	-	.00	.03	.11*	.12*	.08*	.05	.05	.00	.01	.02	.02	.04	.02	.09*	.03	.07	.11*	.06	.03	.01	-.05	-.03	-	
24) GPA	3.36 (0.57)	-	.07*	.10*	.33*	.33*	.11*	.02	.15*	.04	.16*	.15*	-.04	.04	.03	.08*	.08*	.16*	.10*	.00	-.10*	-.07*	.01	.17*	.16*	-

ScS school satisfaction, ASC academic self-concept, ES experience of stress, EA exam anxiety, PS satisfaction with peers, Aut autonomy (SDT), Co competence (SDT), Rel relatedness (SDT), PT pressure teachers, PP pressure parents, For Foreign-born, Fem Female, Range ScS, ASC, PS, PT, PS: 1 (Strongly disagree/Not true/Never) – 4 (Strongly agree/Exactly true/Almost Always), Range ES: 1(Not at all) – 10 (A great deal), Range EA: 1 (Strongly disagree) – 7 (Strongly agree), Range SDT: 1 (Completely disagree) – 5 (Completely agree), Range HISEI: 14.21 to 88.7, Range GPA: 0.87 to 4. Fem: 1 (female), 0 (male); For: 1 (born outside the US), 0 (born in the US). * $p < .05$

Fig. 1 Illustration of the structural equation models used to analyze the relations between SDT and achievement pressure variables and various well-being aspects. *Note.* The number of items for the respective well-being aspect (WBA) varies from 3 to 9



variables) within individuals, leaving only the within-student variation while dropping the between-student variation. This within-individual centering over time eliminated all possible effects of (un)observed student-level variables that are time point invariant (constant over time). In panel or mixed models, these would be referred to as individual fixed effects or unit fixed effects model. The benefit of centering the data before analysis is that we can rule out bias due to time point invariant omitted variables. Thus, the main variation which is analyzed is within individuals and not between them. The idea underlying centering is based on Köhler et al. (2021). In that paper, the authors showed that if time point invariant individual-level characteristics influence the outcome variables, a change score model is superior to ANCOVA. If the time point invariant characteristics also influence the variable of interest, both models fail to produce unbiased results. Since we observed all our variables of interest at both time points, not just the outcome variables, as was the case in Köhler et al. (2021), we could theoretically calculate change scores for all variables. This method would be able to handle the case in which the time point invariant characteristics influence the explanatory variables, thus leading to more robust estimation results. However, by using within-individual centering, we kept both time points and thus did not decrease the sample size unnecessarily. To control for correlations within the error term over time, we, as stated above, calculated clustered standard errors at the individual level. This type of centering is also discussed (and even extended to random growth models) in Hamaker and Muthén (2019). This is similar to the group mean centering in multilevel models discussed by Enders and Tofghi (2007), who used

within-cluster means to control for differences between clusters.

Furthermore, even though our hypotheses were directional, we still used a two-sided test, following, for example, Hübner et al. (2020) as well as Brailovskaia et al. (2020), Kumalasari et al. (2020), and Radkiewicz (2020). Still, since the one-sided test would have just half of the p -value of the two-sided test, we also report the 10 percent significance level, as this refers to the 5 percent level of the one-sided test.

All constructs were modeled as latent variables. Goodness of fit was evaluated with the comparative fit index (CFI), χ^2 , root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) (Shi et al., 2020). To improve model fit, the residuals were allowed to covary. To test whether our well-being measures all loaded on the same latent model or were separable dimensions of well-being, we conducted a CFA. Running a CFA for the global model yielded χ^2 (1364, $N = 1286$) = 17,160.6, CFI = 0.495, RMSEA = 0.095, and SRMR = 0.134. Since the CFI is markedly below 0.9, the RMSEA as well as the SRMR above 0.08, the items did not measure one latent well-being variable. The 5-factor model, in which we included all five well-being latent variables with residual correlations for all latent variables per time point, yielded χ^2 (1320, $N = 1286$) = 3947.8, CFI = 0.916, RMSEA = 0.039, and SRMR = 0.055, meeting the conditions that the CFI be above 0.9 and the RMSEA and SRMR below 0.08 (Hu & Bentler, 1999; Kline, 2015). Table 2 (Summary of fit measure of CFAs) shows that modeling each well-being scale separately, again including both time points, fits the data well. All scales have a CFI above 0.90, a RMSEA and

