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Student wellbeing during COVID-19—Impact of individual characteristics, learning behavior, teaching quality, school system-related aspects and home learning environment

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Introduction: The measures taken to contain the COVID-19 pandemic had a significant impact on the lives of young people. Studies indicate a decrease in wellbeing and an increase in mental health problems among adolescents. However, the influence of individual or contextual factors on student wellbeing has hardly been investigated to date.

Methods: In the present study, we used a cross-sectional survey design to examine the impact of individual student characteristics and learning behavior, teaching quality, school system-related aspects and home learning environment on the wellbeing of N = 1,212 secondary school students from Germany and Switzerland (grade level: 5–13; age: 10–20) during the pandemic. Most students completed the survey retrospectively, while some students were in quarantine at the time of the survey.

Results: In stepwise multivariate regression models, higher student socioeconomic status and perceived teacher support were found to be positive predictors of wellbeing, while more frequent procrastination was found to be a negative predictor. Lower levels of wellbeing were found for female and older students, and German (compared to Swiss) students.

Discussion: Our study contributes to the assessment of the impact of the COVID-19 pandemic on student wellbeing, specifically to the identification of particularly affected or vulnerable groups. This may help to better prepare education systems for future, comparable situations and to mitigate negative outcomes for students.

KEYWORDS

student wellbeing, mental wellbeing, COVID-19, distance learning, school closure

1 Introduction

The containment measures during the COVID-19 pandemic posed a major challenge for many people worldwide and children and adolescents were particularly affected (Döpfner et al., 2021). Not only were they unable to attend school, but they were also unable to participate in leisure and sports activities (Wössmann et al., 2020). In addition, there was constant uncertainty about the duration of the existing and future restrictions, which dominated young people's lives during this time (Kim et al., 2021).

As the containment measures were implemented, the first accompanying studies were initiated to gain insight into the impact of this previously unknown situation. The focus of

these studies were on student learning behavior and learning success, with less research conducted on student wellbeing (Helm et al., 2021). The few studies that exist on this topic during the COVID-19 pandemic focus primarily on psychological wellbeing (compared to, e.g., social or physical wellbeing; Linton et al., 2016) and show a decrease in student life satisfaction (Zdravkovic and Goldstein, 2023). They conclude that students' mental health was severely affected by the containment measures (Viner et al., 2022). While findings on the overall impact on student wellbeing are largely consistent, results on interindividual differences that can be attributed to individual or contextual factors are scarce and more heterogeneous.

Based on a sample of Swiss and German secondary school students, the present study addresses this research gap by examining to what extent aspects of students' personal characteristics, learning behavior, perceived quality of teaching, school system related aspects, as well as home learning environment were positively or negatively related to their perceived stress, overall life satisfaction, and fear of the consequences of the COVID-19 pandemic, and thus aims to assess the impact of the pandemic on student wellbeing. In this way, this study may help to meet the individual needs of students in future similar situations and mitigating negative consequences for student wellbeing. Switzerland and Germany were selected as they have comparable school systems and learning cultures, but Switzerland took a less restrictive approach to containing the pandemic compared to Germany (see section 2.2.3). Thus, this study provides additional indications of the effect of the strictness of the measures on student wellbeing. Even if the COVID-19 pandemic appears to have been successfully overcome, there is a high probability that similar challenges lie ahead due to new waves of disease, teacher shortages, or extreme weather conditions (Clarke et al., 2022; Marani et al., 2021). Therefore, the opportunity should be taken to learn from the COVID-19 pandemic in order to be better prepared for future comparable situations of distress.

2 Theoretical and empirical background

2.1 Student wellbeing during the COVID-19 pandemic

Regarding the COVID-19 pandemic, Ravens-Sieberer et al. (2022) concluded that German students experienced higher levels of stress and lower levels of life satisfaction from spring 2020 to fall 2021. These findings were confirmed for students in other countries (Magson et al., 2021; Romero et al., 2020; Whittle et al., 2020), while no representative studies so far examined the impact of the pandemic on Swiss students' wellbeing. Depending on the study, between 15 and 71% of students reported increased distress (Döpfner et al., 2021). This considerable variation suggests that different groups of students were able to cope to a different extent with the distance learning situation (Brauchle et al., 2024).

As a result of the COVID-19 pandemic and the associated containment measures, the rates of students with depression and anxiety symptoms as well as students with peer-related problems increased, and the health-related quality of life decreased (Laubstein and Scheer, 2022). An increased prevalence of hyperactivity and confrontational behavior was also found (Döpfner et al., 2021). In comparison, only a few studies have shown a positive impact of the COVID-19 pandemic on certain student wellbeing outcomes (Vaillancourt et al., 2021). Reasons for this positive effect include a reduction in academic and social stress among children with contact difficulties (Döpfner et al., 2021).

In summary, existing research suggests that the pandemic and the measures taken to contain it have had severe negative effects on the wellbeing of students in general. However, as will be discussed in more detail below, individual student wellbeing is known to depend on a range of factors related to both the student and his or her environment within and outside of school, which may also have contributed to the high variation between studies mentioned above (see also section 2.2). Assuming that different students were able to deal with the restrictions differently, this raises the question of which factors contributed to student wellbeing being more or less—negatively or positively—affected by the pandemic.

2.2 School-related factors influencing student wellbeing

Wellbeing is a multidimensional construct that refers to the assessment of one's quality of life (Hascher and Hagenauer, 2011; Ryff, 1995). The present study focuses on the psychological and affective aspects of wellbeing and follows the *bottom-up theory* (Diener and Ryan, 2009), which assesses wellbeing through the balance of positively and negatively evaluated feelings (Diener, 1994). The evaluation of one's feelings in different situations depends on individual and contextual factors and is therefore highly subjective (Obermeier, 2021). For students, wellbeing is known to be influenced by personality traits, past experiences, current emotions, but also by social background, the quality of peer relationships, and school conditions (Grommé et al., 2023). Hascher and Hagenauer (2011) identified three levels at which schools influence student wellbeing. These levels will be used in the present study to categorize the various factors influencing students' wellbeing during the COVID-19 pandemic. The first level refers to individual personality aspects as well as emotional and cognitive learning prerequisites of students (section 2.2.1). The second level refers to the influence of teaching quality and social interaction in the classroom (section 2.2.2) and the third level refers to the influence of the school system on student wellbeing (section 2.2.3). To more comprehensively capture relevant influences on students' wellbeing, we supplement these three levels by a fourth level: students' home learning environment (section 2.2.4).

2.2.1 Individual personality and learning prerequisites

Regarding students' gender, studies have shown that girls experience higher stress and more frequent anxiety than boys during the COVID-19 Pandemic (e.g., Bujard et al., 2021). According to Bujard et al. (2021), the proportion of female adolescents with depressive symptoms increased from 13 to 35% during the pandemic, compared to an increase from 7 to 15% among boys.

