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Development of subjective well-being in adolescents before and during the COVID-19 pandemic

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Previous studies have already revealed detrimental effects of the COVID-19 pandemic on school students' subjective well-being (SWB). However, there is a lack of studies examining the development of various facets of SWB such as life satisfaction, mood as well as domain satisfactions regarding peers, family, or school before and during the pandemic among adolescents longitudinally. Furthermore, the present study aims to shed further light on various moderators such as gender, age, migration background and socioeconomic status. Data from $N = 207$ students (Grade 5 to 9) from two German schools were assessed on four measurement time points, three before and one after the onset of the pandemic. Piecewise latent growth curve models with three time slopes were conducted to investigate the development of SWB and its moderators. They showed significant declines in general mood and domain-specific satisfaction with family, peers and school before the COVID-19 pandemic. However, during the COVID-19 pandemic, only satisfaction with family decreased significantly. Among the moderators, especially the socioeconomic status indicated interindividual differences in the variation of different SWB facets.

KEYWORDS

subjective well-being, life satisfaction, domain-specific satisfaction, adolescence, COVID-19 pandemic, longitudinal study

Introduction

Enhancing adolescents' well-being and academic success is a fundamental goal in many educational systems (e.g., Western Europe). The extent to which well-being is prioritized and supported may vary across educational systems and individual schools (OECD, 2023). It has grown into an increasingly important focus, especially during challenging periods such as a widespread pandemic affecting everyone's daily lives and adolescents' educational experiences. Furthermore, high levels of overall and domain-specific subjective well-being (SWB) could serve as a protective factor during challenging times, as high SWB has been associated with many positive outcomes, including mental and physiological health (e.g., Goldbeck et al., 2007), positive self-concept (e.g., Chui and Wong, 2016) and academic achievement (e.g., Buecker et al., 2018).

Previous research from various countries has shown that students' SWB declined during the COVID-19 pandemic (e.g., Magson et al., 2021 in Australia; van der Laan et al., 2022 in the Netherlands), using, however, frequently cross-sectional or cohort designs (e.g., Romm et al., 2021 in the USA; Marckhoff et al., 2022 in Germany). Only a few longitudinal studies from Central Europe have considered measurements before the pandemic (e.g., Green et al., 2023; Casali et al., 2023; Steinmayr et al., 2022). Additionally, some studies only investigated

different facets of SWB (e.g., van der Laan et al., 2022; Magson et al., 2021), and have not taken interindividual differences in SWB changes between students into account (e.g., Shoshani and Kor, 2022; Kassiss et al., 2022; Houghton et al., 2022). The present study aims to examine the longitudinal development of SWB in general and in different domains (such as school, peers, family) amongst German adolescents before and during the pandemic while also considering interindividual differences related to age, gender, socioeconomic status, migration background, and academic achievement.

Subjective well-being and its development during adolescence

There is a growing emphasis on the importance of adolescents' social and emotional development, with well-being emerging as a significant developmental and educational goal, yet many educational systems face challenges in fully supporting it (OECD, 2023). SWB refers to a person's feelings and evaluations about their life in general and within specific domains, such as family, peers, and school (Diener et al., 2018). This definition aligns with the widely established hedonic perspective on SWB, which distinguishes cognitive and affective components (Diener et al., 2018; Diener, 2012). The cognitive component (satisfaction) refers to evaluations about one's life as a whole and within specific domains (e.g., family, peers, school; Diener et al., 2018; Long and Huebner, 2014). The affective component (mood) encompasses pleasant and unpleasant feelings (Diener et al., 2018). This operationalization has been validated for both adolescents and adults and is thus utilized in this study (Diener et al., 2018; Long and Huebner, 2014).

SWB in general seems not constant throughout a person's lifetime as it rather fluctuates with age. In this context, the disruption hypothesis posits temporary declines in well-being during adolescence (Soto and Tackett, 2015). "Adolescence" marks the transition from childhood to adulthood between ages of ten and nineteen (WHO, 2001) with changes in brain development, endocrinology, emotions, and interpersonal relationships (Eccles et al., 1993; Wood et al., 2018). If the surrounding environment does not fulfil the changing developmental needs, the well-being of adolescents may be affected. More specifically, the Stage-Environment-Fit Theory (Eccles et al., 1993) suggests that a mismatch between the developmental needs of adolescents and the opportunities provided by their environment can lead to decreased well-being. Indeed, the meta-analysis by Buecker et al. (2023), which primarily included samples from Europe and North America, found declines in life satisfaction between the ages 9 to 16 ($d = -0.56$), though it was less pronounced between ages 14 and 16. Moreover, they reported a decrease in positive affect from the age of 9 years onwards up to age 70 ($d = -1.64$) and an increase in negative affect from the age of 12 years onwards up to age 22 ($d = 0.20$; Buecker et al., 2023).

Although research on the development of general SWB seems quite clear, research on adolescents' development of SWB within specific domains, e.g., family, peers, and school, is lacking. During adolescence, there can be mismatches between the developmental needs and the opportunities available within adolescents' environment, particularly in these domains. Ryan and Deci's (2000) Self-Determination Theory posits that students' basic psychological needs for autonomy, competence, and social relatedness need to be fulfilled

for high well-being. However, these needs are often not adequately supported in school and familial environments, due to limited independence, decision-making opportunities, and skill development (Eccles and Roeser, 2011). In this regard, adolescents experience more conflicts in their family, might perceive less family support, and evolve a critical attitude toward school (Sanders, 2013; de Fraine et al., 2005; Eccles and Roeser, 2011). Furthermore, although peers are increasingly important during adolescence (Blakemore and Mills, 2014), extra-familial relationships and friendships are becoming more complex, including heightened social comparisons (Wang and Eccles, 2012). Overall, the basic psychological needs may not be fulfilled in the familial, school and social environments, which can result in decreases in the domain-specific satisfactions with family, peers, and school. Prior research is limited and provides preliminary evidence for the expected declines (Goldbeck et al., 2007; Stang-Rabrig et al., 2023).

Development of subjective well-being in adolescence during the COVID-19 pandemic

Additionally to age-related changes in SWB and domain-specific satisfactions, certain life events can influence their trajectories (Luhmann et al., 2012). According to the Set Point Theory, major life events, such as a global pandemic, may cause temporary changes in SWB, but psychological mechanisms help to eventually return SWB to its baseline level (Lykken and Tellegen, 1996; Diener et al., 2006). As one of the most severe health crises in recent decades, the COVID-19 pandemic represents a major life event, posing demanding challenges for young people (Brakemeier et al., 2020; UNICEF, 2020). School closures, social distancing, and limited leisure activities disrupted everyone's daily lives (Andresen et al., 2021; Brakemeier et al., 2020), and especially adolescents' developmental needs for competence, autonomy, and social relatedness were not met. Additionally, individuals faced numerous stressors during the COVID-19 pandemic, such as health fears, social isolation, economic uncertainty, and disruption of daily routines (for Germany see Andresen et al., 2021; Brakemeier et al., 2020), with potentially limited coping strategies, due to insufficient prior experiences, confidence, or social support. In this regard, the Transactional Stress Model by Lazarus and Folkman (1984) posits that the way adolescents appraised both the unknown stressors and their strategies and resources to cope with these stressors influenced their stress levels and well-being. The perception of fewer resources and challenging stressors results in greater experiences of burden (Lazarus and Folkman, 1984). Regarding the exceptional nature of the COVID-19 pandemic, young people may have been particularly affected, resulting in heightened perceptions of stress and reduced SWB as well as domain-specific satisfaction.