Table 2 Summary of fit measures of CFAs

Model	χ^2	df	<i>n</i>	CFI	RMSEA	SRMR
School satisfaction	192.2*	43	1286	0.970	0.052	0.044
Academic self-concept	190.0*	30	1281	0.974	0.064	0.027
Experience of stress	15.9*	5	1285	0.997	0.041	0.018
Exam anxiety	102.1*	15	1283	0.982	0.067	0.027
Satisfaction with peers	511.6*	117	1282	0.959	0.051	0.061
Autonomy (SDT)	26.9*	11	1281	0.992	0.034	0.022
Satisfaction (SDT)	16.8*	15	1281	0.999	0.010	0.011
Relatedness (SDT)	36.7*	15	1281	0.995	0.034	0.019
Perceived pressure from teachers	70.5*	15	1283	0.973	0.054	0.030
Perceived pressure from parents	287.3*	23	1279	0.951	0.095	0.053

* $p < .05$

a SRMR below 0.08. Additionally, Table 2 includes results for the latent explanatory variables: perceived pressure from teachers and parents as well as students' need for autonomy, competence, and relatedness from SDT. For these variables, the CFAs including both time points showed good fit as well, with the exception of perceived pressure from parents where RMSEA was slightly above 0.08 whereby all other fit indices were good.

Results

Descriptive results

On average, students were satisfied with school at both measurement points (see Table 1). They experienced a medium level of stress, and their level of exam anxiety was above the scale midpoint. On a descriptive level, perceived pressure from teachers was higher than perceived pressure from parents. Furthermore, perceived pressure from teachers and parents were statistically significantly positively correlated, indicating that students who perceived higher pressure from teachers also perceived higher pressure from parents. Correlation coefficients were small (Cohen, 1988). Additionally, students were satisfied on average regarding fulfillment of the needs for autonomy, competence, and relatedness. These basic needs had statistically significant positive small to large (Cohen, 1988) correlations with one another, indicating, for example, that students who felt competent also tended to report feeling autonomous (see Table 1).

Development of SWB from Grade 11 to Grade 12

To answer the first research question, we analyzed the variance with repeated measures as described above. Model fits were good (see Table 2). We found a statistically significant negative difference between the first and second

measurement points for experience of stress, $\beta = -0.137$ ($SE = 0.038$), $p < 0.001$, $R^2 = 0.0047$, and satisfaction with peers, $\beta = -0.133$ ($SE = 0.038$), $p < 0.001$, $R^2 = 0.0044$. This means that students experienced less stress on average in Grade 12 compared to Grade 11, but were also less satisfied with their peers. Also for exam anxiety the coefficient was negative, $\beta = -0.066$ ($SE = 0.037$), $p = 0.074$, $R^2 = 0.0011$, indicating that students reported less exam anxiety on average in Grade 12 compared to Grade 11. For the other outcome variables, school satisfaction, $\beta = -0.038$ ($SE = 0.044$), $p = 0.389$, $R^2 = 0.0004$, and academic self-concept, $\beta = -0.006$ ($SE = 0.035$), $p = 0.870$, $R^2 < 0.0001$, the coefficients were negative, but small in magnitude and statistically insignificant according to conventional levels, indicating that these constructs remained largely stable over time. Hence, the results supported Hypothesis 1 only with respect to the following core aspects of SWB: academic self-concept and satisfaction with peers.