Considering students' age, some studies suggest a greater impact of the restrictions on younger students compared to older students (Langmeyer et al., 2020; Romero et al., 2020). This effect has been explained by the greater ability of older students to stay in touch with their peers through digital networks and to better reflect on their current situation (Romero et al., 2020). Other studies conclude that older students were generally more affected by the pandemic than younger students (Campbell et al., 2021; Governale et al., 2024).

Further research, however, found no evidence that different sociodemographic factors were associated with different levels of stress (Döpfner et al., 2021; Whittle et al., 2020). In addition to the influence of sociodemographic factors, Rogge and Seifert (2023) reported that higher self-assessed media literacy was associated with lower levels of stress among German high school students.

As the missing structure of school day was a challenge for many students (Brauchle et al., 2024; Wacker et al., 2020) and due the higher proportion of independent work, self-regulation skills played an important role in successful learning during the pandemic (Holzer et al., 2023). These self-regulation skills develop with increasing age (Fomina et al., 2020). Therefore, it can be assumed that older students were generally better at learning independently. A lack of these skills may have led to difficulties in structuring the school day or working independently on tasks, thus promoting procrastinatory learning behaviors (Engberding et al., 2017). While procrastination may initially protect self-esteem in case of the fear of failure (Duru and Balkis, 2017), over the long term it can lead to feelings of meaninglessness (Maxwell, 1989) as well as reduced self-esteem and a diminished sense of control (Liu, 2024). In addition, procrastinating behavior is associated with depression and anxiety disorders (Steel and Klingsieck, 2016), as well as generally low positive emotions (Holzer et al., 2021).

2.2.2 Teaching quality and classroom social interaction

The teaching formats implemented during the school closures posed significant challenges to student learning. The exact impact of the COVID-19 pandemic on student learning has not yet been fully researched, but some studies (e.g., Betthäuser et al., 2023), suggest that student learning success was lower compared to teaching under "normal" conditions (see also Unger et al., under review). This lower learning success can be attributed to the high proportion of independent work, as – following the scaffolding theory – the steps of teacher modeling and guided practice supporting social intermental learning are lacking, so that learning is primarily limited to the individual intramental processes of independent practice (Pol et al., 2010). As a consequence, students may have worked mostly on tasks they had already mastered or had difficulties learning new skills due to the lack of guidance. The resulting lower learning success can reduce students' sense of personal growth, which is relevant for the perception of eudaimonic wellbeing as part of psychological wellbeing (Ryff et al., 2021). In terms of self-determination theory (Ryan and Deci, 2000), lack of learning success or difficulties in completing tasks independently can inhibit the fulfillment of the basic needs of competence and autonomy (Holzer et al., 2021), which are also fundamental to the experience of wellbeing.

With the closure of schools, students not only lost their guided daily learning space, but also a social space to engage with peers that is not provided in their home environment (Bujard et al., 2021). Surveys focusing on student wellbeing revealed a lack of social contact (Brauchle et al., 2024), which is considered as an important preventive resource against mental illness (Rebar et al., 2015; Schmidt et al., 2019) by fostering the feeling of positive emotions with others as part of eudaimonic wellbeing (Ryff et al., 2021). On the other hand, social deprivation is a strong predictor of the occurrence of internalizing and externalizing problems (Laubstein and Scheer, 2022). In general, older students are at higher risk of loneliness than younger students, as they disengage from established social networks during adolescence and try to develop new ones (Shah and Househ, 2023). This process may have been interrupted by school closures and contact restrictions. However, as noted above (see section 2.1), the reduced social contacts may also have had a positive effect for some students, who may have experienced less bullying (Vaillancourt et al., 2021), or who may have limited their social contacts to a few significant contacts, thus avoiding less affectionate social contacts (Fried et al., 2022).

In addition, schools provide students with a daily rhythm, rules, and routines, which are particularly important for students in times of crisis (Ager et al., 2010; Betancourt et al., 2010). Missing structure (see section 2.2.1) on the other hand can lead to the feeling of not being able to manage the daily challenges and thus reduce the sense of "environmental mastery" as part of eudaimonic wellbeing (Ryff et al., 2021). Teacher support in structuring the school day can help students to maintain a learning rhythm and complete their tasks. Furthermore, more perceived support promotes students' mental health and enables them to better cope with the demands of crisis situations (Rossnagel et al., 2023). In addition, students who rated their teachers' ability to use digital devices and platforms to be appropriate and effective stated to feel less stressed, as they perceived better support by their teacher in case of learning difficulties (Rogge and Seifert, 2023). Beyond that, learning from home may have also led to increased and closer interaction with family members. While this may have been perceived as pleasant in some families (Gadermann et al., 2021), it may have strained parent–child relationship in others, leading to elevated levels of anxiety and anger among children (Schmidt et al., 2021) and a decline of family members' overall wellbeing (Gadermann et al., 2021).

2.2.3 School system

Cross-country and thus cross-school system comparisons of the impact of the COVID-19 pandemic on student wellbeing are largely a desideratum. Although the basic containment measures were similar in most countries, the duration and severity of these restrictions varied considerably (Hale et al., 2021). The severity of these measures for different countries was rated by the Oxford COVID-19 Government Response Tracker on a scale of 0 to 100 (Hale et al., 2021). While Germany had a Government Response Index (GRI) of around 70 for most of the pandemic, which was around the European average, Switzerland took a more liberal approach with a GRI of between 50 and 60 (Hale et al., 2021). School closures also lasted longer in Germany than in Switzerland (UNESCO, 2022). The extent to which differences in the severity of the measures during the COVID-19 pandemic are reflected in student wellbeing has not yet been explored.

Similarly, little research has been done on the differences in wellbeing between students who were surveyed during general school closures and students who were quarantined at a later point in the pandemic and experienced hybrid distance learning. By analyzing responses to open-ended questions, Rogge and Seifert (2023) were able to identify indications of higher levels of stress experienced by the latter group. Due to the limited research focusing on these different

forms of teaching, further insights on the impact of those school-context variables are still needed.

2.2.4 Home learning environment

Due to the importance of the home learning environment and family socioeconomic status (SES) during distance learning (Lips et al., 2022; Ravens-Sieberer et al., 2022), this study adds a fourth level – the home learning environment – to the three levels of Hascher and Hagenauer's (2011) model. Studies have concluded that students having their own room and access to digital devices led to higher levels of wellbeing (Lips et al., 2022). Parents of children with higher SES also had less existential concerns and stress which also promoted children's wellbeing (Eltanamly et al., 2021; Masten and Narayan, 2012).

Furthermore, while Bujard et al. (2021) found no effect of parental education level on student wellbeing, Langmeyer et al. (2020) concluded that children of more highly educated parents were better able to cope with the restrictions. Other Studies also concluded that higher educated parents are better able to support their children during distance learning (Schuurman et al., 2023) by providing more productive support (Ribeiro et al., 2021), leading to lower levels of student stress.