However, research on the pandemic-related changes in adolescents' SWB outcomes in various countries is scarce (see Kauhanen et al., 2023; Schlack et al., 2023; Samji et al., 2022 for reviews). Most studies investigating effects of the COVID-19 pandemic focus on adults (e.g., Pappa et al., 2020; Möhring et al., 2021) or, when examining adolescents, on clinical symptoms (e.g., Naumann et al., 2021; Pedrini et al., 2022). Results of the latter indicate higher levels of anxiety and depression symptoms in cross-sectional studies (Romm et al., 2021; Hansen et al., 2023; Myhr et al.,

2021) as well as longitudinal significant increases of mental health problems during the beginning and early stages of the pandemic in Central Europe, North America and Australia (Naumann et al., 2021; Afriat et al., 2023; Rogers et al., 2024; Houghton et al., 2022; Pedrini et al., 2022). There is a scarcity of studies examining non-clinical outcomes, such as well-being, in adolescents during the early phase of the COVID-19 pandemic; of those that have been conducted, many have focused exclusively on life satisfaction or undifferentiated operationalizations of well-being, or suffer from other methodological shortcomings. Cross-sectional studies indicated lower levels of life satisfaction (Marckhoff et al., 2022; Engel de Abreu et al., 2021; Myhr et al., 2021; von Soest et al., 2020) and mood (Romm et al., 2021; Rogers et al., 2021; Hansen et al., 2023) in adolescents during the pandemic in Central Europe and the USA. Some longitudinal studies from non-German countries (e.g., Netherlands, Australia, Israel) also considered pre-pandemic measurement times of the same students and report small to moderate declines in life satisfaction over the initial pandemic phase ($0.11 \leq d \leq 0.61$; Casali et al., 2023; Magson et al., 2021; Shoshani and Kor, 2022; Stevens et al., 2023; van der Laan et al., 2021). Furthermore, adolescents' positive mood ($d = 0.51$; Shoshani and Kor, 2022) and overall SWB appear to decline ($0.08 \leq d \leq 0.16$; Mundy et al., 2023; Kassis et al., 2022; Houghton et al., 2022; Widnall et al., 2022) in samples from Switzerland, Australia, and England. In contrast, the majority of studies found no significant changes in negative mood across the early pandemic among adolescents in Israel, the USA, Germany, and the Netherlands (Shoshani and Kor, 2022; Wang et al., 2023b; Krueger and Walper, 2023; van der Laan et al., 2021). However, it is important to consider, besides differences in educational systems, the different stages of adolescence – early, middle, and late – as well-being appears to develop differently across these periods (Buecker et al., 2023). The aforementioned studies predominantly examined adolescents across a broad age range, such as 10- to 16-year-olds, or focused exclusively on older adolescents. However, little is known about changes in SWB during the pandemic for those in early adolescence, between the ages of 10 and 13, which is the focus of the present study. This age range is of special interest, as, among all age groups, it is the one with the most severe changes in all components of SWB (cf. Buecker et al., 2023).

Furthermore, adolescents from various countries experienced negative changes in their relationships with friends and family during pandemic-related restrictions, including receiving less support from friends (Stevens et al., 2023; Vira and Skoog, 2021), feelings of isolation and loneliness (Houghton et al., 2022; Hafstad et al., 2022; Farrell et al., 2023), and an increase in conflicts with parents (Ertanir et al., 2021; Vira and Skoog, 2021; Martin-Storey et al., 2021; Wang et al., 2023a). These changes may have worsened adolescents' domain-specific satisfaction with peers and family. In line with this, a longitudinal study with German elementary school students found significant declines in satisfaction with family and nearly significant declines in satisfaction with peers over the begin of the pandemic (Steinmayr et al., 2022). However, research with adolescents on changes of domain-specific satisfactions is lacking. Particularly within the familial context, quarantine measures could intensify pre-existing challenges, such as mental health issues faced by family members (Pappa et al., 2020), which may negatively impact adolescents' quality of life (Fekadu et al., 2019) and, in turn, reduce their overall SWB and satisfaction with family during the COVID-19 pandemic.

Furthermore, the switch to distance learning during school closures disrupted young people's school lives and made daily routines more challenging (Ravens-Sieberer et al., 2022). A meta-analysis of 42 studies across 15 countries reported a significant learning deficit ($d = -0.14$), which emerged early in the COVID-19 pandemic and persisted over time (Betthäuser et al., 2023). Although the majority of students were able to cope with distance learning, approximately one-third of parents and children in Germany expressed concerns regarding the management of schoolwork, poor grades, and the impact on education (Helm et al., 2021; Lampert et al., 2021), which could impact students' school satisfaction. Regarding SWB in school, a study from Sweden reported significant decreases in students' school adjustment and well-being ($d = 0.26$) across the pandemic onset (Vira and Skoog, 2021). However, further longitudinal studies on changes in adolescents' school satisfaction during school closures are lacking.

Nevertheless, there is a need for longitudinal research considering changes in adolescents' SWB during this uncertain period (Wade et al., 2020; Kauhanen et al., 2023). Adolescents experience disruptions in general SWB and domain-specific satisfaction even under normal circumstances (e.g., Buecker et al., 2023). The COVID-19 pandemic, with its far-reaching consequences for daily lives, poses a risk of further deterioration in adolescents' developmental trajectories. Longitudinal studies, incorporating data from before and during the pandemic, are essential for a comprehensive understanding (Wade et al., 2020).

Interindividual differences in the development of subjective well-being and domain-specific satisfaction during the COVID-19 pandemic

The development of SWB and domain-specific satisfaction varies among adolescents, and research indicates interindividual differences in developmental trajectories (Salmela-Aro and Tuominen-Soini, 2010; Steinmayr et al., 2019). Additionally, impacts of the COVID-19 pandemic may also vary among adolescents, although research to date has been insufficient to identify specific groups at risk of worse SWB changes (Schlack et al., 2023). According to the Stage-Environment-Fit Theory (Eccles et al., 1993), individual characteristics such as age, gender, socioeconomic status (SES), migration background, or academic performance may lead to different experiences of a match or mismatch between adolescent needs and environmental opportunities during the COVID-19 pandemic.

Under normal circumstances, girls and boys seem to have similar levels (Chen et al., 2020) and developmental trajectories in SWB (Buecker et al., 2023). However, when facing life stressors girls seem to rely more intensely on their social networks and to have stronger need for social connectedness than boys (Tamres et al., 2002), possibly resulting in more pronounced deteriorations in girls' SWB. In line with this, studies during the early phase of the pandemic indicate that girls experienced more pronounced declines in life satisfaction (Magson et al., 2021), mood (Gniewosz, 2024; Romm et al., 2021), and general SWB (Knowles et al., 2022; Houghton et al., 2022) compared to boys in Australia, Central Europe and the USA. However, one study from the Netherlands reported significant declines in life satisfaction among boys, while girls' life satisfaction remained constant (van der Laan et al., 2021).