Importance of psychological needs, pressure from teachers and parents for the development of SWB

Next, we sought to determine which changes in (a) psychological needs and (b) pressure variables affected changes of different SWB aspects. Table 3 shows the within-individual centered SEM results after adding the latent variables measuring autonomy, competence, and relatedness and perceived pressure from teachers and parents to the model estimated above. Model fits including both measurement points were good (see Table 3).

First, we can see that the decrease in experience of stress and satisfaction with peers from Grade 11 to Grade 12 is robust, meaning that variation in the control variables does not explain this negative development. On the contrary, the coefficients increased in magnitude, revealing an even stronger negative trajectory. Next, the SEM revealed that the SDT variables did contribute to

Table 3 Structural equation models with within-individual centralization

Predictor	School satisfaction	Academic self-concept	Experience of stress	Exam anxiety	Peer satisfaction
Time point 2	-.217 (0.222)	.112 (0.085)	-.217* (0.089)	-.024 (0.085)	-.255** (0.091)
Autonomy (SDT)	.378* (0.159)	-.061 (0.126)	-.001 (0.15)	.064 (0.131)	.004 (0.122)
Competence (SDT)	-.075 (0.137)	.360** (0.127)	-.251* (0.122)	-.120 (0.108)	.107 (0.105)
Relatedness (SDT)	.021 (0.084)	-.061 (0.075)	.084 (0.077)	.094 (0.07)	.316*** (0.081)
Pressure from teachers	-.092 (0.071)	-.064 (0.056)	.451*** (0.071)	.410*** (0.067)	-.072 (0.065)
Pressure from parents	.002 (0.064)	-.062 (0.058)	.045 (0.057)	.102+ (0.055)	-.080 (0.05)
<i>N</i>	2572	2572	2572	2572	2572
<i>R</i> ²	.1225	.0852	.2142	.1707	.1514
χ^2	2326.1	1251.2	1177.4	1249.9	1531.0
<i>df</i>	330	306	257	281	412
<i>p</i> -value	< .001	< .001	< .001	< .001	< .001
CFI	.901	.896	.900	.899	.906
RMSEA	.05	.03	.04	.04	.03
SRMR	.057	.046	.048	.048	.046

Even though our research questions were directional, we run a two-sided test using lavaan. Hence, we also show the marginal significance level of 10 percent, since this would be the 5 percent cutoff for a one-sided test. Heteroskedasticity-robust and individual clustered standard errors in parentheses. + $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

explaining the well-being variables: (i) Higher satisfaction of the need for autonomy was positively related to school satisfaction, $\beta = 0.378$ ($SE = 0.159$), $p < 0.05$. Students who felt more autonomous in Grade 12 than in Grade 11 were happier with their school. (ii) Competence was significantly positively related to academic self-concept, $\beta = 0.360$ ($SE = 0.127$), $p < 0.01$, and negatively related to experience of stress, $\beta = 0.251$ ($SE = 0.122$), $p < 0.05$. Thus, students who experienced increased satisfaction of their need for competence from Grade 11 to Grade 12 also tended to experience an improved academic self-concept and lower perceived stress. Lastly, relatedness was positively related to satisfaction with peers, $\beta = 0.316$ ($SE = 0.081$), $p < 0.001$, i.e., an increase in relatedness is accompanied by more positive perceived relationships with peers. With respect to the direction of the found relations, the findings are in line with Hypothesis 2a, although not all expected relations were found.

Alongside the SDT variables, perceived achievement pressure was also related to the development of the SWB constructs over time. An increased perceived pressure from teachers was positively related to experience of stress, $\beta = 0.451$ ($SE = 0.071$), $p < 0.001$, and exam anxiety, $\beta = 0.410$ ($SE = 0.067$), $p < 0.001$, but not to school satisfaction, academic self-concept or satisfaction with peers. This means that students who perceived increased pressure from teachers in Grade 12 compared to Grade 11 experienced greater stress and exam anxiety in Grade 12. Perceived pressure from parents did not influence the well-being outcomes, except exam anxiety $\beta = 0.102$ ($SE = 0.055$), $p = 0.062$, indicating that students

who perceived increased pressure from parents in Grade 12 compared to Grade 11 reported greater exam anxiety. In summary, the data supported Hypothesis 2b only partially, while the direction of the found relations were as expected. To test whether results are robust or exhibit external validity, we run another analysis which can be found in the supplement. Results revealed that inferences to general population should be valid (ESM 1).