3 Research interest

The previous review of studies shows that school closures to contain the COVID-19 pandemic had a major impact on student wellbeing, with various factors having a strong influence on how students experienced the restrictions. While the findings on some aspects (e.g., learning behavior or gender) are largely consistent, research on other aspects has not yet been conducted (e.g., differentiation between students from Germany and Switzerland) or has provided inconsistent results (e.g., regarding student age). Therefore, the influence of individual characteristics and learning behaviors, teaching quality, aspects of the school context and the home learning environment on student wellbeing during the COVID-19 pandemic needs to be further investigated, to identify particularly affected students and mitigate negative outcomes in future comparable situations.

Against this background, the aim of the present study is to examine the relationship between school-related factors and student wellbeing during the school closure, based on a survey of Swiss and German secondary school students. We examine the following research questions, referring to the three levels of school-related wellbeing according to Hascher and Hagenauer (2011) and to the fourth level of the home learning environment additionally considered in this study:

> RQ1a: To what extent are aspects of students' individual or personal characteristics – as part of the examined individual predictors – associated with their wellbeing during the COVID-19 pandemic?

The findings mentioned above indicate that male students and students with better self-rated media literacy are likely to have higher levels of wellbeing during the COVID-19 pandemic. In addition, the findings regarding the age of the students are ambiguous, and therefore a direction of this effect cannot be anticipated. This results in the following hypotheses:

> *H1a*: Male students are expected to report higher levels of wellbeing compared to female students.
>
> *H1b*: It is expected that the student age has an effect on the reported levels of wellbeing.
>
> *H1c*: Students who rated their own media literacy higher are expected to report higher levels of wellbeing.

> RQ1b: To what extent are aspects of students' learning behaviors – as part of the examined individual predictors – associated with their wellbeing during the COVID-19 pandemic?

The findings mentioned above also indicate that students with better self-regulation are likely to have higher levels of wellbeing during the COVID-19 pandemic. In addition, procrastinating behavior is associated with lower levels of wellbeing. This results in the following hypotheses:

> *H1d*: Students who procrastinated more often are expected to report lower levels of wellbeing.
>
> *H1e*: Students who rated their own self-regulation skills higher are expected to report higher levels of wellbeing.

> RQ2a: To what extent are the student-perceived learning climate, use of challenging tasks and structure of distance learning – i.e., different aspects of teaching quality—related to student wellbeing during the COVID-19 pandemic?
>
> RQ2b: To what extent are students' perceptions of sufficient teacher support and teachers' media literacy—i.e., relevant aspects of teacher behavior – related to student wellbeing during the COVID-19 pandemic?

The findings mentioned above indicate a better perceived support as well as a better assessed media competence of the teachers are associated with higher levels of student wellbeing. Furthermore, an association between learning success, students sense of personal growth and the perception of psychological wellbeing was demonstrated. We therefore assume a higher student assessed teaching quality (operationalized according to Praetorius et al., 2018, see section 4.2) is also associated with higher levels of student wellbeing. This leads to the following hypotheses:

> *H2a*: Students who perceived more sufficient teacher support are expected to report higher levels of wellbeing.
>
> *H2b*: Students who rated their teacher's media competence higher are expected to report higher levels of wellbeing.
>
> *H2c*: Students who perceived a more favorable learning climate during distance learning are expected to report higher levels of wellbeing.
>
> *H2d*: Students who rated the tasks during distance learning as more challenging are expected to report higher levels of wellbeing.

> *H2e*: Students who rated distance learning as better structured are expected to report higher levels of wellbeing.

> RQ3a: To what extent is the distinction between students from Germany and Switzerland – as part of the examined school-context variables – associated with student wellbeing during the COVID-19 pandemic?

As there were the longer and stricter containment measures in Germany compared to Switzerland, this leads to the following hypotheses:

> *H3a*: Students from Switzerland are expected to report higher levels of wellbeing compared to students from Germany.

> RQ3b: To what extent is the difference in students' assessment of distance learning at the beginning of the pandemic together with the whole class and during hybrid distance learning due to quarantine – as part of the examined school-context variables – associated with student wellbeing?

As current or recently quarantined students were more affected by the containment measures at the time of the survey compared to students who assessed their wellbeing retrospectively during the general school closures, this leads to the following hypotheses:

> *H3b*: Students who were asked about hybrid distance learning due to quarantine are expected to report lower levels of wellbeing compared to students who were asked about their experiences during general distance learning at the beginning of the pandemic.

> RQ4: To what extent are aspects of the home learning environment related to student wellbeing during the COVID-19 pandemic?

The findings mentioned above indicate that a better equipped home learning environment, operationalized via the equipped home workspace and the family's household are associated with higher levels of student wellbeing. This leads to the following hypotheses:

> *H4a*: Students with a better equipped home workspace are expected to report higher levels of wellbeing.

> *H4b*: Students who reported living in a better-equipped household are expected to report higher levels of wellbeing.

The findings mentioned above indicate that a higher level of parental education (operationalized via the number of books in the household, see section 4.2) is associated with higher levels of student wellbeing. This leads to the following hypotheses:

> *H4c*: Students with higher educated parents are expected to report higher levels of wellbeing.

4 Materials and methods

The data of the present study were collected through the online survey "My Corona Diary," in which students were asked about their experiences during the COVID-19 pandemic and distance learning. The survey was conducted via the web application SoSci-Survey (Leiner, 2024) using German language. The link was sent to students from Germany, Austria, and Switzerland. The survey was widely distributed through friends and mailing lists on the one hand and advertised via the mailing list of a commercial platform on the other. Data was collected between April 5th, 2022 and July 22nd, 2022. As we have much less personal contact with schools and school administrators in Austria than in Germany and Switzerland, the questionnaire was less widely distributed in Austria, so that only 3 students completed the questionnaire. We therefore decided to limit our analysis to students from Germany and Switzerland.

4.1 Sample

The present study examines the data from $N = 1{,}212$ secondary school students in Germany and Switzerland, aged between 10 and 20. The composition of the sample is shown in Table 1. As our survey was based on an online questionnaire, the sample is self-selected. Students without adequate access to the internet or lower skills in operating digital devices may be underrepresented in this study.

4.2 Variables

Given that wellbeing is a multiple-source phenomenon (Diener, 1984), the present study focuses on the affective aspects of psychological wellbeing. To this end, the following three relevant aspects will be considered: (1) feelings of stress, (2) overall life satisfaction, and (3) fear of the consequences of the COVID-19 pandemic. These three aspects are based on Diener's (1994) definition of wellbeing and the related bottom-up theory (Diener and Ryan, 2009). These are used as dependent variables in multivariate regression models (see section 4.3). The following scales and items from the student questionnaire were used to assess the three aspects:

4.2.1 Perceived stress

Student stress during the COVID-19 pandemic was measured using the "*Stress in Distance Learning*" subscale from Rogge and Seifert (2023). Students were asked to rate the extent to which they agreed with five statements about the stress they experienced during distance learning (e.g., "The demands of school are very stressful for me.") on a scale from 1 (*never*) to 7 (*always*). Rogge and Seifert (2023) found an internal consistency of $\alpha = 0.890$ for the overall scale that comprised 17 items on student stress, and an item discrimination between $R_{IT} = 0.290$ and $R_{IT} = 0.730$. In the present study an internal consistency of $\alpha = 0.900$ was demonstrated for the considered items.