Older adolescents may also perceive stronger needs for autonomy and social relationships outside the family (Ryan and Deci, 2000; Sanders, 2013), which could not be fulfilled during the pandemic restrictions, leading to possible greater declines in the SWB facets among older adolescents compared to younger ones. During the COVID-19 pandemic, older adolescents reported higher levels of anxiety and depressive symptoms (Ravens-Sieberer et al., 2022; Samji et al., 2022) as well as lower levels of life satisfaction (Casali et al., 2023; Reiss et al., 2024). Nevertheless, a study with older adolescents (mean age 17 years) indicates that age does not affect the development of mental health problems and life satisfaction (Stevens et al., 2023). However, studies considering age as a predictor of changes in general and domain-specific SWB during the pandemic in younger adolescents are lacking.

In families with lower SES or a migration background, the restriction measures during the pandemic may have had particularly severe impacts, as these families might have reduced material resources or financial concerns during the pandemic (McGill et al., 2022), or linguistic and cultural barriers (Gibson et al., 2021). According to the Transactional Stress Model (Lazarus and Folkman, 1984), reduced resources could lead to higher perceived stress and declines in the SWB facets among adolescents from lower SES families or those with a migration background. Furthermore, those adolescents appeared to be less motivated and showed less academic progress, according to reports of German parents (Steinmayr et al., 2021), which could negatively impact changes in their SWB and satisfaction in different domains, such as family or school. Studies conducted during the early stages of the pandemic in different countries reported positive correlations between various operationalizations of SES and levels of life satisfaction (Myhr et al., 2021; von Soest et al., 2020; Reiss et al., 2024), overall SWB (Mundy et al., 2023), and mental health (Ravens-Sieberer et al., 2022; Myhr et al., 2021). A favorable SES also appears to lead to a more advantage development of life satisfaction (Reiss et al., 2024), mood (Rogers et al., 2024), and emotional problems (Krueger and Walper, 2023) than a less favorable SES. However, studies also report non-significant effects on the levels (Engel de Abreu et al., 2021; Ertanir et al., 2021) and changes (Naumann et al., 2021; Knowles et al., 2022; Ertanir et al., 2021) of these outcomes. Regarding migration background, longitudinal studies conducted during the initial phase of the pandemic have predominantly revealed no significant effects on changes in life satisfaction (Stevens et al., 2023) and mental symptoms (Ertanir et al., 2021; Knowles et al., 2022; Boullion et al., 2023). However, during the pandemic, there appears to be a higher prevalence of mental health issues among adolescents with a migrant background compared to their non-migrant counterparts (Ravens-Sieberer et al., 2022; Pieh et al., 2022; Ertanir et al., 2021).

School and academic success are of central importance for students' overall development. Good school grades may lead to a better fit between perceived own abilities and academic requirements in school and society (Stage-Environment-Fit Theory; Eccles et al., 1993). Before the pandemic, research showed that adolescents with better grades tend to have more positive developmental trajectories in life satisfaction and school satisfaction (Steinmayr et al., 2019; Li et al., 2023). During the COVID-19 pandemic, adolescents with higher grades might have better resources to adapt to the new situation and challenges of distance learning, possessing more resources to cope with these stressors (Transactional Stress Model; Lazarus and Folkman, 1984) and their SWB may have developed more positively compared to adolescents with lower grades. However, to date there is no evidence

that academic achievement impact the development of SWB during the pandemic (Mundy et al., 2023) and longitudinal research is scarce.

Overall, there is limited evidence on interindividual differences regarding the development of general SWB and domain-specific satisfaction among adolescents before and especially throughout the COVID-19 pandemic. Notably, there is a scarcity of longitudinal research examining the same adolescents pre-pandemic and during its outbreak, taking into account various indicators of interindividual differences, such as age, gender, SES, migration background, and academic achievement. It is important to note that, besides these indicators, other important influences on adolescents' development in general SWB and domain-specific satisfactions may exist, although research remains limited. For instance, other factors may be personality traits such as extraversion (Steinmayr et al., 2019), emotional intelligence (Llamas-Díaz et al., 2022), internalizing behaviors (Lyons et al., 2013), positive identity and spirituality (Shek and Liang, 2018) as well as social relationships with peers, parents, and teachers (Kiuru et al., 2020; Shek and Liang, 2018; Webster et al., 2021).

The present study

The COVID-19 pandemic was an exceptionally challenging situation for everyone. As social relationships, experiencing autonomy, and being competent are important factors for well-being, the school closures and contact restrictions may have jeopardized the fulfillment of these basic psychological needs (Ryan and Deci, 2000). Although SWB in general and domain-specific satisfactions appear to decline during adolescence even under normal circumstances (Buecker et al., 2023), it is reasonable to posit that these will be even more pronounced during the pandemic. This has already been demonstrated in a few longitudinal studies from different countries (e.g., Magson et al., 2021; Stevens et al., 2023); however, there is a paucity of evidence among early adolescents, longitudinal research from Germany, and regarding different components and domains of SWB. Furthermore, vulnerable groups whose well-being was particularly impaired during the pandemic could only be identified to a limited extent (Schlack et al., 2023). Moreover, especially longitudinal studies are required when examining changes in SWB and domain-specific satisfactions before and after the onset of the pandemic. Addressing this gap, we followed the study design by Steinmayr et al. (2022), and analyzed the self-report data of adolescents at three measurement points before and one measurement point after the first pandemic-related school closure in Germany. We expected significant declines in general SWB (life satisfaction and general mood), as well as in domain-specific satisfactions with family, peers, and school after the onset of the COVID-19 pandemic. Furthermore, we hypothesized greater declines in all SWB aspects during the pandemic for older adolescents, for girls, for adolescents with a lower SES, with a migration background, and with poorer grades.

Method

Sample and design

We examined the data of $N = 207$ students ($n = 122$ girls, $n = 80$ boy, $n = 5$ did not report their gender) from two academic track schools ("Gymnasium") in North Rhine-Westphalia, Germany at three

measurement points before the first school lockdown ($T1$: autumn 2018, $T2$: spring 2019, $T3$: autumn 2019) and at one measurement point after the first school lockdown ($T4$: autumn 2020). This sample was not representative of the general student population in Germany, as it was drawn from only two academic track schools in a specific region. While distance learning and hybrid model were implemented before the summer break in 2020, schools in North Rhine-Westphalia were predominantly open in the autumn of 2020, allowing for face-to-face learning and assessing $T4$ in person. However, strict hygiene measures, such as mandatory mask-wearing and regular ventilation, were required to minimize the spread of the virus (Bundesministerium für Gesundheit, 2023; Ministerium für Schule und Bildung des Landes Nordrhein-Westfalen, 2020). By the end of 2020, rising infection rates led to a return to a school lockdown, but the $T4$ measurement point of our study was completed before this occurred. The data collection was part of a larger longitudinal project initiated prior to the COVID-19 pandemic (Christiansen et al., 2019), offering a unique opportunity to track those adolescents before and during the pandemic. For the recruitment process, we initially contacted several schools in North Rhine-Westphalia to participate in the larger project, in which both elementary and secondary schools were recruited, allowing students from Grade 2 to 9 to take part. However, as SWB and domain-specific satisfaction are known to vary over the course of schooling (e.g., Buecker et al., 2023), this study focused exclusively on secondary school students. Only schools with students who participated at $T4$ were included in our analyses. At each measurement point, participants were guided by trained researchers and research assistants in regular school lessons and completed the same self-report questionnaires. The students were informed that participating in the survey was voluntary and anonymous, and that nobody would be allowed to access their personal data. Furthermore, consent forms of the parents were obtained. At $T1$, students were on average $M = 12.74$ ($SD = 1.45$) years old and attended Grade 6 ($n = 35$), Grade 7 ($n = 43$), Grade 8 ($n = 4$) and Grade 9 ($n = 34$). In the context of the larger project, additional students participated from $T2$ onwards.