Discussion

Despite the relevance of SWB, not much is known about its temporal development, especially during the critical and important phase of adolescence and for students in high-achieving environments. Furthermore, it is unknown whether theoretically crucial factors like fulfillment of basic needs and achievement pressure are related to the development of various SWB aspects. The present study shed light on these questions by longitudinally investigating them in a large sample of high-achieving students.

Contrary to our assumptions and prior research, satisfaction with school did not decrease significantly from Grade 11 to Grade 12 (e.g., Kleinkorres et al. 2020). Nevertheless, the mean value of school satisfaction at the second measurement point was descriptively lower than at the first, which could be explained by SEFT (e.g., Eccles et al., 1993; Gutman & Eccles, 2007). As expected, students' academic self-concept remained stable over time. This result aligns with prior studies focusing on an earlier stage of adolescence (e.g., Preckel et al.,

2013). The stability of students' academic self-concept can be explained by its general developmental trajectory from students' early school careers, where academic self-concepts are very positive and inaccurate, to the end of elementary school and beginning of secondary school, where the largest decline takes place due to feedback, frame of reference effects, and more accurate perceptions of one's own abilities (e.g., Aunola et al., 2002; Jacobs et al., 2002; Möller et al., 2020; Wigfield et al., 2006). Hence, a further strong decline in late adolescence is unlikely. In general, also exam anxiety should be stable due to the trait-like character of the measured construct, which captures personality-specific anxiety, which is more stable than the situational (state) component of anxiety (e.g., Gidron, 2013; Usala et al., 1991). However, against our assumption, exam anxiety was not stable. As the negative coefficient was very small as well as the descriptive comparison of the two mean values, we do not like to overinterpret this result. Contrary to our expectations and prior research, students' experience of stress did not increase from Grade 11 to Grade 12 (e.g., Hoferichter et al., 2021). This significant decrease rather than increase in experience of stress might result from the privileged nature of the sample. Mean HISEI in this sample was much higher than mean HISEI in the US as a whole ($M = 54.1$, $SE = 0.6$; Müller & Ehmke, 2016), and higher ISEI is associated with lower perceived stress (e.g., Sonali, 2016). Another reason for the decrease in experience of stress as well as for exam anxiety might relate to the specific time point of measurement: after students apply to college, which usually starts to happen one year before finishing school, their stress might be less than before. Furthermore, as assumed, satisfaction with peers declined (e.g., Högberg et al., 2021), which can be explained by SEFT, which would posit that these adolescents did not feel satisfied due to a misfit between their needs and reality (e.g., Eccles & Midgley, 1989). Additionally, the decline might be related to the specific phase of adolescence under study, just before the transition to college and accompanying change in social context (Oswald & Clark, 2003).

As expected, changes in the fulfillment of basic needs and achievement pressure were significantly associated with changes in SWB, focusing on within-variation (Table 3). These results were also robust including between variance, i.e. without individual mean centering (Table A, supplement). Hence, for this study, the interpretation of the relation of state or change of variables of interest with development of SWB aspects is similar. Increased fulfillment of the need for autonomy led to improved satisfaction with school. When students felt more autonomous, they were more satisfied with school, meaning the environment fitted. Moreover,

feeling competent was significantly related to positive changes in achievement-related aspects such as academic self-concept and experience of stress. Additionally, fulfillment of the need for relatedness was associated with positive changes in satisfaction with peers. These relations between fulfillment of basic needs and SWB can be theoretically explained by SDT (Ryan & Deci, 2000). Moreover, the fact that satisfaction of basic needs facilitated different aspects of SWB is in line with prior research focusing largely on other age and cultural groups (e.g., Lepper et al., 2021; Neubauer et al., 2017; Tian et al., 2014).