4.2.2 Fear of the consequences of COVID-19

Students' fear of the consequences of the COVID-19 pandemic for their future was assessed using a four-item scale based on the "*Epidemiebezogene Dark Future Scale für Kinder (eDFS-K) am Beispiel von COVID-19*"[1] (Voltmer and von Salisch, 2021). The items (e.g., "Are

1 "Epidemic-related Dark Future Scale for children (eDFS-K) based on the example of COVID-19."

TABLE 1 Sample composition.

Variables	Switzerland		Germany		Total	
	n	%	*n*	%	*n*	%
Survey group						
Cohort 1*	6	3.6	66	6.3	72	5.9
Cohort 2**	64	38.8	493	47.1	557	46.0
Cohort 3***	95	57.6	488	46.6	583	48.1
Gender						
Female	86	52.1	714	68.2	800	66.0
Male	79	47.9	333	31.8	412	34.0
Age						
10 years old	–	–	3	0.3	3	0.2
11 years old	–	–	16	1.5	16	1.3
12 years old	9	5.5	31	3.0	40	3.3
13 years old	26	15.8	56	5.3	83	6.8
14 years old	42	25.5	75	7.2	116	9.6
15 years old	70	42.4	128	12.2	198	16.3
16 years old	11	6.7	180	17.2	191	15.8
17 years old	3	1.8	111	10.6	114	9.4
18 years old	2	1.2	364	34.8	366	30.2
19 years old	2	1.2	75	7.2	77	6.4
20 years old	–	–	8	0.8	8	0.7
Grade level†						
Grade 5††	–	–	20	1.9	20	1.7
Grade 6††	–	–	32	3.1	32	2.6
Grade 7	33	20.0	32	3.1	65	5.4
Grade 8	36	21.8	92	8.8	128	10.6
Grade 9	84	59.9	129	12.3	213	17.6
Grade 10	1	0.6	273	26.1	275	22.7
Grade 11	–	–	200	19.1	200	16.5
Grade 12	2	1.2	170	16.2	172	14.2
Grade 13	–	–	71	6.8	71	5.9
N	165		1,047		1,212	100

*Students who were in quarantine at the time of data collection. **Students who were in quarantine within 3 months prior to data collection. ***Students who were neither in quarantine at the time of data collection nor within 3 months prior to data collection. †36 values regarding the grade level are missing in total. ††Secondary school in Switzerland starts at grade level 7.

you worried that the coronavirus will prevent you from pursuing your hobbies, graduating from school or finding your dream job in the future?") were answered on a rating scale from 1 (*never*) to 4 (*often*). The authors found acceptable internal consistency for the scale and provided indications of satisfactory content validity as well as convergent and discriminant construct validity (Voltmer and von Salisch, 2021). In our data, the internal consistency of the scale was $\alpha = 0.781$.

4.2.3 Overall life satisfaction

Students' overall life satisfaction was assessed with the item "Overall, how satisfied are you with your life right now?," according to the "*Kurzskala zur Erfassung der Allgemeinen Lebenszufriedenheit (L-1)*"[2] (Beierlein et al., 2015). Students indicated their satisfaction on a scale from 1 (*not at all satisfied*) to 11 (*completely satisfied*). This item enables people to assess their quality of life globally using self-selected criteria (Shin and Johnson, 1978). Beierlein et al. (2015) reported medium retest reliability for the scale, as well as high convergent validity with the multiple-item scale by Diener et al. (1985). Additionally, they found medium convergent validity with self-esteem and general self-efficacy (Beierlein et al., 2015).

Although the first two scales were designed to assess frequency in distinct categories, and thus have strictly speaking ordinal response

2 "Short scale to measure overall life satisfaction."

scales, the present study adheres to the recommendations of the scales' authors as well as Robitzsch (2020) by treating them as continuous variables in the analyses.

The following scales and items from the questionnaire were considered as independent variables to predict student wellbeing:

4.2.4 Teaching quality

Teaching Quality from the students' perspective was assessed using Jaekel et al.'s (2021) *teaching quality during distance learning scale*. Students evaluated various aspects of the quality of teaching during distance learning (e.g., "My math teacher supports me when I need additional help.") on a rating scale from 1 (*strongly disagree*) to 4 (*strongly agree*). Teaching quality as conceptualized in Jaekel et al.'s study is based on the model of three basic dimensions: supportive climate, classroom management, and cognitive activation (e.g., Praetorius et al., 2018). For our analyses, we used a seven-item scale "*supportive learning climate*," a six-item scale "*challenging tasks*," and a four-item scale assessing "*structure of the class*." The last two scales were composed of subsets of all items capturing cognitive activation and classroom management, respectively. The items were selected based on the superior goodness-of-fit indices when conducting the confirmatory factor analysis (CFA). The items of the scales are based on large-scale studies such as PISA or TIMSS, thereby providing indications of content validity (Jaekel et al., 2021). The individual subscales provided acceptable to very good internal consistencies while the internal consistencies for the selected subscales in the present study ranged from $0.702 \leq \alpha \leq 0.906$.

4.2.5 Self-regulation

Students rated their ability to self-regulate in the context of learning for school on a rating scale from 1 (*not at all*) to 4 (*exactly*) on 9 items (e.g., "I set learning goals for myself."). The scale is based on Zimmerman's (2006) theory of self-regulation and was adapted by Toering et al. (2012). The authors were able to demonstrate evidence of content and construct validity as well as satisfactory internal consistency and retest reliability for the overall scale (Toering et al., 2012). In the present study, the items of the considered subscale had an internal consistency of $\alpha = 0.827$.

4.2.6 Procrastination

In the present study, procrastination focuses on behavioral aspects and is defined as the postponement of an intended course of action, or the avoidance of a task or obligation, typically for an extended period of time (Schouwenburg, 1995). Students' tendency to procrastinate was assessed using a subscale of the German version of the "*Academic Procrastination State Inventory (APSI-d)*" (Patzelt and Opitz, 2005). Students were asked to answer 8 items (e.g., "Please estimate how often you distract yourself from working.") on a scale from 1 (*never*) to 5 (*always/regularly*). Patzelt and Opitz (2005) reported evidence of convergent and divergent validity as well as criterion validity for the original scale and high internal consistency (Patzelt and Opitz, 2005). For the selected items used in the present study, an internal consistency of $\alpha = 0.890$ was demonstrated.

As mentioned above, age effects regarding self-regulation and procrastination can be expected. However, the demonstrated strict measurement invariance of the scales across student age (see section 4.3) suggests that the scales in the present study worked comparably well for students of different ages.