Measures

Subjective well-being in general

Life satisfaction was assessed using four present-related items from the Habitual Subjective Well-Being Scale (HSWBS; Dalbert, 1992; e.g., “My life could hardly be happier than it is”). *General mood* was measured with four items from the general mood scale of the HSWBS (e.g., “Usually, I feel pretty happy”). Items on both scales were rated from 1 (strongly disagree) to 5 (strongly agree) and showed high internal consistency across the four time points ($0.86 \leq \alpha \leq 0.91$).

Domain-specific satisfaction

Adolescents' domain-specific satisfaction was measured in three domains: *family* (e.g., “I like being at home with my family”), *peers* (e.g., “My friends are nice to me”), and *school* (e.g., “I look forward to going to school”), using four items each from the Multidimensional Students' Life Satisfaction Scale (MSLSS; Huebner et al., 1998). Internal consistencies were good for all domains ($0.76 \leq \alpha \leq 0.90$). The school satisfaction scale included two negatively items (e.g., “There are a lot of things I do not like about school”) which were recoded for analysis. All items were rated from 1 (strongly disagree) to 5 (strongly agree).

Moderator variables

Socio-economic status (SES) was operationalized by parental occupation. Students' reports of their mothers' and fathers' occupation at $T1$ were converted into scores on the International Socio-Economic Index (ISEI; Ganzeboom et al., 1992), ranging from 16 to 90, with higher scores indicating more prestigious occupational status (Ganzeboom et al., 1992; OECD, 2010). The highest family ISEI (HISEI) was used to represent SES.

In Germany, identifying migration background by parents' nationality or country of birth becomes less valid as many children belong to third-generation immigrants whose parents were also born in Germany (Becker et al., 2013). Nevertheless, many families still practice the language and culture of their country of origin. Family language significantly impacts school success (Stanat et al., 2010), which may affect SWB. Thus, language is a more relevant indicator of migration background than parents' country of birth. In this study, migration background was coded as 0 if adolescents reported only German as their first language at $T1$, and as 1 if they reported other languages.

Students reported their GPA at $T1$ or, for those who did not participate in $T1$, at $T2$. In Germany, grades range from 1 (very good) to 6 (poor). To facilitate interpretation, we recoded the grades so that higher values indicate better academic performance.

Statistical analysis

Missing data

Before computing the models, we inspected the data for missing values. Across all grades, $N = 116$ (56.04%) participated at $T1$, $N = 156$ (75.36%) at $T2$, $N = 144$ (69.57%) at $T3$ and $N = 124$ (59.90%) at $T4$. A total of $N = 164$ (79.23%) students were assessed on at least two measurement time points, $N = 132$ (63.77%) on at least three measurement time points. $N = 37$ (17.87%) participants took part in all four measurement points. Concerning nonresponse, across all measurement time points, 2.83% of the data on the SWB variables were missing. We considered the missing values in our models by using Full Information Maximum Likelihood Estimation (FIML; Enders, 2010).

Measurement invariance

We examined the measurement invariance over time of all SWB variables. We tested three measurement invariance models per scale: configural invariance, metric invariance and scalar invariance (e.g., Putnick and Bornstein, 2016; for details see Supplementary material). To assess non-invariance, Chen (2007) recommends considering the difference in fit indices ($\Delta CFI \geq 0.01$, $\Delta RMSEA \geq 0.015$, $\Delta SRMR \geq 0.030$) in addition to a statistically significant ($p < 0.05$) increase in the Satorra-Bentler corrected χ^2 , which we also used in our analyses.

Piecewise latent growth curve models

Piecewise latent growth curve models (PGCMs) are an extension of conventional growth curve models by integrating multiple stages of change from separate growth profiles into a single model (Chou et al., 2004). In particular, the development of the general SWB and domain-specific satisfaction before and after the COVID-19-related school lockdown can be modeled in different stages. For example, a conventional growth curve model captures the development from $T1$ to $T4$, whereas PGCMs may consider developmental trajectories from

T1 to T2, from T2 to T3 (before COVID-19) and from T3 to T4 (during COVID-19). These different time periods may contain different developmental patterns, so growth trajectories can be decomposed into separate linear components and compared (Li et al., 2001).

We performed all latent analyses using Mplus version 8.5 (Muthén and Muthén, 2017). We estimated individual models for each component of SWB. In each model, we estimated three latent time variables (Time1, Time2, Time3). The path coefficients of these time variables predicting the respective SWB component (e.g., general life satisfaction) at the four measurement occasions were fixed to specific values (Time1: $b_{T1} = -1$; $b_{T2} = 0$; $b_{T3} = 0$; $b_{T4} = 0$; Time2: $b_{T1} = -1$; $b_{T2} = -1$; $b_{T3} = 0$; $b_{T4} = 0$; Time3: $b_{T1} = 0$; $b_{T2} = 0$; $b_{T3} = 0$; $b_{T4} = 1$). Thus, the estimated latent mean of Time1 represents the estimated average change in the respective variable (e.g., general life satisfaction) from T1 to T2, the estimated latent mean of Time2 represents the estimated average change from T2 to T3, the estimated latent mean of Time3 represents the estimated average change from T3 to T4, and the intercept represents the estimated value at T3, the last measurement occasion before the pandemic (see Muthén and

Muthén, 2017). In order to estimate the influence of the moderators on development in SWB, we estimated individual models for each moderator. In each of these models, the intercept as well as the three latent time variables were predicted by the respective moderator.

We assessed the fit of the PGCMs using established model fit indices with the following cut-off criteria: CFI ≥ 0.95 and RMSEA ≤ 0.08 (Hu and Bentler, 1999; Browne and Cudeck, 1992).

Results

Descriptive results and correlations

Sample sizes, means, standard deviations, skewness, kurtosis and Cronbach's α of all non-dichotomous variables across T1 to T4 are shown in Table 1.