Achievement pressure from teachers seemed to negatively affect the development of different SWB aspects, especially experience of stress and exam anxiety. If pressure from teachers was perceived, more stress and exam anxiety were experienced over time. Contrary to our expectations, parental pressure was not related to changes in SWB aspects with the exception of exam anxiety, even though bivariate correlations did exist also with other SWB aspects. The non-significant predictive power of parental pressure with the exception of the small relation with exam anxiety, which was also smaller than that between pressure from teachers and exam anxiety, and which we do not want to overinterpret, might be due to the importance of the other investigated constructs. Moreover, this result is understandable in light of socialization theory concerning this phase of adolescence. Parents are the main agents of socialization for young children. As students transition to school, this changes to teachers and peers (Berns, 2015). The association between perceived pressure from teachers and SWB can be explained by SEFT, as indicative of a misfit between students' needs and environmental context (Eccles & Midgley, 1989). Achievement pressure from teachers might be seen as an external factor that controls students' behavior and therefore reduces SWB (e.g., Ryan & Deci, 2017).

Limitations and strengths

When interpreting the results, certain aspects of the present study warrant attention. First, average GPA in this sample was much higher than average GPA in the US as a whole, while HISEI was also high compared to the average HISEI nationwide (e.g., NCES, 2009). Another limitation is that the physical dimension of SWB was not assessed, meaning that the full complexity of the SWB construct was not considered. Furthermore, data were only collected at two measurement points. For more complex cross-lagged panel models, 3 or even 5 measurement points are needed, which is why such models were not used here (Mulder & Hamaker, 2021; Orth et al., 2021; Usami, 2021). However, the study also has its strengths. One important strength is that we focused on different

aspects of SWB longitudinally, allowing for an investigation of its temporal trajectory. Moreover, we focused on the crucial phase of adolescence, in which students face several challenges and must complete certain developmental tasks. By focusing on high-achieving students, the study also addresses an important group of at-risk students (see Luthar et al., 2020) in terms of well-being. Additionally, we analyzed all theoretically derived, potentially relevant constructs simultaneously and applied state-of-the-art methods to answer our research questions. By focusing on the development of various SWB aspects among high-achieving adolescent students and examining several potential influencing factors, the current study yielded important insights and contributed significantly to the existing body of knowledge.

Conclusion

This study's results and limitations have implications for research and practice. In addition to basic need satisfaction, further research could also include frustration of basic needs and how this is associated with SWB to offer a more holistic view of satisfaction and frustration of needs (Ryan & Deci, 2000). It would also be interesting to focus on comparable internal and external factors and how they are related to changes in SWB during adolescence and among students in high-achieving environments. In this context, investigating students', parents', and teachers' achievement attitudes would be of interest. Additionally, it could be worthwhile to analyze more deeply whether certain parenting styles are associated with the development of SWB, as parenting styles are at least related to psychological well-being (Cripps & Zyromski, 2009). Moreover, teachers' judgment accuracy could be analyzed as a factor influencing SWB development, because slightly overestimating students' characteristics seems to be beneficial for various aspects of motivation as well as achievement (e.g., Stang & Urhahne, 2016; Urhahne et al., 2011). The results also have important implications for educational practice. On the one hand, SWB is related to academic achievement. On the other hand, it is crucial for several psychological outcomes and students' positive functioning (e.g., Bückner et al., 2018; Suldo et al., 2006). Therefore, parents and especially educators should be made aware of the effects of applying achievement pressure. Moreover, the school environment should support the fulfillment of psychological needs, which are crucial for SWB (e.g., Ryan & Deci, 2000, 2017).

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Data availability Due to the absence of consent from respondents to publish (some or all of) the analyzed data, it is not available in a public repository.

Declarations

Conflict of interest The authors have no conflict of interest to declare. There has been no significant financial support for this study.

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