4.2.7 Home learning environment

Student home learning environment was assessed by a 6-item scale regarding the availability of *home workspace equipment*, each of which could be answered as "*available*" (2) or "*not available*" (1); a 5-item scale regarding the *number of items* such as cars or computers in the *students' household*, each of which could be answered as "*none*" (1), "*one*" (2), "*two*" (3), or "*three or more*" (4), and the single question "How many books do you have at home?" to be answered on a 7-point scale from "*none or very few (0–10)*" to "*enough to fill several shelves in a room (more than 301)*." Again, the frequency variables *Equipped household* and *Number of books* were included in the data analysis as continuous variables (Robitzsch, 2020). While the first two scales mainly assess the SES of students' families, the third item can be taken to indicate families' cultural capital (Bourdieu, 2012), in particular their educational level (Bos et al., 2012). The items are based on the "Home Educational Resources-Scale" and the "Cultural Possessions-Scale" from the household possessions assessment in the 2018 PISA student questionnaire (Mang et al., 2021). We selected certain items of the scales based on the determined item discriminatory power (Mang et al., 2021) and the presumed relevance for teaching during the COVID-19 pandemic, in order to improve the questionnaire's economy. The selection of items was communicatively validated by the authors of the questionnaire, considering the assessment of experts.

4.2.8 Further individual variables

The following student variables were assessed using individual items adapted from Rogge and Seifert (2023): *Self-assessed media literacy* ("I had sufficient media skills for distance learning."), *teacher media literacy* as perceived by the students ("Most of my teachers had sufficient media skills for distance learning."), and the extent to which students *perceived sufficient support from the teacher* (e.g., "I had sufficient help with questions and problems."). Responses were collected on a rating scale from 1 (*strongly disagree*) to 6 (*strongly agree*). Finally, the questionnaire included items on students' *gender*, *country of schooling*, *age*, and *grade level*.

Finally, the survey contained questions to differentiate between students who were (1) in quarantine at the time of the survey, (2) in quarantine within the last 3 months prior to the survey, or (3) not in quarantine within the last 3 months prior to the survey. While the first two groups were asked to respond to the questionnaire referring to their current and recent hybrid distance learning experiences, respectively, the last group was asked to rate their experiences retrospectively, focusing on the period of general school closures. In our analysis, we examined whether these two subsamples ("quarantined" group and "retrospective" group) reported different levels of wellbeing as a result of the COVID-19 pandemic.

4.3 Analyses

To answer the research questions, multivariate regression models were used to predict the three variables referring to school-related wellbeing during the COVID-19 pandemic. First, the effects of the predictors related to the questions (see section 3) were examined in four separate multivariate regression models. Then, all statistically significant predictors from the previously estimated models were included in a fifth model, to examine which variables retained their

TABLE 2 Results of Model 1: individual level predictors.

Predictors	Life satisfaction		Perceived stress		Fear	
	β	SE	β	SE	β	SE
Gender	0.200***	0.028	−0.129**	0.046	−0.236***	0.032
Age	−0.123***	0.031	0.162**	0.055	0.134***	0.037
Procrastination	−0.060	0.040	0.488***	0.048	0.174***	0.047
Media literacy	0.170***	0.045	−0.021	0.053	−0.215***	0.060
Self-regulation	0.237***	0.035	−0.009	0.056	0.079	0.043
Explained variance	$R^2 = 0.164$		$R^2 = 0.296$		$R^2 = 0.162$	

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

explanatory power in a model encompassing all statistically meaningful predictors.

Due to the different scale ranges all interval-scaled variables were z-transformed to facilitate comparisons of the effects of the predictors on the different dependent variables. Dummy-coded variables were created for all categorical variables [gender: female = 0, male = 1; country of schooling: Germany = 0, Switzerland = 1; survey group: "quarantined" group (cohort 1 and 2) = 0, "retrospective" group (cohort 3) = 1].

As students were allowed to skip questions, a total of 23.9% of all values in our data are missing. Since younger students had a higher rate of missing values and more missing values were found in items that appear late in the questionnaire, these missing values appear not to be "missing completely at random" (Enders, 2023). To avoid bias in the analyses due to the systematic structure of the missing responses (Enders and Baraldi, 2018) and to increase the number of cases retained for the analyses, the missing values were imputed using model-based multiple imputation (Enders, 2023) in Blimp (Enders et al., 2022). Due to their low frequency, the cases of students who self-identified as a non-binary gender had to be excluded, in order to ensure a reliable result of the multiple imputation ($\hat{R} < 1.05$; Keller and Enders, 2022). To verify the quality of the imputation, in addition to evaluating the usual relevant parameters (posterior predictive checking, potential scale reduction factor) an indirect validation was performed by comparing the models with models from the data set without missing values ($n = 431$). A correlation of $r = 0.901$ was found between the standardized regression weights across the four base models calculated.

In the regression analyses, the composite dependent variables "*perceived stress*" and "*fear of the consequences of the COVID-19 pandemic*" and the composite independent variables "*self-regulation*," "*procrastination*," "*equipped home workspace*" and "*equipped household*," perceived "*learning climate*," "*challenging tasks*" and "*structured lessons*" were modeled as latent variables. Beforehand, the psychometric quality of each of the scales was examined by a unidimensional CFA. The CFA goodness-of-fit indices indicate acceptable to good fit of the unidimensional factor models ($0.923 \leq CFI \leq 1.000$; $0.000 \leq RMSEA \leq 0.127$;[3] $0.006 \leq SRMR \leq 0.059$) (Hu and Bentler, 1999). Additionally, measurement invariance was tested for *gender*, *country of schooling*, *student age* and whether or not students were *quarantined* during or shortly before the data collection. The step-up approach (Schwab and Helm, 2015) was applied, and increasingly stringent forms of measurement invariance were tested. Model comparisons were based on the χ^2-difference test (Satorra and Bentler, 2001) and the rules of thumb introduced by Chen (2007). According to these rules, two models were considered to fit the data equally well as long as the decrease in CFI was ≤0.02 and increase in RMSEA was ≤0.015 (Chen, 2007). Metric measurement invariance was demonstrated for "*fear of the consequences of the COVID-19 pandemic*" regarding *gender* and *country of schooling*.[4] Strict measurement invariance was demonstrated for all other variables tested.

To examine potential multicollinearity of the independent variables, VIF values were calculated and found to lie between 1.01 and 1.58. Accordingly, it can be assumed that there was no noticeable multicollinearity that could lead to a bias (Montgomery et al., 2001). The estimation of the regression models as well as the CFA and the measurement invariance models were performed in MPlus (Muthén and Muthén, 1998–2017). Data preparation for multiple imputation was performed in R (R Core Team, 2018).

5 Results

5.1 Descriptive analysis of the examined variables

Appendix Table A shows the mean values, standard deviations, skewness and kurtosis of the examined variables as well as the correlation between the variables in the estimated models.

5.2 RQ1: individual level

Table 2 shows the results of the multivariate regression model that uses various aspects at the individual student level to predict student wellbeing (model 1).

3 High RMSEA value of the scale "fear of the consequences of the COVID-19 pandemic" are in line with the fit indices of the authors of the scale (Voltmer and von Salisch, 2021).

4 Additional regression analyses with the single items of the "fear of the consequences of the Covid-19 pandemic" scale as dependent variables resulted in similar regression coefficients. This indicates that the results obtained in the latent variable model were not biased due to the lack of scalar measurement invariance for this scale.