Supplementary Table A1 displays additionally the Pearson correlation coefficients between the SWB variables within each measurement point. The SWB variables were positively and

TABLE 1 Sample sizes (n), means (M), standard deviations (SD), skewness, kurtosis and Cronbach's α for all dependent variables across measurement time points (T1 through T4) as well as for the nondichotomous covariates at T1.

	n	M	SD	Skewness	Kurtosis	α
T1						
General life satisfaction	105	3.56	1.09	-0.63	-0.38	0.89
General mood	108	3.47	1.01	-0.40	-0.30	0.87
Satisfaction with family	103	4.29	0.85	-1.24	0.77	0.90
Satisfaction with peers	103	4.55	0.56	-1.36	1.32	0.76
Satisfaction with school	101	3.24	0.98	-0.41	-0.49	0.85
Age	112	12.74	1.45	0.70	-0.27	-
SES	111	45.05	13.71	0.62	0.37	-
Grade Point Average	72	4.66	0.65	-0.13	0.15	-
T2						
General life satisfaction	156	3.81	0.99	-0.63	-0.23	0.89
General mood	156	3.59	0.91	-0.28	-0.50	0.86
Satisfaction with family	155	4.33	0.82	-1.57	2.33	0.86
Satisfaction with peers	156	4.47	0.73	-1.76	2.91	0.88
Satisfaction with school	155	3.29	1.00	-0.49	-0.18	0.85
T3						
General life satisfaction	144	3.56	1.12	-0.49	-0.71	0.90
General mood	144	3.40	1.10	-0.32	-0.64	0.91
Satisfaction with family	144	4.20	0.87	-0.94	-0.17	0.84
Satisfaction with peers	144	4.43	0.76	-1.89	4.25	0.89
Satisfaction with school	144	3.12	0.99	-0.29	-0.43	0.81
T4						
General life satisfaction	125	3.51	1.08	-0.48	-0.46	0.89
General mood	125	3.28	1.09	-0.19	-0.61	0.91
Satisfaction with family	124	4.06	0.96	-1.25	1.44	0.90
Satisfaction with peers	125	4.45	0.68	-1.39	1.58	0.88
Satisfaction with school	124	2.94	1.17	-0.11	-0.75	0.85

All dependent variables were measured on a five-point Likert scale, with 5 indicating the highest level. SES = socioeconomic status.

significantly correlated with each other within each measurement time points ($0.21 \leq r \leq 0.81$; all $p \leq 0.021$), with the exception of satisfaction with family and satisfaction with school at T1 ($r = 0.19$, $p = 0.059$; see [Supplementary Table A1](#)). The correlations of the dependent variables with the moderator variables were displayed in [Supplementary Table A2](#).

Measurement invariance

For all scales, except for satisfaction with peers, scalar invariance was demonstrated (all $\Delta CFI \leq 0.006$, $\Delta RMSEA \leq 0.007$, $\Delta SRMR \leq 0.007$). Satisfaction with peers, however, only reached configural invariance. Detailed results can be seen in [Supplementary material](#).

Piecewise growth curve models

First, we analyzed the development of the SWB components itself, and second, the interindividual differences by examining the influence of the moderators on the developmental trajectories. All PGCMS without moderators fitted the data well (all CFI ≥ 0.963 ; all RMSEA ≤ 0.058 ; see [Table 2](#) for details). During the pre-pandemic time periods, the time slopes for life satisfaction, general mood, and domain-specific satisfaction were all negative in their direction ($-0.181 \leq \mu \leq -0.008$) and, in some cases, significant (see [Table 2](#) for details), replicating the declines found in previous studies.

For the time slopes representing changes during the COVID-19 pandemic, we expected significant declines in all measures. However, only satisfaction with family declined significantly between T3 and T4 ($\mu = -0.194$, $SE = 0.074$, $p = 0.008$). Nevertheless, the time slopes of life satisfaction ($\mu = -0.085$, $SE = 0.053$, $p = 0.111$), general mood ($\mu = -0.077$, $SE = 0.057$, $p = 0.183$) and satisfaction with peers ($\mu = -0.020$, $SE = 0.087$, $p = 0.814$) and school ($\mu = -0.182$, $SE = 0.094$, $p = 0.053$) indicated negative trends but were not significant, against our expectations. It is noteworthy that satisfaction with school had a relatively high mean, but slightly missed significance, possibly due to a high standard error.

To examine the effects of the moderators on the development of SWB, we first regressed the intercept and time slopes separately on each moderator (see [Table 3](#) for detailed results; all CFI ≥ 0.948 ; all RMSEA ≤ 0.065). Finally, we inspected all moderators simultaneously for each SWB component in overall PGCMS each, which showed at least acceptable model fit indices, except for the CFI in the model for general mood (CFI = 0.939; RMSEA = 0.055; see [Table 4](#) for detailed results).

Age at T1 showed a marginally negative effect on changes in satisfaction with family in the overall model ($\beta = -0.271$, $SE = 0.147$, $p = 0.065$), which was, however, not significant in the single model ($\beta = -0.165$, $SE = 0.128$, $p = 0.197$). Age at T1 did not have significant effects on any of the other SWB components during the COVID-19 pandemic ($-0.165 \leq \beta \leq 0.328$, $p \geq 0.151$). Note that age had relatively high regression weights but also high standard errors (see [Tables 3, 4](#)), which contributed to the lack of significance. Contrary to our expectations, gender ($-0.066 \leq \beta \leq 0.150$, $p \geq 0.355$), migration background ($-0.130 \leq \beta \leq 0.030$, $p \geq 0.153$), or GPA at T1 ($-0.081 \leq \beta \leq 0.214$, $p \geq 0.322$) did not have significant effects on changes in the SWB components or domain-specific satisfactions during the pandemic.

Regarding SES, in the models that included all moderators, SES showed hints of significant effects on changes of satisfaction with family (single model: $\beta = -0.102$, $SE = 0.059$, $p = 0.085$; full model: $\beta = -0.131$, $SE = 0.065$, $p = 0.045$) during the COVID-19 time slope. Surprisingly, the direction of this effect was negative, contrary to our expectations, indicating that adolescents with higher SES experienced stronger declines in satisfaction with their families during the COVID-19 lockdown. Note that, in the time intervals prior to COVID-19, however, the regression weights were negligible and not significant ($-0.024 \leq \beta \leq -0.008$, $p \geq 0.622$). Furthermore, SES had a significant positive effect on changes in school satisfaction in the COVID-19 time interval (single model: $\beta = 0.149$, $SE = 0.076$, $p = 0.048$; full model: $\beta = 0.149$, $SE = 0.081$, $p = 0.067$), indicating a favorable development for adolescents with higher SES, in line with our expectations.

Discussion

Helping students with low well-being is an important goal, especially during challenging times such as the COVID-19 pandemic which negatively impacts students' well-being on average (e.g., [Shoshani and Kor, 2022](#); [Marckhoff et al., 2022](#)). Though it is important to recognize interindividual differences and that some adolescents may already exhibit high levels of well-being. However, most students undergo a turbulent developmental period during adolescence ([Eccles et al., 1993](#); [Sanders, 2013](#)) with declines of general SWB and satisfaction in different domains even under normal circumstances (e.g., [Buecker et al., 2023](#)). The onset of the COVID-19 pandemic could have contributed especially to a further decrease in adolescents' SWB, as hypothesized by different theoretical models ([Lazarus and Folkman, 1984](#); [Ryan and Deci, 2000](#); [Eccles et al., 1993](#)). Research examining the development of adolescents' general SWB and

TABLE 2 Model fit, means, and standard errors of the intercepts and time slopes for the PGCMS.

	Model fit			Mean (Standard error)			
	χ^2 (df)	CFI	RMSEA [90% CI]	Intercept	Time1	Time2	Time3
General life satisfaction	117.935* (88)	0.982	0.041 [0.018, 0.059]	3.178*** (0.142)	0.033 (0.120)	-0.176* (0.071)	-0.085 (0.053)
General mood	148.278*** (88)	0.963	0.058 [0.041, 0.073]	3.618*** (0.090)	-0.025 (0.095)	-0.141** (0.048)	-0.077 (0.057)
Satisfaction with family	117.210* (88)	0.972	0.040 [0.017, 0.059]	4.324*** (0.065)	-0.044 (0.052)	-0.094* (0.046)	-0.194** (0.074)
Satisfaction with peers	73.618 (70)	0.995	0.016 [0.000, 0.045]	4.373*** (0.068)	-0.181* (0.086)	-0.008 (0.074)	-0.020 (0.087)
Satisfaction with school	110.773 (88)	0.980	0.036 [0.000, 0.055]	3.058*** (0.097)	-0.177* (0.089)	-0.141 (0.090)	-0.182 (0.094)

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

TABLE 3 Model fit, regression weights, and standard errors of the moderators examined individually on the intercepts and time slopes for the PGCMs.

	Model fit			Regression weight (Standard error) on			
	χ^2 (df)	CFI	RMSEA [90% CI]	Intercept	Time1	Time2	Time3
General life satisfaction							
Age	111.093 (100)	0.992	0.023 [0.000, 0.045]	-0.276 (0.303)	0.290 (0.184)	-0.386* (0.157)	0.155 (0.154)
Gender	132.921* (100)	0.981	0.040 [0.018, 0.057]	0.115 (0.074)	0.000 (0.109)	0.051 (0.054)	-0.010 (0.111)
SES	126.806* (100)	0.984	0.036 [0.010, 0.054]	-0.031 (0.080)	0.010 (0.030)	-0.105 (0.088)	-0.001 (0.099)
Migration	133.800* (100)	0.980	0.040 [0.019, 0.057]	0.003 (0.094)	0.098 (0.109)	0.076* (0.039)	0.030 (0.147)
GPA	141.072** (100)	0.976	0.045 [0.026, 0.061]	0.084 (0.126)	-0.019 (0.086)	-0.046 (0.091)	-0.072 (0.073)
General mood							
Age	188.420*** (100)	0.948	0.065 [0.051, 0.080]	0.046 (0.096)	0.109 (0.160)	0.126 (0.084)	0.206 (0.348)
Gender	171.870*** (100)	0.956	0.059 [0.044, 0.074]	-0.007 (0.068)	-0.022 (0.088)	-0.002 (0.038)	0.061 (0.119)
SES	175.343*** (100)	0.955	0.060 [0.045, 0.075]	-0.054 (0.050)	0.037 (0.048)	-0.092* (0.039)	-0.001 (0.100)
Migration	158.256*** (100)	0.963	0.053 [0.037, 0.068]	0.106* (0.063)	0.115 (0.086)	0.035 (0.051)	0.011 (0.147)
GPA	176.559*** (100)	0.954	0.061 [0.046, 0.075]	0.030 (0.082)	-0.039 (0.112)	-0.048 (0.071)	0.143 (0.237)
Satisfaction with family							
Age	133.601* (100)	0.969	0.040 [0.019, 0.057]	-0.054 (0.127)	-0.026 (0.112)	0.065 (0.036)	-0.165 (0.128)
Gender	132.696* (100)	0.970	0.040 [0.018, 0.057]	0.055 (0.059)	0.011 (0.048)	-0.035 (0.043)	0.057 (0.067)
SES	134.226* (100)	0.969	0.041 [0.020, 0.058]	0.032 (0.064)	-0.008 (0.062)	-0.024 (0.048)	-0.102* (0.059)
Migration	130.049* (100)	0.973	0.038 [0.015, 0.055]	0.003 (0.058)	-0.058 (0.051)	0.071* (0.043)	-0.059 (0.069)
GPA	133.006* (100)	0.970	0.040 [0.019, 0.057]	0.172* (0.101)	0.011 (0.068)	0.099 (0.069)	-0.050 (0.144)
Satisfaction with peers							
Age	89.151 (82)	0.991	0.021 [0.000, 0.045]	-0.259* (0.150)	-0.290* (0.148)	0.021 (0.186)	0.172 (0.185)
Gender	87.425 (82)	0.993	0.018 [0.000, 0.040]	-0.060 (0.058)	0.007 (0.068)	0.035 (0.055)	0.073 (0.079)
SES	84.782 (82)	0.997	0.013 [0.000, 0.041]	0.056 (0.045)	-0.070 (0.055)	0.059 (0.052)	-0.002 (0.070)
Migration	89.394 (82)	0.991	0.021 [0.000, 0.045]	0.010 (0.058)	-0.050 (0.060)	0.089 (0.054)	0.012 (0.072)
GPA	102.244 (82)	0.975	0.035 [0.000, 0.055]	0.135 (0.108)	-0.023 (0.156)	0.043 (0.121)	-0.041 (0.150)
Satisfaction with school							
Age	129.294* (100)	0.974	0.038 [0.014, 0.055]	0.151 (0.185)	0.032 (0.331)	0.309 (0.423)	-0.068 (0.335)
Gender	115.172 (100)	0.987	0.027 [0.000, 0.047]	-0.094 (0.093)	-0.055 (0.097)	0.186* (0.085)	-0.030 (0.089)
SES	118.603 (100)	0.984	0.030 [0.000, 0.049]	-0.114 (0.091)	-0.111 (0.099)	0.069 (0.072)	0.149* (0.076)
Migration	147.663** (100)	0.960	0.048 [0.030, 0.064]	0.235** (0.087)	0.117 (0.085)	0.181* (0.085)	-0.130 (0.091)
GPA	131.470* (100)	0.973	0.039 [0.017, 0.056]	0.053 (0.146)	-0.006 (0.087)	-0.393** (0.135)	0.003 (0.157)

The standardized regression weights and standard errors of the covariates on intercept and time slopes of the respective models are shown, whereby each covariate was considered individually in the model. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$. SES, socioeconomic status; Migration, migration background; GPA, grade point average.

domain-specific satisfaction before and during the COVID-19 pandemic using longitudinal designs is limited. Providing empirical answers to this question, the results of the present study showed negative trends in all SWB facets, but only significant declines for satisfaction with family during the pandemic. While gender, migration background, and academic performance showed no effects, SES appears to be particularly important in explaining interindividual differences in the pandemic-related changes.

Before the onset of the COVID-19 pandemic, we found significant declines in both overall SWB and domain-specific satisfactions. While the developmental trends remained negative during the COVID-19 pandemic, only the decline in satisfaction with family was significant. These pre-pandemic declines complement previous findings (see Buecker et al., 2023), which have generally been identified over longer

periods of a few years, but they also appeared over shorter periods of six months in our analyses. Furthermore, different seasonal trends emerged between the two pre-pandemic time intervals, which might have been obscured in the analysis of only one time slope or longer time periods. For instance, general life satisfaction, general mood, and satisfaction with family initially remained relatively stable between T1 and T2, i.e., from autumn to spring, but declined significantly between T2 and T3, i.e., from spring to autumn. However, analyzing seasonal trends of various SWB facets was not the primary focus of this study, and should be investigated further in future research, using shorter time intervals or experience sampling methods (e.g., Leonhardt et al., 2016).