Student gender and *age* are significantly related to all three dependent variables. While *male students* are predicted to have higher levels of *overall life satisfaction* ($\beta = 0.200$, SE = 0.028, $p < 0.001$), *female students* are predicted to have higher levels of *perceived stress* ($\beta = -0.129$, SE = 0.046, $p = 0.005$) and more frequent *fear of the consequences of the COVID-19 pandemic* ($\beta = -0.236$, SE = 0.032, $p < 0.001$). Furthermore, a higher *student age* is related to lower levels of *overall life satisfaction* ($\beta = -0.123$, SE = 0.031, $p < 0.001$), higher levels of *perceived stress* ($\beta = 0.162$, SE = 0.055, $p = 0.003$) and more frequent *fear of the consequences of the COVID-19 pandemic* ($\beta = 0.134$, SE = 0.037, $p < 0.001$).

For more frequent *procrastination*, significant effects on higher *perceived stress* ($\beta = 0.488$, SE = 0.048, $p < 0.001$) as well as more frequent *fear of the consequences of the COVID-19 pandemic* ($\beta = 0.174$, SE = 0.047, $p < 0.001$) are found. Higher student *media literacy* is related to higher *overall life satisfaction* ($\beta = 0.170$, SE = 0.045, $p < 0.001$) and less frequent *fear of the consequences of the COVID-19 pandemic* ($\beta = -0.215$, SE = 0.060, $p < 0.001$). Higher *self-regulation* also has a positive effect on higher *overall life satisfaction* ($\beta = 0.237$, SE = 0.035, $p < 0.001$).

5.3 RQ2: level of teaching

Table 3 shows the results of model 2 with the predictors regarding the quality of teaching.

A significant positive effect of *perceived sufficient teacher support* on higher *overall life satisfaction* ($\beta = 0.149$, SE = 0.050, $p = 0.003$) and on less frequent *fear of the consequences of the COVID-19 pandemic* ($\beta = -0.168$, SE = 0.065, $p = 0.010$) is found. Higher levels of student-perceived *learning climate* are significantly related to higher levels of *overall life satisfaction* ($\beta = -0.195$, SE = 0.067, $p = 0.004$).

5.4 RQ3: level of the school system

Table 4 shows the results of model 3, which examines the differences between students from Germany and Switzerland as well as differences between students in general and hybrid distance learning, in order to assess effects of the school system.

The results indicate higher *overall life satisfaction* ($\beta = 0.165$, SE = 0.029, $p < 0.001$), lower levels of *perceived stress* ($\beta = -0.244$, SE = 0.110, $p = 0.026$) and less frequent *fear of the consequences of the COVID-19 pandemic* ($\beta = -0.257$, SE = 0.031, $p < 0.001$) for students from *Switzerland* compared to those from *Germany*. Students who were quarantined at the time of data collection or within 3 months prior to the survey, and accordingly reported on their experiences during *hybrid distance learning*, show more frequent *fear of the consequences of the COVID-19 pandemic* ($\beta = -0.078$, SE = 0.033, $p = 0.012$).

5.5 RQ4: level of home learning environment

Table 5 shows the results of model 4 with the predictors of the home learning environment.

Students with a better *equipped home workspace* report higher *overall life satisfaction* ($\beta = 0.221$, SE = 0.066, $p = 0.001$), lower *perceived stress* ($\beta = -0.367$, SE = 0.102, $p < 0.001$), and less frequent *fear of the consequences of the COVID-19 pandemic* ($\beta = -0.238$, SE = 0.075, $p = 0.002$). Furthermore, there is a significant effect of a better *equipped household* on higher *overall life satisfaction* ($\beta = 0.143$, SE = 0.061, $p = 0.018$) and less frequent *fear of the consequences of the COVID-19 pandemic* ($\beta = -0.229$, SE = 0.071, $p = 0.001$). The *number of books* in the household is associated with higher *overall life satisfaction* ($\beta = 0.087$, SE = 0.030, $p = 0.003$) and less frequent *fear of*

TABLE 3 Results of Model 2: level of teaching predictors.

Predictors	Life satisfaction		Perceived stress		Fear	
	β	SE	β	SE	β	SE
Sufficient support	0.149**	0.050	−0.072	0.060	−0.168*	0.065
Teachers' media literacy	0.052	0.051	0.074	0.052	0.011	0.062
Learning climate	0.195**	0.067	−0.159	0.083	0.120	0.079
Challenging tasks	0.037	0.083	−0.041	0.100	−0.017	0.094
Structured lessons	−0.062	0.085	−0.013	0.103	−0.011	0.101
Explained variance	$R^2 = 0.073$		$R^2 = 0.056$		$R^2 = 0.054$	

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

TABLE 4 Results of Model 3: level of school system predictors.

Predictors	Life satisfaction		Perceived stress		Fear	
	β	SE	β	SE	β	SE
Country of schooling	0.165***	0.029	−0.244*	0.110	−0.257***	0.031
"Quarantined" vs. "retrospective"	−0.027	0.031	0.017	0.042	−0.078*	0.033
Explained variance	$R^2 = 0.029$		$R^2 = 0.071$		$R^2 = 0.087$	

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

TABLE 5 Results of Model 4: level of home learning environment predictors.

Predictors	Life satisfaction		Perceived stress		Fear	
	β	SE	β	SE	β	SE
Equipped home workspace	0.221**	0.066	−0.366***	0.102	−0.238**	0.078
Equipped household	0.143*	0.061	0.023	0.010	−0.229**	0.071
Number of books	0.087**	0.030	−0.031	0.043	−0.090**	0.034
Explained variance	$R^2 = 0.119$		$R^2 = 0.130$		$R^2 = 0.189$	

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

TABLE 6 Results of Model 5: Significant predictors from Models 1–4.

Predictors	Life satisfaction		Perceived stress		Fear	
	β	SE	β	SE	β	SE
Model 1						
Gender	0.169***	0.029	−0.109*	0.045	−0.224***	0.031
Age	−0.077*	0.033	0.104*	0.046	0.073*	0.036
Procrastination			0.483***	0.041	0.119**	0.040
Media literacy	0.133**	0.050			−0.155**	0.054
Self-regulation	0.212***	0.031				
Model 2						
Sufficient support	0.159***	0.042			−0.148**	0.047
Learning climate	0.107**	0.037				
Model 3						
Country of schooling	0.106*	0.050	−0.135	0.113	−0.220***	0.054
Quarantined vs. retrospective					−0.073*	0.033
Model 4						
Equipped home workspace	0.105	0.060	−0.101*	0.047	−0.124	0.068
Equipped household	0.106*	0.052			−0.161**	0.062
Number of books	0.044	0.032			−0.053	0.035
Explained variance	$R^2 = 0.236$		$R^2 = 0.321$		$R^2 = 0.300$	

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

the consequences of the COVID-19 pandemic ($\beta = 0.090$, SE = 0.034, $p = 0.009$).