Taking into account the pre-pandemic development, our study focused on the investigation of longitudinal changes in overall SWB and various domain-specific satisfactions through the early pandemic phase.

TABLE 4 Model fit, regression weights, and standard errors of all moderators together on the intercepts and time slopes for the PGCs.

	Regression weight (Standard error) on			
	Intercept	Time1	Time2	Time3
General life satisfaction				
[$\chi^2 = 141.280$, $df = 148$; CFI = 1.000; RMSEA (90% CI) = 0.000 (0.000, 0.028)]				
Age	-0.294 (0.269)	0.284 (0.183)	-0.437** (0.126)	0.190 (0.178)
Gender	0.138 (0.082)	0.019 (0.134)	0.001 (0.080)	0.051 (0.141)
SES	-0.027 (0.087)	0.004 (0.064)	-0.047 (0.072)	-0.025 (0.098)
Migration	0.054 (0.123)	0.085 (0.090)	0.094 (0.052)	0.005 (0.141)
GPA	0.081 (0.107)	0.015 (0.138)	-0.104 (0.108)	0.106 (0.110)
General mood				
[$\chi^2 = 240.534$ ***, $df = 148$; CFI = 0.939; RMSEA (90% CI) = 0.055 (0.042, 0.067)]				
Age	0.059 (0.112)	0.120 (0.165)	0.112 (0.057)	0.328 (0.228)
Gender	0.025 (0.085)	-0.017 (0.130)	-0.013 (0.055)	0.107 (0.193)
SES	-0.057 (0.055)	0.043 (0.045)	-0.099* (0.043)	-0.039 (0.106)
Migration	0.117 (0.062)	0.120 (0.068)	0.016 (0.051)	-0.012 (0.130)
GPA	0.081 (0.096)	-0.014 (0.133)	-0.046 (0.102)	0.214 (0.326)
Satisfaction with family				
[$\chi^2 = 188.712$ *, $df = 148$; CFI = 0.966; RMSEA (90% CI) = 0.036 (0.018, 0.051)]				
Age	-0.018 (0.127)	-0.038 (0.116)	0.095* (0.047)	-0.271 (0.147)
Gender	0.111 (0.080)	0.020 (0.060)	-0.007 (0.053)	0.087 (0.118)
SES	0.011 (0.066)	-0.021 (0.064)	-0.017 (0.050)	-0.131* (0.065)
Migration	0.017 (0.062)	-0.060 (0.052)	0.064 (0.044)	-0.056 (0.071)
GPA	0.186 (0.114)	0.031 (0.086)	0.093 (0.077)	-0.081 (0.210)
Satisfaction with peers				
[$\chi^2 = 149.496$ *, $df = 130$; CFI = 0.977; RMSEA (90% CI) = 0.027 (0.000, 0.045)]				
Age	-0.220 (0.176)	-0.276 (0.152)	0.027 (0.178)	0.186 (0.188)
Gender	-0.021 (0.080)	0.014 (0.092)	0.037 (0.066)	0.085 (0.124)
SES	0.061 (0.053)	-0.065 (0.053)	0.060 (0.054)	-0.009 (0.073)
Migration	0.023 (0.057)	-0.052 (0.061)	0.096 (0.058)	0.005 (0.071)
GPA	0.082 (0.137)	-0.030 (0.164)	0.024 (0.124)	0.052 (0.201)
Satisfaction with school				
[$\chi^2 = 165.308$ *, $df = 148$; CFI = 0.983; RMSEA (90% CI) = 0.024 (0.000, 0.042)]				
Age	0.113 (0.262)	0.225 (0.311)	0.002 (0.523)	0.075 (0.334)
Gender	-0.056 (0.100)	0.014 (0.101)	-0.001 (0.104)	-0.066 (0.123)
SES	-0.097 (0.087)	-0.118 (0.100)	0.097 (0.084)	0.149 (0.081)
Migration	0.238* (0.092)	0.114 (0.083)	0.128 (0.088)	-0.117 (0.089)
GPA	0.056 (0.148)	0.079 (0.102)	-0.435** (0.136)	0.052 (0.184)

The standardized regression weights and standard errors of the covariates on intercept and time slopes of the respective models are shown, whereby all covariates were considered together in the model. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. SES, socioeconomic status; Migration, migration background; GPA, grade point average.

Overall, the results confirmed the declining trends in various SWB measures as found in the few existing longitudinal studies (Magson et al., 2021; van der Laan et al., 2021; Shoshani and Kor, 2022). However, under consideration of the pre-pandemic changes of the same adolescents, our study found significant declines during the COVID-19 pandemic only in satisfaction with family. While all examined SWB facets showed tendentially negative trends, only satisfaction with family declined significantly and descriptively more strongly than prior the onset of the pandemic. After the pandemic outbreak, various restriction measures

were implemented to inhibit the spread of the virus, such as school closures, contact limitations, and restricted leisure activities (Brakemeier et al., 2020). These restrictions forced everyone to spend most of their time at home, typically within their immediate family. Adolescents, who have an increasing need for social interactions and experiencing autonomy (Self-Determination Theory; Ryan and Deci, 2000), found these needs nearly impossible to fulfil within their families under the pandemic restrictions, resulting in declining satisfaction with their families (Stage-Environment Fit Theory; Eccles et al., 1993). Many

families reported concerns about care, health effects, financial situations, and the educational development of their children (Gassman-Pines et al., 2020; Patrick et al., 2020). These stressors can have a cumulative effect (Evans et al., 2013). The present results indicated that particularly those families with a higher SES appeared to be affected by the multiple stressors of the pandemic. Contrary to our expectations, SES showed a negative effect with adolescents from higher SES backgrounds experienced greater declines in satisfaction with family. These rather surprising findings may be explained in several ways: On one hand, families with higher SES seem to consume more news and were better informed about the pandemic situation and its course (Bergström et al., 2019; Ucar et al., 2021), leading to increased worries and stress about the pandemic within the families. Another explanation may be derived from the adaptation effect. Families with higher SES may be accustomed to the constant availability of resources (Hobfoll, 2010; Diener and Biswas-Diener, 2002). When these resources became less accessible during the COVID-19 pandemic, it may have resulted in more stress and concerns. Furthermore, in families with higher SES, parents were more likely to have prestigious jobs, often work from home, which may have contributed to a parental double burden of managing work alongside educational and caregiving responsibilities (Griffith, 2022). Accordingly, many parents reported decreases in their well-being and increases of psychological distress right after the onset of the restriction measures (Gassman-Pines et al., 2020; Patrick et al., 2020). All in all, families and parents with higher SES might have experienced higher stress levels, which, according to the spillover-crossover model (Bolger et al., 1989) are closely linked to the well-being of the children. Another possible explanation might be found in the adolescents themselves. Those from higher SES families were more likely to have engaged in organized leisure activities before the pandemic, which were constrained during the pandemic restrictions (Brakemeier et al., 2020). This could have resulted in increased stress and reduced family satisfaction. However, it is important to note that our sample was drawn from two academic track schools ("Gymnasium"), resulting in a relatively homogeneous sample with a tendency toward higher SES, which may not be representative of the general population. Furthermore, we found hints that older adolescents at T1 reported stronger declines in the satisfaction with their families during the COVID-19 pandemic. As mentioned above, one possible explanation is that especially older adolescents have stronger needs for autonomy, social relationships, and independence from their families compared to younger adolescents (Ryan and Deci, 2000; Sanders, 2013), which may have led to greater declines in their family satisfaction during the pandemic restrictions. However, these findings should be interpreted with caution, as we were unable to re-survey older adolescents after T1 due to the design of the broader project for which the data were originally collected.