5.6 Joint model of all significant predictors

The fifth model includes all significant predictors of the dependent variables from models 1 to 4 (see sections 5.2 to 5.5) to determine the extent to which controlling for additional independent variables changes the influence of the predictors. The results of the fifth model are presented in Table 6.

Compared to the individual models 1–4, the addition of further control variables from the other models causes several regression coefficients to become insignificant. The effect of *Swiss school country* on *perceived stress* as well as the effects of *home workspace equipment* on *overall live satisfaction* and the frequency of *fear of the consequences of the COVID-19 pandemic* are no longer significant. Furthermore, the *number of books* in the household loses its power to explain *overall life satisfaction* and the frequency of *fear of the consequences of the COVID-19 pandemic* when further control variables are added.

6 Discussion

The restrictions imposed to contain the COVID-19 pandemic affected many students and adolescents particularly hard. In addition to severe restrictions on leisure activities (Döpfner et al., 2021), school closures posed many challenges. Besides familiar learning formats being replaced by distance learning, leading to the loss of social intermental learning (Pol et al., 2010), students also lost the immediate relationship to an institution that provided rhythm and routine in their daily lives (Schmidt et al., 2021) and a social space for peer interaction (Bujard et al., 2021). Studies examining student wellbeing during the COVID-19 pandemic found high levels of stress and lower life satisfaction (Ravens-Sieberer et al., 2022; Romero et al., 2020).

As wellbeing is a subjective construct with various influencing factors, the evidence for school-related effects on student wellbeing is ambiguous. In the present study, the main effects on student wellbeing during the COVID-19 pandemic were related to students' individual characteristics like gender, age, self-regulation and procrastination ($0.162 \leq R^2 \leq 0.296$) and aspects of the home learning environment like the availability of a quiet place to study, students having their own computer and the number of cars or digital devices in the students' household ($0.119 \leq R^2 \leq 0.189$). In contrast, only small relationship with wellbeing were found for aspects related to the quality of teaching ($0.054 \leq R^2 \leq 0.073$) or the difference between students from Germany and Switzerland and students during general and hybrid distance learning ($0.029 \leq R^2 \leq 0.087$).

Female students were found to have lower levels of wellbeing compared to male students on all three dependent variables. Hypothesis 1a was therefore supported. However, the results regarding the frequency of anxiety should be interpreted with caution due to the lack of scalar measurement invariance in respect of the distinction female and male students. Nevertheless, this finding is in line with previous research (Bujard et al., 2021). Studies on the different perceptions of wellbeing between boys and girls of primary school age concluded that peer contact tends to reduce negative emotions in girls (Markus et al., 2022). In addition, a good relationship with teachers also plays a greater role in girls' perceptions of wellbeing (Markus et al., 2022). Accordingly, the loss of these peer contacts, as well as of the contact with their teacher, appear to have had a stronger negative effect on girls' wellbeing, and it seems particularly important for female students to maintain these contacts during distance learning.

Regarding students' age, the present study finds evidence of more negative effects on wellbeing for older students compared to younger students. Hypothesis 1b is therefore supported. Although older students are expected to better work independently (Cera et al., 2013), their reduced wellbeing may be due to higher expectations of learning success in higher grades, especially with regard to final exams many students had to pass. However, in lower grade levels, learning requirements may have been reduced to some extent during the COVID-19 pandemic. In addition, the lack of social contacts had a greater impact on the wellbeing of older students (Shah and Househ, 2023). Therefore, even in the higher grade levels, teachers should place more emphasis on aspects such as maintaining social contacts or reflecting current feelings and emotions under comparable circumstances. Older students were also expected to work more independently than younger students, which may have led to a stronger negative impact of the aforementioned challenges. With regard to distance learning, it would therefore seem even more important to sufficiently prepare students for independent work and to provide them with appropriate tasks.

For students showing more frequent procrastination in independent learning, higher levels of stress and more frequent anxiety of the consequences of the pandemic were found in this study. This indicates that procrastination may pose a considerable risk to student wellbeing, therefore supporting Hypothesis 1d. Procrastination may be an expression of excessive teacher demands with respect to independent learning (Engberding et al., 2017), which might reduce students' self-efficacy (Dresel and Lämmle, 2017), ultimately leading to lower wellbeing in accordance with self-determination theory (Ryan and Deci, 2000). Furthermore, students' self-regulation abilities were positively related to overall life satisfaction. Accordingly, Hypothesis 1e can also be supported. Better self-regulation may have helped students to maintain a regular daily routine despite the loss of the institutional framework of school, resulting in higher overall life satisfaction. Therefore, it is important that students are better prepared to learn and work independently in comparable situations, not only to ensure learning success (Huber et al., 2023), but to maintain higher levels of life satisfaction. Teachers should also be trained to provide students with tasks in distance learning that are suitable for independent and exploratory learning (Wacker and Unger, 2021) and to foster students' self-regulation.

Higher students' self-assessed media literacy was shown to have positive effects on student wellbeing, supporting Hypothesis 1c. In addition to better participation in class, higher media literacy may have helped students to maintain contact with their peers (Langmeyer et al., 2020), as the loss of social contacts was a major challenge for many students during the COVID-19 pandemic (Brauchle et al., 2024). Digital literacy is a key skill in today's world, and giving the use of these media a higher priority in school—even in lower grades—would not only prepare students better for future crisis situations, but also provide them with relevant skills for their professional lives (Al-Masri, 2023).

In addition to individual characteristics, the present study indicates a noticeable positive relationship between students' equipment at their home workplace and in their household and students' wellbeing. Therefore, Hypotheses 4a and 4b were supported, although the effects of a better equipped home workspace on overall life satisfaction and less fear of the consequences of the COVID-19 pandemic were no longer significant in model 5 due to the addition of further control variables. Due to the rather heterogeneous composition of the home workplace and household scales, we conducted supplementary analyses with the individual items instead of the scales as predictor variables.[5] Regarding students' home workplace, we found particularly strong effects of students having an undisturbed learning space with their own computer on student wellbeing. In contrast, the household items all had an about equally strong relationship to wellbeing.

Overall, these results suggest a strong effect of SES of students' family on students' wellbeing, thus confirming previous studies showing that family SES (e.g., Ravens-Sieberer et al., 2022) and equipment of the home workplace (e.g., Lips et al., 2022) influenced students' experience of stress and wellbeing during the COVID-19 pandemic. This effect on student wellbeing can be attributed to several causes: On the one hand, a quieter learning environment and a better equipped learning space may have allowed for better participation in class during distance learning, which may also have led to higher self-efficacy (Dresel and Lämmle, 2017; Ryan and Deci, 2000). On the other hand, family SES' positive effect on wellbeing may have been due to less financial and existential worries of students' parents and increased freedom for family members in a larger household (Masten and Narayan, 2012). These findings suggest that the COVID-19 pandemic has contributed to increased inequality not only in terms of academic achievement (Maldonado and De Witte, 2022), but also in terms of students' wellbeing (Lips et al., 2022). Accordingly, in

5 For this purpose, multivariate regression models were calculated univariately with the three dependent variables and the single individual items of the scales.

comparable situations, special attention should be paid to the wellbeing of socio-economically disadvantaged students. Measures to compensate for their disadvantages could include providing digital devices or a quiet place to learn or the implementation of emergency classes for particularly socio-economically disadvantaged students.