While life satisfaction and general mood significantly declined before the COVID-19 pandemic, they did not show significant decreases during the pandemic, in contrast to other studies (Casali et al., 2023; Magson et al., 2021; Shoshani and Kor, 2022). It appears that the restriction measures had no substantial impact on the overall SWB of the adolescents in our study. As mentioned above, the sample might be highly selective and not representative. In a more heterogeneous sample, significant declines in SWB might have been observed. Additionally, it should be noted that T4 took place after the summer holidays in 2020, when schools had already reopened and the adolescents could meet their friends, improving the overall SWB. Unfortunately, our data do not provide insight into the levels of the SWB facets during the

acute lockdown. A similar explanation could apply to satisfaction with peers, which remained almost constant from T3 to T4. At T4, adolescents were able to regularly interact and meet with their peers again. Furthermore, they may have managed to stay in contact with their peers during the lockdown through social media, chats, and video calls (Shoshani and Kor, 2022; Ellis et al., 2020). These contact opportunities may have maintained interactions with friends and peers, making adolescents' feel less lonely and more socially integrated.

At first glance, satisfaction with school did not change significantly during the COVID-19 pandemic. However, a closer look reveals that the pandemic-related time slope had a similarly negative mean as the time slopes before the pandemic but was not statistically significant possibly due to high standard errors and the relatively small sample size. The declining trend of satisfaction with school during the COVID-19 pandemic is consistent with some previous studies, which revealed more concerns about potential educational impairments (Ellis et al., 2020) and lower SWB regarding school and classmates among adolescents (Vira and Skoog, 2021). However, despite students rated distance learning as more difficult during the pandemic (Ravens-Sieberer et al., 2022), our findings did not provide evidence to suggest that school satisfaction has worsened more, as the pandemic-related decline in school satisfaction appears to be similar to pre-pandemic trends. One explanation could be that distance learning may have aligned better with adolescents' increasing need for autonomy, as they were often given school work rather than adhering regular school lessons (Steinmayr et al., 2021). Furthermore, online schooling had the potential to provide a new learning opportunity that adolescents found more attractive and engaging. For example, students had the opportunity to complete the school assignments with unlimited attempts and without time restrictions, which may have positively influenced their motivation, learning process, and school satisfaction during the distance learning period (see, for example, Stoyanova and Giannouli, 2023). Additionally, the school closures may have been more conducive to adolescents' sleep requirements. Due to hormonal changes, adolescents tend to shifted sleeping patterns, with staying up later at night and sleeping longer in the morning (Hagenauer et al., 2009). While this sleeping requirements could not be met during the normal school day, it was possible during distance learning without regular school hours (Kaditis et al., 2021), which could explain the absence of a significant decline in school satisfaction during the pandemic. Including moderators into the analyses showed that adolescents with higher SES experienced a more favorable development during the pandemic as those with lower SES. A higher SES was operationalized through a more prestigious parental occupation in our study, which is typically associated with higher parental education. This, in turn, seems to have been linked to greater motivation and better learning among students during the lockdown (Steinmayr et al., 2021; Betthäuser et al., 2023), potentially resulting in more favorable changes in school satisfaction. It is important to note again that our sample was not representative in terms of SES and the related parental education levels (Blaeschke and Freitag, 2021), and that the timing of T4 may have obscured potential processes that occurred during the acute school closures.

Surprisingly, we found no significant effects of gender, migration background, or GPA at T1 on changes in the SWB facets during the COVID-19 pandemic. This provides some hints for the notion that the pandemic affected the well-being of both girls and boys, adolescents with and without a migration background, as well as those with higher and lower grades, in a similar manner (Stevens et al.,

2023). In particular, SES appears to be a key factor in explaining interindividual differences in the pandemic-related changes of SWB.

Strengths and limitations

Overall, this study provides important insights into the developmental trajectories of general SWB and domain-specific satisfaction in adolescents before and during the COVID-19 pandemic. We extend the current state of research by investigating cognitive and affective components of general SWB, as well as satisfaction in key life domains at three measurement points before the pandemic and at one measurement point after the first school lockdown. To do this, we used the PGCM to apply appropriate methods of analysis that reflect the actual course of development. Overall, our results support the need to distinguish between a cognitive and an affective component of SWB, as well as between satisfactions in different domains, as we found different developmental trajectories. Our results replicate the previously found declines in SWB during adolescence and provide insights into the influence of school lockdowns during the COVID-19 pandemic.

However, there are also important limitations in the study design. The sample size was relatively small and included only students from academic-track schools. Additionally, there was a large amount of missing values, particularly in the moderator variables as they were recorded at *T1*. Furthermore, the extent to which the results can be generalized to students from other school types also remains an open question. Additionally, *T4* does not reflect the exact state during the school lockdown. Instead, it only took place after the initial lockdown, when the adolescents went back to school regularly and were able to meet their friends again. It is possible that their SWB had already improved again at this time point. Clearly, having information about the exact SWB states during the school closures would be useful to better understand the pandemic-related development. Furthermore, we only analyzed self-report data. While SWB is inherently based on personal experiences (Huebner et al., 2014), it would be valuable to include more objective measures of adolescent's SWB, such as perceptions from parents, friends, or class teachers, in future research. Most of the discussed limitations are due to the fact that the study was not planned with these specific hypotheses and research questions in mind. Naturally, as the study was planned prior to the COVID-19 pandemic, it was not originally concerned with effects of the pandemic on SWB. However, using data from this study for this objective has the advantage of allowing longitudinal pre- and post-pandemic comparisons.

Conclusion

Our study sheds light on the development of SWB in adolescence during challenging times such as the COVID-19 pandemic. The results contribute to the growing body of evidence highlighting the adverse effects of the COVID-19 pandemic on young people and identifying at-risk groups. However, due to several limitations, including a small, homogeneous sample, further research is needed to provide a comprehensive understanding of the development of SWB in adolescence and during periods of crisis. In order to mitigate adverse effects of future crisis on adolescents' well-being, it is crucial to implement prevention and intervention measures, e.g., by promoting social and emotional skills and resilience strategies (Dowling et al., 2019; Barry et al., 2017).

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Ethics Committee of Technical University Dortmund. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

HE: Data curation, Formal analysis, Investigation, Methodology, Validation, Visualization, Writing – original draft, Writing – review & editing. PP: Data curation, Formal analysis, Methodology, Project administration, Software, Validation, Writing – review & editing. LW: Conceptualization, Funding acquisition, Investigation, Project administration, Resources, Writing – review & editing. RS: Conceptualization, Funding acquisition, Methodology, Project administration, Resources, Supervision, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2025.1485289/full#supplementary-material>

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