In addition to the positive effect of a better equipped home learning environment on student wellbeing, results showed that a larger number of books in the household was related to higher overall life satisfaction and less frequent fear of the consequences of the COVID-19 pandemic. Since these effects became insignificant when further control variables were entered, Hypothesis 4c was only partially supported. The number of books in the household serves not only as an indicator of wealth, but also of the educational background of the family (Bos et al., 2012). Parental support played an important role in teaching during the COVID-19 pandemic. Parents with a higher educational background support their children more frequently and in a more productive way (Balayar and Langlais, 2022; Ribeiro et al., 2021). In order to prevent an increase in social inequality during times of crisis, students who may receive less support at home due to their parents' lower educational background should be provided with greater support from school in order to promote students' wellbeing in addition to better learning success.

Teaching aspects were shown to have less impact on student wellbeing. However a few effects became apparent: a positive effect of sufficient perceived teacher support on student wellbeing could be demonstrated. Accordingly, Hypothesis 2a was supported. Many students reported that the lack of direct learning support was challenging when learning from home (Brauchle et al., 2024). Sufficient learning support seems to be particularly important in times of crisis, so it is important for teachers to be aware of the responsibility of one's own behavior on student wellbeing. Furthermore, a positive effect of perceived learning climate on overall life satisfaction was found, confirming Hypothesis 2c. Learning climate represents a positive teacher-student relationship as well as feedback conducive to learning (Jaekel et al., 2021). Since a lack of feedback during independent work was a challenge for many students (Brauchle et al., 2024), this result may indicate that such feedback helped students to know how they could further improve and thus had a positive impact on their self-efficacy and wellbeing. Accordingly, in future comparable situations, teachers should ensure they provide their students with adequate feedback on the work they have done independently (Unger et al., 2022). No other effects of learning behavior and teaching quality could be demonstrated, so Hypotheses 2b, 2d and 2e were not supported.

When comparing Germany and Switzerland, there was an indication of higher levels of wellbeing among Swiss students. Here again, the results regarding students' fear of the consequences of the pandemic should be interpreted with caution due to the lack of scalar measurement invariance. With this limitation, Hypothesis 3a can be considered as supported. The duration and intensity of containment measures were lower in Switzerland than in Germany (Hale et al., 2021), which may contribute to explaining the differences in perceptions of wellbeing. It suggests that the duration and stringency of the containment measures affected student wellbeing to some extent, even if cross-country differences in student wellbeing may have been also affected by other variables.

When distinguishing between students who were asked about their experiences in distance learning during the general school closures and those who were asked about their experiences in hybrid distance learning during the quarantine, more frequent fear of the consequences of the COVID-19 pandemic was found among students who were quarantined. These results indicate that Hypothesis 3b was also supported. In general, wellbeing is influenced by a habituation effect (Brickman and Campbell, 1971). Thus, if students' current state is changed by them being quarantined, they will perceive changes in their wellbeing even more strongly (Diener and Ryan, 2009). To mitigate the anxiety of quarantined students, preparing them in advance for this situation could help them to maintain a structure and know what to expect. Teachers should also try to stay in touch with quarantined students to foster a sense of relatedness within the school community.

The present findings allow for a better assessment of the impact of the COVID-19 pandemic containment measures on student wellbeing by providing indications of which factors related to individual students, teaching, the school system, and students' home learning environment had a positive or negative effect on student wellbeing during the COVID-19 pandemic. On the one hand, these findings can be used to identify children and adolescents who were particularly affected by these measures, in order to give them special attention in follow-up. On the other hand, these results allow to identify and take into account aspects that may have a negative impact on student wellbeing in future, comparable situations. In this way, an increase in mental health problems among children and adolescents, as found by Döpfner et al. (2021), might be mitigated. Even though the COVID-19 pandemic appears to be under control and overcome, research has shown that the frequency of pandemics is increasing and the intervals between pandemics continue to decrease (Marani et al., 2021). In addition, local illness waves cause school closures every year, affecting millions of students within the United States alone (Zviedrite et al., 2024). Climate change has also been found to increase almost all types of extreme weather conditions (Clarke et al., 2022), resulting in large numbers of students unable to attend school temporarily. A recent and prominent example is the flood in Spain in the fall of 2024, which caused school closures in southern and eastern Spain (Jones, 2024). Such extreme weather conditions can have serious consequences for the educational biography of individual students, as well as for the economy of entire countries (Groppo and Krähnert, 2015). Therefore, the opportunity should be taken now to learn from experience in order to respond appropriately to such situations in the future by using the present findings as an example, to identify factors that are beneficial or detrimental to the wellbeing of children and young people. Consideration of the opportunities and risks of distance learning can also help to incorporate learning-productive elements from these lessons into the classroom under normal conditions (Letzel-Alt et al., 2023).

The present study has some limitations that must be taken into account when assessing the relevance of the results. The data were collected in the spring and summer of 2022. At that time, the GRI was between 40 and 50 in Germany and below 30 in Switzerland (Hale et al., 2021). Accordingly, students' lives were less constrained at that time than they typically were during the time periods the students were asked about. Thus, students' responses may have been distorted to some extent by recall bias. The construct of wellbeing is captured in the present study by the aspects of overall life satisfaction, perceived stress, and fear of the consequences of the COVID-19 pandemic. However, these aspects cover only a part of the large and diverse construct of wellbeing. In addition, overall life satisfaction is measured with only one item. This makes the scores susceptible to bias toward extreme judgments. All of the data collected is based on self-reports by the students. Therefore, no claims can be made about the accuracy of the information. The sample is also not evenly balanced, with the proportion of students from

Germany compared to those from Switzerland, female students and students from higher grade levels being more strongly represented in the sample. Furthermore, the school systems in Germany and Switzerland are both federally organized, meaning the decision-making authority lies with the federal states. However, the permissible scope for action due to the pandemic emergency laws was largely determined by the central government. The data collection, using an online questionnaire, led to a self-selection of respondents. Among others, the questionnaire only reached students with access to the Internet and a digital device. Students who do not have access to the Internet, and who were therefore particularly ill-equipped for distance learning, as well as students with low skills in the usage of a computer, are underrepresented in this study.

Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: There are no restrictions for the data set. Requests to access these datasets should be directed to julian.brauchle@phsg.ch.

Ethics statement

Ethical approval was not required for the study involving human samples in accordance with the local legislation and institutional requirements of the countries in which this study was conducted (Germany, Austria, Switzerland), as the data were collected anonymously and processed in accordance with local data protection laws. Written informed consent for participation in this study was provided by the participants' legal guardians.

Author contributions

JB: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. VU: Data curation, Funding acquisition, Project administration, Writing – review & editing. JH: Methodology, 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.2025.1518609/full#supplementary-material

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